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Dietary fibre, food consumption patterns and diet-related chronic diseases in the Arab Middle East countries

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Dietary fibre, food consumption patterns and diet-related chronic diseases in Arab Middle East countries

Papers

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Editorial

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The Arab Middle Eastern countries are varied in geography, climate, population, economic, and health status. Economically they can be divided into three main categories (FAO, 1990; WHO, 1990):

High income per capita countries (>US$5000). These include oil producing countries such as the Gulf states. They are characterised by low infant mortality and high per capita calorie intake (>3000 kcal per capita/day).

Medium income per capita countries. These include Egypt, Iraq, Jordan, Lebanon and Syria. These countries are characterised by medium per capita income (US$600–3000) and a calorie intake per capita of 2700–3000 kcal/day.

Low income per capita countries. These include Somalia, Sudan, and Yemen. These countries are characterised by a very low income per capita (<US$600), poor health and nutritional status, and a low calorie intake per capita (2000–2300 kcal per capita/day).

Changes in food consumption patterns

Large socio-economic, geographical and cultural discrepancies exist between the Arab Middle Eastern nations. Despite this, the region has experienced a dramatic and collective change in it's dietary habits (Musaiger & Miladi, 1997). The traditional diet, which has been characterised by a high fibre, low fat, cholesterol, and sodium diet, has changed to an increasingly westernised diet. This exhibits an excess intake of energy-dense foods, rich in fat, free sugars and sodium, and deficient in complex carbohydrates. Calorie intake obtained from carbohydrate consumption has subsequently decreased. In the Arab Gulf countries, cereal consumption now constitutes only 35–40% of the calorie intake, while in other Arab countries cereals contribute up to 40–55% of the calorie supply. Sugar consumption has risen considerably over the last three decades to reach between 50–110 g per capita/day. Similarly, fat and oil consumption have also increased to 80 g/capita/day. (FAO, 1990; Musaiger, 1996).

Fibre intake

Previous studies investigating fibre intake in the Arab Middle Eastern countries have been limited. This has been due to a lack of information on fibre content in some foods consumed, as well as neglecting the role of fibre and disease in nutritional surveys. It has, however, been observed that the percentage of dietary calories comprised from carbohydrate intake is decreasing. Since fibre is found only in the carbohydrate portion of the diet, it is widely accepted that the presence of fibre in the Arab diet is also decreasing. Additionally, foods in the region are becoming increasingly processed resulting in more refined grains, thus reducing their fibre content further. The reduced con-

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sumption of whole grains has also exacerbated the problem, enhancing the decrease in fibre consumption per capita. Sorghum and millet, for example, which are usually unrefined (and therefore retain much of their fibre) are becoming less important in the diet of poor Arab countries, and have been replaced by refined wheat flour (WHO, 1989).

Diet-related chronic diseases

In most Arab Middle Eastern countries, particularly those of medium and high per capita income, diet-related chronic diseases such as coronary heart diseases, hypertension, diabeties, cancer and obesity have become major health problems. Several factors have contributed to the high prevalence of these diseases. The rapid change in food consumption patterns and socio-economic status during the past three decades are factors thought to be responsible for the increase in diet-related chronic diseases. Such an increase in chronic diseases cannot, however, be attributed to dietary changes alone. Increases in tobacco smoking and sedentary lifestyles have played an important role in the occurrence of some diet-related chronic diseases. Conversely, it should be noted that improved standards of living and health service provision have contributed to longer life expectancies in many Arab countries. Life expectancy is now above 65 years in more than half of these Arab countries, and exceeds 70 in some (WHO, 1989; FAO, 1990; Musaiger, 1994).

Objectives of the workshop

The workshop was organised to achieve the following objectives:

1. Review the current situation of food consumption patterns in the Arab and Middle East countries, with a greater emphasis on dietary fibre intake.
2. Review the prevalence of diet-related chronic diseases in the Arab Middle Eastern countries, particularly diabeties, cardiovascular diseases (CVDs), cancer and obesity.
3. Suggest measures to prevent and control diet-related chronic diseases in these countries.

The programme

International speakers and representatives from Arab Middle Eastern countries participated in the workshop. The programme consisted of six sessions. The first session dealt with technical papers encompassing the role of dietary fibre in health and disease. The second session focused on the dietary intake and food consumption patterns of the Middle East countries. The third and fourth sessions concentrated on the prevalence and factors associated with diet-related chronic diseases. The participants were then divided into two groups to discuss dietary guidelines for Arab Middle Eastern countries, and recommendations for the prevention and control of diet-related diseases. In the sixth session, participants discussed the reports of the working groups.

Recommendations

Data indicates that diet-related chronic diseases have become a major health concern in most Arab Middle Eastern countries. Changes in food consumption patterns appear to play an important role in the occurrence of these diseases. The participants have therefore suggested recommendations to prevent and control the incidence of diet-related chronic diseases in Arab countries.

1. In-depth studies and investigations on the prevalence and factors associated with diet-related chronic diseases are required. These should take into consideration socio-economic factors such as age, gender, geographical location, and nomadic and semi-nomadic lifestyles. Collaborative studies between institutes in the region should be encouraged. Standardisation of data collection methods and analysis is recommended.
2. Data collection on the incidence of morbidity and mortality of diet-related chronic diseases should be encouraged. Strengthening of the current health information system is an essential step in the provision of such data.
3. A multi-sectorial committee should be established in each Arab Middle Eastern country, to oversee collaboration between

governmental and academic institutions, as well as the private sector.

4. Many Arab Middle Eastern countries have no private associations actively involved in nutrition and chronic diseases. Establishing such societies should be encouraged as they play an important role in the prevention and control of such diseases.
5. A national programme to prevent and control diet-related chronic diseases should be initiated in each country. While some countries already have such programmes, their function and objectives are limited. The national programme should have a multi-sectorial, integrated and practical approach and should use mass media, private associations, labour organisations, and other non-governmental organisations to achieve it's aims.
6. International organisations, such as the Food and Agriculture Organisation (FAO) and the World Health Organisation (WHO), should provide technical support and effective participation to establish a network to link institutions dealing with diet-related chronic diseases. A database for these diseases should be considered.
7. The promotion of public awareness of the causes and preventative measures pertaining to diet-related chronic diseases is strongly recommended.
8. Legislation for regulations related to tobacco, drug dependence, and food labelling should be highly prioritised.
9. Dietary habits which have a preventative role against diet-related diseases should be encouraged.
10. Simplified dietary guidelines should be established to promote health and nutrition education for the public. The following guidelines were suggested:

    - Eat a variety of foods each day.
    - Increase the dietary intake of grains, legumes, vegetables and fruits.
    - Increase physical activity.
    - Decrease intake of fat, particularly animal fats.
    - Maintain an appropriate body weight.
    - Decrease the use of refined sugars and salt.
    - Ensure that food consumed is safe and clean.
    - Consume three regular daily meals.

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International Journal of Food Sciences and Nutrition (1998) **49**, S5–S8

A review of the effects of dietary fibre and their potential benefits for health

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This article reviews the association between dietary fibre intake and health. The separation of dietary fibre into water-soluble and water-insoluble parts based on laboratory analysis is useful in medical and dietetic practices. Several studies showed that there was a good association between fibre intake and function of some human body organs such as colon and upper gut. The relationship between fibre intake and fat absorption, blood lipids and obesity was also discussed.

Introduction

Before considering the definition of fibre it is important to remember that we are considering plants and foods, not just chemical components. The amount and type of fibre eaten depends on the species and variety of the plant as well as the part of the plant eaten. Young cells have thin walls made chiefly of cellulose. As the cell matures the wall thickens, eventually to be lignified and become woody. Some definitions of dietary fibre restrict the definition to plant cell wall components, but there are dietary fibre molecules such as storage polysaccharides (used by the plant as energy stores and which are not part of the wall structure) in some specialised cells, such as in the cells of beans (legume seeds). The material between cells is high in pectin.

Definition and methods of analysis

There is a continuing debate on the definition of dietary fibre. The original definition by Hugh Trowell (plant substances not digested by human digestive enzymes) was refined in 1976 by Southgate, Trowell, Jenkins and Leeds to 'plant polysaccharides and lignin not digested by the enzymes of the small intestine' (Trowell *et al.*, 1976). Clearly this definition is very much a physiological definition rather than a definition based on chemical composition. The physiological effects were recognised in an earlier definition 'unavailable carbohydrate' by McCance and Lawrence and have recently been taken up in Japan where the definition is very broad and includes all indigestible materials regardless of whether they are carbohydrate, protein or fat. 'Non-starch polysaccharides' (NSP) is a term which defines plant polysaccharides which are not starch (which is digestible by alpha-amylase). Dietary fibre and NSP are not quite the same. Generally, dietary fibre is measured using the official AOAC (American Organisation of Analytical Chemists) method (Englyst & Cummings, 1990) which gives figures which include non-starch polysaccharides and a fraction of the starch (a fraction which would be expected to be digestible in the human gut) which in the laboratory is

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0963-7486/98/000S05-04

not removed by the preliminary processing with enzymes. In practice when the composition of foods is compared using the dietary fibre method (AOAC) and the NSP (Englyst) method, lower figures are often obtained for NSP.

The dietary fibre method involves separation in water so that two fractions can be defined – a water-soluble part and a water-insoluble part. This separation into two parts based on laboratory analysis is actually very useful in medical and dietetic practice, because it is broadly true to say that soluble fibre acts in the upper gut where it slows digestion and absorption – effects which may be beneficial in diabetes, hyperlipidaemia, and possibly in weight control. In contrast insoluble fibre acts more in the lower gut where it has a stool bulking effect and influences bowel function, generally in a beneficial way. Foods which supply soluble fibre are beans (legume seeds), oats, barley and rye. Foods which supply insoluble fibre are cereals (especially wheat).

Colon function

Denis Burkitt developed the hypothesis that a low fibre intake would slow transit through the gut, resulting in drying of faecal material causing constipation. Higher pressures would be needed to move faeces through the colon – this might be related to the causation of diverticular disease. Slow movement of material through the colon might be related to higher risk of cancer. Burkitt wrote about these ideas in the early 1970s – in the 27 years since that time how much evidence has accumulated to support his ideas? The relationship between stool weight and transit time is now well established. In the UK an average daily stool weight is about 100 g – this corresponds to a mean transit time of about 50 h. Lower stool weights correspond to much longer transit times and high stool weights to transit times as short as 24 h. There is also a clear association of NSP intake with stool weight (Cummings *et al.*, 1992). The typical UK stool weight of about 100 g/d occurs in people who have an NSP intake of about 13–15 g/d. Stool weights of about 175 g/d are associated with NSP intakes of 23–25 g/d.

In large population groups colon cancer incidence is clearly related to stool weight. Stool weights of about 100 g/d (typical UK values) correspond to a colon cancer incidence of about 25 cases per 100,000 per year. Incidence rates of 50,000 per year correspond to stool weights of about 175 g/d. Thus in the UK the epidemiological evidence suggests that to halve the incidence of colon cancer average stool weights would need to rise to about 175 g/d – about 75% increase. In the UK a committee discussed the evidence for a UK dietary reference value (DRV) in the late 1980s. However, the committee compromised in its final recommendation. A UK DRV of 18 g/d was set as a compromise between the present NSP intake level of 13–15 g/d and the amount needed to achieve stool weights of 150–175 g/d which would be about 24 g NSP/d (Department of Health, 1991).

The upper gut

What happens in the large gut depends very much on what happens in the small gut where dietary fibre has several effects. Dietary fibre is generally associated with bulky foods which are less energy dense than others, which are slow to chew and eat – thus the rate and amount of intake into the gut may be slowed or reduced. Dietary fibre may slow gastric emptying and delivery of carbohydrate to the small gut – there is evidence for this. In the small gut digestion in the lumen is slowed, and absorption is also slowed down – there is plenty of experimental evidence for this.

Slowing digestion and absorption of carbohydrate flattens the blood glucose and insulin responses. Clearly this effect has great potential for treating diabetes. Since the publication of the first paper on this topic in 1976 (Jenkins *et al.*, 1976) many clinical studies have been done which show the benefits of high fibre diets and high fibre foods in the dietary management of diabetes. Foods high in soluble fibre, such as beans (legume seeds) and oats are beneficial. Tests with beans, however, showed that while children liked them adults were not happy to eat large amounts. How could this problem be overcome? If people would not eat beans containing lots of soluble fibre why not take the fibre out of beans and put it into a food which the older diabetics would eat? At King's College London a programme of work has been underway for 20 years to develop ways of creating good cereal products (breads, cereals

and pasta products) into which soluble fibre has been incorporated. This is an example of innovation and processing of fibre materials to meet the needs of a particular group of people.

Energy absorption and obesity

High fibre foods are low in energy density, bulky and more difficult to eat – thus total energy intake may be limited. High fibre foods may distend the stomach for a longer time period after a meal especially if gastric emptying is slowed, thus prolonging the feeling of fullness after a meal. There is evidence for this and it might tend to limit energy intake. In the small gut the efficiency of energy absorption might be limited and more energy may overflow into the colon – this is know to happen under certain conditions. Some of the energy which escapes into the colon may be recovered but if that happens the efficiency of recovery of energy is not as good as in the small gut (each gram of carbohydrate recovered in this way may provide 1.5 kcals compared to 4 kcals if absorbed in the small gut). The final effect may be to increase energy losses in the faeces – does this happen? There are several studies on the effect of faecal energy in which low-fibre and high-fibre diets or foods were used. The studies cannot be compared directly but if the average faecal energy losses are calculated for the diet without the added fibre and for the diet with the added fibre there is a difference of about 100 kcal per day. 100 kcal/d is not very much and perhaps this could be dismissed. However 100 kcal per day is 700 kcal per week. The energy content of 100 g of body tissue, as lost during a weight loss programme, contains about 700 kcal. Extended over a year 100 kcal per day makes a difference of 5 kg per year. It is therefore possible that relatively small effects of fibre on the efficiency of energy handling in the gut (for which we do have evidence) might help people either to maintain weight or to lose weight under some conditions (Rytting *et al.*, 1990).

Fat absorption and blood lipids

Digestion and absorption of fat in the small gut is slowed by dietary fibre. Fat is moved further down the small gut to be absorbed lower down. Under some conditions some fat may be malabsorbed thus increasing faecal fat. Soluble fibre also has a small effect on binding bile salts – this has the effect of carrying more bile salts beyond the point of absorption in the terminal ileum, thus lowering the body bile salt pool, and in turn lowering blood cholesterol.

From a practical point of view there are several questions. Does dietary fibre lower blood lipids? If it does, is there an effect of dose? How much is needed for a useful effect? Is the effect of practical value and are there any side effects?

There is a huge literature on dietary fibre and blood lipids. Meta-analyses have been performed (Ripsin *et al.*, 1992) and the effects of some materials are widely accepted. The literature is broadly divided into different designs – whether parallel treatment groups or cross-over studies into different diets – some used normal diets, others low-fat diets, and into studies on hypercholesterolaemic subjects or normocholesterolaemic subjects. The literature can also be divided according to whether the treatments were diets, dietetic products or pharmaceutical products.

Most of the work has been done on pectin (poly-galacturonic acid, which occurs in fruits and vegetables and is available as purified fine powders), guar gum (galactomannan, a storage polysaccharide from the cluster bean), psyllium (plantago or isphagula husk, widely used as a bulking laxative, but a good source of soluble fibre) and foods high in soluble fibre (especially beans, oats, rye and barley).

There is a large literature reporting studies in which the doses of psyllium given ranged from 4 to 21 g/d, but the commonest dose was 10 g/d. The effect on total blood cholesterol was a reduction of between 5 and 15%. In terms of reduction of risk this represents a reduction of cardiovascular risk of up to 30%. The evidence for the effect of psyllium is good and it is possible to achieve a useful effect with just one daily portion of a food product fortified with psyllium. Studies have been undertaken to examine the importance of processing on the efficacy of psyllium. When psyllium is given as a separate pharmaceutical powder or granule it is not as effective as a fortified food product in lowering blood cholesterol. Intimate mixing of the fibre and food is important. This is another example of the importance of processing to get

fibre into an acceptable form so that an adequate daily dose can be given on a sustained basis.

Thus, soluble fibre does lower blood lipids, and a daily dose of 3 g soluble fibre per day seems to be the minimum needed. The cost of long-term drug treatment with lipid-lowering drugs is very high, so the effect of fibre is of practical value – the use of a fortified food product as an extra help to dietary treatment seems sensible. However, in some people increasing fibre in the diet gives a transient change of bowel habit, but at the moderate doses used there are no sustained adverse effects.

Health claims

In the light of the evidence for the effects of fibre are health claims possible? Is the evidence sufficient to justify health claims? In January 1996 the Food and Drug Administration in Washington published a notice of its intention to allow a specific health claim relating to oats (a good source of soluble fibre) to heart disease (FDA, 1996). During 1996 further evidence was received and reviewed and in January 1997 the health claim 'Diets high in oat bran or oatmeal and low in saturated fat and cholesterol may reduce the risk of heart disease' was allowed (FDA, 1997). It is likely that other claims relating fibre to health effects will follow in the United States and possibly in other countries later on.

Conclusions

Physiologically, dietary fibre is plant polysaccharides and lignin not digested by the small intestinal enzymes of man (the 1976 Southgate definition), and chemically it can be defined as non-starch polysaccharides (Englyst and Cummings). In the future we will see acceptance of the variation in definition but there must be standardisation within trading zones for food labelling purposes.

In the small gut dietary fibre slows absorption and digestion, thus moderating blood glucose and insulin levels. In the small gut its effects on fat and bile salts can lower blood cholesterol. In the large gut it bulks the stool and shortens transit time. Its effects on metabolism may go far beyond its influence on blood levels of glucose and cholesterol, etc., – it may influence insulin sensitivity and thereby may reduce the risk of heart disease by another mechanism. In the future, continuing research will reveal more detail of these effects and possibly others.

The UK has defined a dietary reference value but this is lower than the ideal level. There are various barriers to increasing dietary fibre intake and there is a great need for innovation including the development of special foods with high amounts of particular types of fibre.

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Fibre and its role in health and disease

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Over the last few decades considerable research has been conducted on the role of dietary fibre in health and disease. Fibre is a very general term. Broadly it can be defined as water soluble and insoluble. These different types of fibre exert different physiological effects and have clinical implications. There is much research that associates low intakes of different types of fibre with the incidence of many diseases such as obesity, heart disease, diabetes and cancers. The evidence to date will be reviewed.

Introduction

In terms of classification of dietary fibre, in general fibre is defined according to its solubility in water into soluble and insoluble fibre. Insoluble fibre includes lignins, celluloses, and hemicelluloses. Soluble fibre includes pectins and gums. Most foods of plant origin, however, contain both soluble and insoluble fibre, but they tend to be rich in one type of fibre. The major food sources of insoluble fibre are wheat products, most grains and vegetables. The major food sources of soluble fibre are fruits, oats, barley, beans, and psyllium (Table 1).

Physiological effects

Both soluble and insoluble fibre exert different physiological effects in the body as shown in Table 2. The physiological effects of fibre occur throughout the length of the gastrointestinal tract. High-fibre foods are 'chewy' and chewing stimulates the flow of saliva and the secretion of gastric juices. In the stomach, soluble fibre increases the viscosity and stickiness of the stomach contents and thereby delays gastric emptying which may enhance satiety. It also appears to slow the rate of digestion and absorption of nutrients from foods. Soluble fibre has been shown to improve glucose metabolism, lower fasting serum insulin and peripheral insulin response to oral glucose administration. It also selectively lowers serum LDL cholesterol concentrations.

In the large intestine, fibre in general alters transit time. While most fibres contribute to stool bulking, insoluble fibre tends to be more effective in accelerating intestinal transit. It also profoundly alters bacterial metabolism in the large intestine. It may bind or dilute carcinogens or alter bile acid metabolism to reduce risk of colon cancer. It also reduces intraluminal pressure (Anderson, 1986; Schweizer & Wursch, 1991).

Because of the many physiological effects of the different components of dietary fibre, fibre *per se* has been linked to the etiology of many diseases (Southgate, 1990; Ahmed, 1995).

Fibre and its role in health

Fibre is necessary to maintain normal functioning of the gastrointestinal tract. The laxative effect of fibre has been well documented in

0963-7486/98/000S09-04

Table 1. Classification of dietary fibre

Type	*Component*	*Major food sources*
Insoluble	Lignin	Wheat
	Cellulose	Most grains
	Hemicellulose	Vegetables
Soluble	Pectins	Fruits
	Gums	Oats
		Barley
		Beans
		Psyllium

many studies (Council on Scientific Affairs, 1989; COMA. 1991). Constipation is a very common problem particularly amongst children, pregnant women and the elderly. While not a life-threatening condition it can affect the quality of life. In particular insoluble fibre has been used in the prevention and treatment of constipation. There is evidence to suggest that the amount of stool passed in relation to the frequency of defecation and transit time has a bearing on health, especially colon cancer (COMA, 1991). In epidemiological studies faecal weights below 150 g/d are associated with increased risk of colon cancer (Burkitt *et al.*, 1972, Cummings *et al.*, 1982) and diverticular disease (Findlay, 1974).

Fibre and its role in disease prevention

The hypothesis that fibre has protective effects against many diseases has been under investigation for many years. There is much epidemiological evidence of its role in disease prevention (Southgate. 1990; Ahmed, 1995). An inverse relationship between fibre intake and the incidence of obesity. heart disease, cancers (particularly colon and breast), diabetes and gastrointestinal disorders has been documented (Council on Scientific Affairs, 1989).

Table 2. Physiological effects of dietary fibre

Type of fibre	*Physiological effect*
General	Induce satiety
Soluble	Delay gastric emptying
	Delay rate of absorption
	Reduce blood cholesterol levels
Insoluble	Reduce transit time
	Reduce intraluminal pressure
	Increase stool weight
	Increase frequency
	Dilution effect on luminal contents
	Increase fecal bacterial mass
	Increase bile acid excretion
	Reduce colonic pH

In terms of obesity, this is a growing problem in many Arab countries (Musaiger, 1990; Khashoggi *et al.*, 1994). Obesity is associated with an increased risk of many chronic diseases. Epidemiological observation suggests that higher-fibre diets are lower in energy and less likely to contribute to the development of obesity. They tend to be bulky and also to induce satiety. High-fibre diets may promote long-term weight loss and maintenance for this and other reasons. They take longer to eat, increasing satiety and satisfaction. They slow gastric emptying, contributing to a feeling of fullness. They also lower serum insulin, enhancing satiety, since insulin is known to stimulate appetite (COMA, 1991).

Several studies associate high fibre intake with lower incidence of cancers (Peto, 1986). In particular, there is much evidence linking fibre intake to colon cancer (Trock *et al.*, 1990). Colon cancer is a common disease in Europe (Jensen *et al.*, 1990). It is also a cancer that is being seen more often in Arab countries (El-Akkad *et al.*, 1986). Several mechanisms have been proposed for fibre's protective effect against colon cancer. Fibre may act to reduce transit time in the colon and thereby decrease the time for exposure to potential carcinogens. Through its hydrophilic nature, fibre can dilute the concentration of carcinogens in the colon. It can affect the production of bile acids and other potential carcinogens in the stool, it can alter the nature of faecal bile acids by virtue of its influence on the constitution and metabolic activity of faecal bacteria, and it can reduce colonic pH by increasing fermentation and short-chain fatty acid production (Council on Scientific Affairs. 1989).

Recently there have been human intervention studies that support the anti-cancer properties of a specific type of fibre called wheatbran. Alberts *et al.*, (1990) studied the effect of wheatbran on rectal epithelial cell proliferation (a marker for risk of colon cancer) in patients with resected colon cancer. They found that DNA synthesis and cell proliferation was

reduced in the wheatbran-supplemented group. DeCosse *et al.*, (1989) reported similar beneficial effects of wheatbran in a group of patients with familial polyposis, a group of people genetically predisposed to colon cancer. These human intervention studies and others (Alberts *et al.*, 1996) suggest that wheatbran fibre might be a useful chemopreventative agent for colon cancer.

Fibre and its role in disease management

Fibre is known to be beneficial in the management of certain diseases, including hyperlipidaemia (Anderson & Tietyen-Clark, 1986), diabetes and weight reduction (Anderson, 1986).

In terms of hyperlipidaemia, consumption of soluble fibre has been shown to reduce blood cholesterol levels in many studies (Glore *et al.*, 1994). In one study by Anderson *et al.*, (1984) 100 g of oat bran for 21 days resulted in a 19% reduction in total cholesterol, 23% reduction in LDL cholesterol and a 22% reduction in the HDL/LDL ratio.

Several mechanisms are thought to be involved. The short-chain fatty acids of fibre fermentation may mediate some of fibre's hypolipidaemic effect. These fatty acids are absorbed into the portal vein and appear to inhibit hepatic and peripheral synthesis and increase LDL cholesterol clearance. Changes in rate of glucose absorption and serum insulin levels may also affect cholesterol metabolism (Glore *et al.*, 1994).

Fibre may offer many health benefits for diabetics. The prevalence of diabetes is rising in many Arab countries (Fatani *et al.*, 1987). High fibre intake lowers fasting postprandial plasma glucose and insulin levels, reduces insulin requirements, and improves glycaemic blood sugar control. It also lowers serum cholesterol and triglyceride values in diabetic individuals. Because diabetes accelerates atherosclerosis, maintenance of normal serum lipid levels is a primary goal in diabetes management (Anderson & Byrant, 1986).

In conclusion, there is general agreement that dietary fibre is an important part of a healthy diet. Because of the different types and physiological effects of fibre, a wide range of foods needs to be consumed which encompasses the diversity of dietary fibre in order to maximise the health benefits. An adequate amount of dietary fibre can be obtained by choosing several helpings daily from a variety of fibre rich foods such as whole grain breads and cereals, fruits and vegetables and legumes.

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Fibre recommendations throughout the world

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The role of dietary fibre (DF) in the prevention and treatment of constipation has been well recognized for over a century. Currently dietary fibre is considered an important nutrient in reducing the risk of western diseases such as cancer, cardiovascular disease, and diabetes. Data exist to relate dietary fibre intake to certain disease states. However, lack of agreements on what dietary fibre is and how it should be measured often make data interpretation difficult. Between 1972–76, dietary fibre was defined as the remnants of plant components that are resistant to the hydrolysis by human alimentary enzymes. Most dietary fibre intake databases have been developed based on analytical values to meet this definition. Recently, the scientific community has supported the expansion of the definition to include resistant oligosaccharides and resistant starch in addition to non-starch polysaccharides and lignin. Except for special products, this new definition would not affect dietary fibre values in most food tables in the next decade. Typical recommendations in various countries are set at 20–30 g of dietary fibre per day. Despite the enormous amount of scientific literature on the benefits of dietary fibre and dietary guidelines, dietary fibre intakes of the general public are well below the recommended levels. The recommended DF intake in the US is 20–30 g/d while actual consumption ranges from 11–13 g/d. In the Arab countries, dietary fibre intake levels have decreased significantly over the past decades as whole grains are replaced with refined grain flours. Fibre-related nutrition education may be required to improve public health related to optimum consumption of fibre-rich foods. Whole grain or bran-enriched food products should be promoted in such nutrition education programmes.

Introduction

Based on studies conducted in rural Africa, Burkitt and Trowell (1975) proposed that the consumption of diets deficient in fibre are associated with increased incidence of diseases common to western industrialized countries. In the past 25 years, evidence of the beneficial effects of dietary fibre (DF) in diabetes, heart disease, colon cancer and other chronic diseases of the gastrointestinal tract has accumulated (Gray, 1995). Studies on the relationship of DF to health and disease are dependent on accurate DF values for foods. However, the existing methodologies for the measurement of fibre for a particular food yields a wide range of results (Lanza & Butrum, 1986). This variability and inconsistency is then reflected in the variety of

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food composition tables utilized by epidemiologists and other research scientists to estimate DF intake.

Despite these difficulties, government agencies around the world have been able to set recommended levels of DF intake based on existing data. Unfortunately, the actual intake has been far below these recommended levels. Education on the benefits of consuming higher levels of fibre needs to be implemented. In this review, the recommendations and intake levels in North America, Europe, Latin America, and the Asia-Pacific region will be discussed. However, before these issues are addressed, DF will be defined and the various methodologies for its measurement will be reviewed.

What is dietary fibre?

Burkitt and Trowell's definition of DF, being the sum of polysaccharides and lignin that are not hydrolyzed by human alimentary enzymes, has gained wide acceptance (Lee & Prosky, 1992; Cho & Prosky, 1998). This physiological definition allows the inclusion of other compounds that may differ in chemical structure but have fibre-like characteristics. On the other hand, analytical chemists prefer the definition proposed by Southgate (1982) where DF is the sum of lignin and non-starch polysaccharides (NSP). The NSP consist of cellulose, hemicelluloses, β-glucans, pectin, gums, and mucilages. Lignin, the non-carbohydrate constituent of DF, is a complex three-dimensional polymer of phenyl propane units. Resistant starches, formed by retrogradation of amylase that escapes digestion in the small intestine (Berry, 1986; Englyst & Cummings, 1987), are also included in the definition of DF because they behave like NSP in the gut.

The addition of resistant oligosaccharides to DF definition may open up new avenues in the nutritional, analytical, and food technology research areas. Along these lines, a common understanding on resistant oligosaccharides should be developed.

Certain types of oligosaccharides may be claimed for DF in the future if their unavailability in the human upper gastrointestinal tract and the resulting physiological actions similar to other DF components are fully proven. It should be emphasized that most of the foods in today's market do not contain resistant oligosaccharides, except a few formulations using resistant oligosaccharides as ingredients. Thus, this new definition would not affect the DF values of most food products. Nevertheless, the inclusion of resistant oligosaccharides would allow new product development efforts as well as nutrition research to evolve. Subsequently, analytical methodology needs to be fine-tuned to fully recover these resistant oligosaccharides as well as resistant starch in the DF analysis. Until a reliable methodology is developed to meet this new definition, current DF methods should continue to be used for DF labelling and dietary analyses (Lee & Prosky, 1992).

Recommendations for dietary fibre intake levels

Before making DF recommendations, the physiological effects of its different components must be known. The two main types of DF, water-soluble (SDF) and water-insoluble (IDF), have some different mechanisms of action *in vivo*. The SDF such as B-glucans, pectins, gums, mucilages, and some hemicelluloses delay transit time in the gut, and gastric emptying, impede the absorption of certain nutrients like glucose, and decrease serum cholesterol levels. Insoluble DF like cellulose, lignin, and other hemicelluloses decrease intestinal transit time and increase faecal weight, slow starch hydrolysis, and delay glucose absorption (Cummings *et al.*, 1985). Both types of fibre are important for overall health.

The health benefits of a dietary recommendation should also outweigh potential deleterious consequences. Using the estimation that 35% of all cancer cases are attributable to diet, 315,000 new cancer cases or 166,000 cancer deaths would result if dietary goals for cancer prevention such as increasing DF intake levels are not achieved (Englyst *et al.*, 1987a). This could cost as much as US $25 billion a year. Based on international correlation statistics, an inverse relationship has been found between fibre and fibre-containing foods and colon cancer risk (Englyst *et al.*, 1987b; Orman, 1993). Wheat-bran has been shown to lower recurrence of rectal pre-cancerous polyp lesions in humans (Cassidy *et al.*, 1994). Both IDF and SDF may

reduce breast cancer risk by binding estrogen, a potent promoter, and thus preventing enterhepatic reabsorption and lowering circulating levels. Although increased DF intake seems to be beneficial in terms of cancer, there are concerns about impaired mineral availability. Examination of populations that consume much higher levels of DF (e.g. vegetarians vs omnivores) showed that mineral levels in various biological samples were comparable to those individuals with lower DF intakes (Bal & Foerster, 1993). In addition, bone mineral mass was observed to be higher or at least the same: bioavailability of minerals with higher DF intakes does not appear to be an issue as long as mineral intakes are adequate.

Other issues that need to be considered in making a recommendation are the intended audience, the current intake levels of DF, and how the DF will be consumed (i.e. in foods vs supplements) (Bal & Foerster, 1993). Recommendations are generally based on a healthy, adult population and are not applicable to special populations like young children and the elderly. In reviewing existing data on current DF intakes of a population, the methods used for dietary assessment and chemical analysis of the DF content of a food are determined since they both influence the estimated intake level. Finally, recommendations are for DF in foods and not supplements. The use of DF supplements may affect the balance of nutrients in an otherwise healthy diet. Limited data exist on the effect of isolated DF which may differ from the DF naturally present in a food (Bal & Foerster, 1993).

Worldwide dietary fibre intake recommendations

Recommendations for DF intake by the World Health Organization (WHO) are 16–24 g/d of NSP or 27–40 g of total dietary fibre (TDF) (Table 1). The Food and Agriculture Organization (FAO) of the United Nations recommends that individuals should eat a variety of foods in order to obtain all the necessary nutrients for proper health. Carbohydrates was one of seven food groups mentioned, with cereals listed as a choice. In contrast, the WHO study group (Pilch, 1987) advocated that complex carbohydrates should be a major portion of the diet at 50–70% of the total energy consumed. Suggested sources of NSP included fruits and vegetables (no less than 400 g/d) and pulses, nuts, and seeds (no less than 30 g/d but part of the 400 g recommendation for fruits and vegetables). The WHO further specified that free sugars should be no more than 10% of energy (Pilch, 1987).

Dietary fibre intake recommendations in North America

Recommendations for DF intake in North America range from 25 to 35 g/d. The US FDA recommends that DF goals be based on a caloric basis (Table 1). General dietary recommendations by organizations in the US and Canada are to increase intakes of grain products, fruits and vegetables which will subsequently increase overall DF intake if these recommendations are followed. Recent US recommendations for intakes of grain-based foods are at least 6 servings per day. In Canada, recommended intake levels of breads, cereals and other grain products have increased from 3–5 servings per day to 5–12 servings per day.

Even though paediatric guidelines for DF intakes in the US have been set for the consumption of other macronutients such as protein, fat and carbohydrates, no specific recommendations on DF levels have been made until recently. In 1993, the America Academy of Pediatrics (AAP) Committee on Nutrition made the recommendation that DF intake in children over age 2 should be 0.5 g/kg body weight (DeCosse *et al.*, 1989). To avoid the potential hazards of excessive consumption, especially for overweight children, the AAP suggest a cap of 35 g/d. However, intakes up to 25 g/d should not be deleterious even with suboptimal mineral intake (DeCosse *et al.*, 1989). The American Health Foundation (AHF) recommends that a range of DF intake, between 'Age+5' and 'Age+10' g/d may represent a safe and tolerable level for most children over the age of 2 years (Rose, 1990). Consistent with guidelines for adult DF intake, the AHF recommendation gradually increases the fibre intakes to the minimal adult DF level by age 20. Consumption of the recommended level of DF by children may help to decrease the risk of developing chronic diseases such as cancer and cardiovascular disease later on in life (Rose, 1990).

Table 1. Dietary fibre daily intake recommendations

Country	*Recommended intake*	*Basis*	*Source of recommendation*
WHO	16–24 g 27–40 g	NSP TDF	Report: diet, nutrition and the prevention of chronic diseases
Australia	30 g	DF	Australian Government Department of Community Services and Health
Belgium	26–38 g (male) 19–28 g (female)	DF	National Council for Nutrition (unofficial)
Canada	25–35 g	DF	Expert panel in 1985 (unofficial)
Central America	18–24 g	DF	Institute of Nutrition of Central America and Panama (INCAP)
Columbia	15–20 g	?	Health Ministry (1992)
Denmark	25–30 g	TDF	National Food Agency/Nutrition Council
Finland	25–30 g	DF	National Food Agency/Nutrition Council
France	25–30 g	DF	Well known French gastroenterologist—unpublished
Germany	30 g	DF	German Society on Nutrition
India	40 g	DF	Indian Council of Medical Research, National Institute of Nutrition
Ireland	25–35 g	DF	The Food Advisory Committee of the Department of Health (1987)
Italy	19 g	TDF	National Nutrition Institute
Japan	20–25 g	TDF	Ministry of Health and Welfare
Mexico	25–30 g	DF	National Nutrition Institute
Netherlands	3 g/MJ/day (24–30 g)	DF	Dutch Nutritional Values 1989: Nutritional Council
Norway	25 g	DF	National Food Agency/Nutrition Council
Puerto Rico	25 g/2000 kcal	DF	Food and Drug Administration (FDA)
South Africa	30–40 g	TDF	Heart Foundation, Cancer Association, Association of Dietetics, Department of Health (unofficial)
Spain	30 g	TDF	General literature references, no official figures
Sweden	25–30 g	DF	National Food Agency/Nutrition Council
United Kingdom	18 g	NSP	Department of Health Committee on Aspects of Food Policy, Department of Health Dietary Reference Values Report
United States	25 g/2000 kcal (adult) 'Age+5' to 'Age+10' g	DF	Food and Drug Administration (FDA)
United States	(3–20 years of age) 0.5 g/kg BW up to 25 g/day	DF	American Health Foundation
United States	(adolescents)	DF	American Academy of Pediatrics
Venezuela	8–10 g/1000 kcal	DF	National Nutrition Institute (1993)

Dietary fibre intake recommendations in Europe

In the UK, the recommendation for DF intake is based on NSP because it is the major fraction of DF regardless of the DF definition used and is chemically identifiable and measurable with reasonable precision. In the early 1970s, fibre tables in the UK had been constructed with Southgate's unavailable carbohydrate method (WHO, 1990) which overestimates DF values of high-starch foods due to incomplete starch removal during the procedure (Lanza & Butrum, 1986). The NSP methods of analysis developed by Englyst and colleagues (Southgate, 1969; AAP, 1993; Williams *et al.*, 1995), classifying NSP into soluble and insoluble fractions, are now used for labelling purposes in the UK. The UK Department of Health recom-

mends an average NSP intake of 18 g/d to be consumed from a variety of foods and not supplements (Table 1). Confusion in data interpretation had resulted in the previous recommendation of 30 g/d, based on the unavailable carbohydrate method, by the British National Advisory Committee on Nutrition Education in 1983 (Horwath, 1989).

The present NSP recommendation is based on its importance for overall colonic health and regularity. At NSP intakes of less than 12 g/d, stool weights are less than 100 g/d which is associated with an increased risk of bowel disease (Department of Health, 1991). However, a recent study showed that NSP plus resistant starch, and not NSP alone, correlated with colon cancer incidence (Cassidy *et al.*, 1994). Carbohydrate metabolism, insulin metabolism, or blood lipid profiles were not considered in the recommendation due to the lack of evidence that NSP plays any significant role. There does not appear to be any significant reduction in mineral bioavailability with populations which habitually consume high levels of NSP. Because this may be a factor in those with marginal mineral intakes like the elderly, the recommendation is only applicable to healthy adults (Department of Health, 1991).

Using TDF method as a basis, most countries in Europe recommend a daily DF intake of 20–35 g (Table 1). General recommendations are to increase consumption of fruits, vegetables, and cereals and cereal products, replacing energy intakes from fatty or sugary foods.

Dietary fibre recommendations in the Asia-Pacific region

Generally, DF tables in the Asia-Pacific region are based on the AOAC/TDF method 985.29, sometimes with modifications for foods unique to the country, e.g. Japan. Recommendations for DF intake are lower in Japan (20–25 g/d) than in Australia (30 g/d) (Table 1). Australians have dietary habits similar to that of Americans. Officials in Japan believe that the American RDA for DF is probably too high for the Japanese considering the lower energy consumption, lower fat intake, and insufficient calcium intakes which may be exacerbated by high levels of DF intakes (Nishimune *et al.*, 1993). Using 2088 kcal as the average Japanese energy intakes in 1985, daily DF intake levels were calculated to be 10–12 g/1000 kcal (about 20–25 g/d). The lower limit is based on the DF required for a minimum daily faecal output of 140–150 g since this is associated with increased bowel disease risk (Spiller *et al.*, 1977). Factors considered in establishing the upper limit are mineral sufficiency, fat consumption, ratio of IDF to SDF intake, the decreasing trend in Japanese TDF intake, and the increase in mortality rates of diabetes mellitus, ischemic heart disease, and diverticulosis.

Dietary fibre recommendations in Latin America

The recommendations in Latin America, generally based on the AOAC/TDF method 985.29, are similar to other countries around the world although Colombian values are quite low at 15–20 g/d (basis unknown) (Table 1). In the late 1970s and early 1980s, the NDF method was the basis for Latin American food labelling. Latin American government agencies advocate increasing complex carbohydrates (CHO) intake by increasing consumption of fruits, vegetables, legumes, and grain-products. Mexico, Chile, and Puerto Rico (which follows US recommendations) give guidelines for relative consumption for DF from different food sources. Brazil and Argentina have no official guidelines in place.

Dietary fibre recommendations in South Africa

The Department of Health Services and Welfare in South Africa and HMAC subcommittee on nutrition services have published booklets containing recommendations to satisfy the normal requirements of healthy South Africans. They endorse the consumption of fibre-rich foods such as whole grain products, fruits, vegetables, and dry legumes. Due to the concern for the unknown effects of consuming isolated DF products, they also state that it is preferable to consume foods naturally high in fibre than to add bran to low-fibre foods. Increasing fibre intake by consuming unrefined cereal products like brown and whole wheat bread and high-fibre breakfast cereals is advocated. The recommended DF intake of 30–40 g TDF/d is consistent with recommendations in the UK (Table 1).

Actual dietary fibre intake levels

Problems in assessing dietary fibre intakes

One of the difficulties encountered in making specific recommendations for DF intake is in assessing the current intake levels. Variability in estimated DF intakes can be attributed in part to the type of dietary assessment and method of fibre analysis utilized.

There are three main methods for obtaining dietary data: (1) food balance (e.g. per capita disappearance) statistics; (2) household food surveys; and (3) studies of individuals (Cummings, 1995). Dietary data obtained from food balance statistics tend to overestimate actual consumption by individuals (Bright-See & McKeown-Eyssen, 1984; Cummings, 1995). Household food survey data need to be corrected for food waste, consumption of meals outside the home, locally grown produce, and household size and composition (Cummings, 1995). Studies on individuals, which are probably more representative than the other two techniques, use a variety of methods to assess intake: 24-h recall, food frequency questionnaires, and food records for varying periods which may or may not include weighing of food consumed. Assessments through single 24-h recall tend to underestimate and detailed food records tend to overestimate intakes (Bingham, 1985). The coefficient of variation in day-to-day intake in individuals, which cannot be assessed by 24-h recall, is much greater than intake variability observed season to season (Bingham, 1985). In comparing a food frequency questionnaire with 7-d weighed records, Saba *et al.* (1995) found that TDF estimates were higher with the questionnaire for all categories of high DF foods. Weighed food records strongly correlate with chemical analysis methods of food composites and independent markers of food intake (i.e. urinary and faecal nitrogen excretion) (Bingham *et al.*, 1982). Thus, the most objective method available is the weighing and recording of all food eaten, but even the act of doing so can disturb a person's normal eating pattern (Bingham, 1985).

Dietary fibre intake levels around the world

Dietary fibre intake levels in North America, the Asia-Pacific region, and most industrialized nations in Europe are far below the recommended levels. In North America, usual intake levels of TDF are between 10 and 15 g/d. Estimates of DF intakes in Europe, mostly based on Southgate's unavailable CHO method, are in the range of 18–25 g/d. Two European studies, one in Italy (Turrini *et al.*, 1995a) and one in the Netherlands (Kromhout *et al.*, 1990), obtained much higher estimates of about 32 g/d. In the UK and Scandinavia, NSP intakes range from 13–18 g/d. Studies in Australia and New Zealand have found DF intake levels in the range of 18–20 g/d (unavailable CHO) whereas countries like Japan and Korea are even lower at 10–17 g TDF/d. However, South Asians who have immigrated to the UK were found to have much higher intake levels than the native British in one study (Frost-Anderson *et al.*, 1995). Dietary fibre consumption in Latin America is closer to recommended levels (20–23 g/d) but still falls below official guidelines.

As mentioned previously, some of the variability in estimated DF intake levels is due to the fibre analysis method used in the assessment. Studies comparing values derived from the Southgate unavailable CHO method with the NSP (Lewis & Buss, 1988; Emmett *et al.*, 1993a;), TDF (Nakaji *et al.*, 1993), or a combination of methods (Lanza *et al.*, 1987) always found Southgate estimates to be higher. In a Japanese study by Nakaji *et al.* (1993), Southgate estimates were only slightly higher than the TDF estimates by the AOAC method developed by Prosky's group. However, the proportion of DF from different food sources differed greatly between the two methods, especially for grains and vegetables.

The major source of DF varies from region to region. Kasper *et al.* (1980) found that most of the DF in Germany was from cereals (44–52%) and then potatoes and vegetables (25–32%). Studies in Japan, the UK and Italy have found more of the DF intake to come from vegetables (Davies *et al.*, 1986; Lee *et al.*, 1994; Frost-Anderson *et al.*, 1995; Turrini *et al.*, 1995b). In Asia, rice constitutes the greatest proportion of grain products consumed at approximately 12% (Lee *et al.*, 1994; Hwang *et al.*, 1996). Decreasing trends in bread and cereal consumption have resulted in a concomitant rise in fruits consumption in the Netherlands (Van Staveren *et al.*, 1982; Kromhout *et al.*, 1990). Unfortunately,

decreased consumption of cereals and cereal products can have a serious impact on DF intakes. Emmett and colleagues found that increasing the NSP contribution from cereals greatly increases the overall NSP intake (Emmett *et al.*, 1993b). Unfortunately, negative trends in DF consumption have been observed in some countries. Dietary fibre intakes in Japan have been declining consistently since the 1950s (Acevedo & Bressani, 1989; Nishimune *et al.*, 1993). Similar drops are being observed in certain rural and urban areas of Latin America (Acevedo & Bressani, 1989). So although some positive dietary patterns have been observed in certain regions (Acevedo & Bressani, 1989; Kromhout *et al.*, 1990), especially in Italy where significant positive trends in DF intake have been observed (Turrini *et al.*, 1995b), dietary intake levels of DF are still falling short of the recommended levels.

Dietary fibre intake levels can also vary according to sex, ethnicity, and lifestyle. Women usually have lower intakes than men. In some cases, this is due to lower energy intakes. Some investigators have found that although women's overall intake of DF was lower, they consumed more fibre-dense diets (Lanza *et al.*, 1987) consisting of foods such as brown breads, cereals, raw salads (Potter *et al.*, 1986). In one study, men and younger individuals tended to consume more DF from potatoes cooked in fat and pulses (Emmett *et al.*, 1993b). In the US, Block and Lanza (1987) found trends in DF intakes also differ between the sexes.

Dietary fibre intakes in women increased with age whereas the opposite occurred in men (Block & Lanza, 1987). In the same study, ethnic differences in DF intakes existed with African Americans tending to consume less than Caucasians in both sexes across all age groups. However, Ballew and Sugerman (1995) found that DF intakes in Mexican women living in Chicago were different than those living in Texas, suggesting that within an ethnic group there are also temporal and regional variations in dietary intake patterns. Greater DF intakes in rural vs urban areas is not uncommon (Englyst *et al.*, 1982). Lifestyle plays a large role in the level of DF consumed. In general, those who had healthier lifestyles or concern about getting adequate nutrient intakes had higher intakes of DF (Potter *et al.*, 1986; McKeigue *et al.*, 1989; Frost-Anderson *et al.*, 1995; Slesinski *et al.*, 1996).

Conclusion

It is important that regulatory agencies, researchers in nutrition and analytical areas, industry representatives, consumers, and health professionals have a common understanding of the definition of DF. International surveys like those conducted by the AOAC (Cummings *et al.*, 1985) are a necessary step in keeping abreast of perceptions about the definition of DF. Chemical methodology for DF analysis needs to keep up with changing or expanding definitions of DF for proper food labelling for the consumer and for assessment in epidemiological studies. Although AOAC/TDF methods appear to be the most ideal, improvements must be made for better recoveries of resistant starch and resistant oligosaccharides that are part of the new and expanded DF definition.

Dietary recommendations for fibre must take into account several factors: (1) physiological effects of various fibre components; (2) long-term effects of fibre on health and disease; (3) potential adverse effects of mineral availability in more susceptible populations; (4) the intended population for the recommendation; (5) current intake levels to assess feasibility of the recommended level; and (6) whether DF will be consumed in foods or supplements. Although analysis and characterization of DF is one of the more popular areas of research according to the European Management Committee of COST 92 (Cummings, 1995), research into DF epidemiology and intakes is severely lacking. Despite official recommendations and increased awareness around the world to increase DF consumption by increasing intakes of grain products, fruits, and vegetables, this advice is not being followed by the general public. Children and adolescents are an important group to reach since the development of good dietary habits now will most likely be carried throughout their lifetime, affording protection against the development of chronic diseases associated with low fibre intakes. A necessary step is to increase education regarding the importance of DF to change the existing perceptions about food choices. Diet and health-related beliefs are crucial factors in changing dietary patterns.

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Changes in food consumption patterns in the Arab countries

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Since ancient times, until only 30 years ago, the traditional diet of the region was basically a mixture of wheat and grain legumes, mainly chickpeas, broad beans, lentils and sesame. Fruits, especially dates, and green vegetables were consumed traditionally. However, during the last three decades, the region has witnessed very rapid social and economic changes which affect the food habits of the population. The average per capita energy intake in the region increased by 30% and fat intake by 45%. However, there are big variations among countries in terms of the increase of energy intake. The largest increases in food consumption were seen in sugar, fat and vegetable oil and meat, especially poultry, none of which are sources of fibre. Sugar consumption doubled in Egypt, Algeria, Libya and Saudi Arabia and increased by more than 50% in Jordan and Lebanon. The consumption of vegetable oils tripled in Algeria, Iraq and Libya. There was a slight increase in consumption of milk, fruits and vegetables. In general, the food habits of the people in the region are characterized by a low intake of food rich in fibre and a high intake of energy derived from fat, sugar and refined wheat flour in addition to saturated fatty acids and cholesterol.

Introduction

The Arab Middle East region sits astride the lines of communication with Europe, Africa and East Asia, and it has therefore been subjected to influences, in terms of food consumption patterns, from the East as well as the West.

The total land area of these countries is 13.67 million km^2. The land under permanent crops represents only 3.9% of the total area of which 18.7% of the arable land is irrigated and the remaining 81.3% relies on rainfall. The erratic rainfall in the region contributes to the instability of food production. Thus, the fluctuation and uneven distribution of rainfall in the region affects food production, food availability and food consumption in several countries.

The two major constraints affecting the expansion of food production in the Arab Middle East are lack of arable land, as about 75% of the total area is desert, and the scarcity of water resources in the remaining 25% of agricultural land. Some countries in the region such as Somalia, Sudan and Mauritania, are affected (from time to time) by severe droughts while other countries such as Tunisia, Morocco and Jordan, may also suffer occasionally from droughts, leading to acute food shortages in these countries.

The total population of the Arab region was about 250 million in 1995–96 with an annual average growth rate of 3.1%, which is considered to be among the highest rates in the world. This means that the population in the region will double within the next 23 years, whereas the population of Europe, in contrast, is

0963-7486/98/000S23-08

expected to double in about 235 years. Consequently, food security, availability and consumption in this region are being affected by high population pressures on the limited arable land as well as scarcity of water resources coupled with the increasing food demand.

The region is also characterized 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. During the last two decades, the region has additionally witnessed massive population movements both within as well as from outside the region. The latter have been mainly from the East Asian countries and have led to changes in food consumption patterns, especially in the labour-importing countries (Miladi & Farrag, 1993).

Magnitude of the food problems in the Arab countries

The average annual growth rate of food production in the Arab countries increased by about 2.2% compared to an increase of more than 5% in the last three decades in food demand. This, in turn, led to an increase in the dependence on costly food imports from outside the region. As a result, the self-sufficiency ratio (SSR) for major food commodities in turn decreased remarkably during this period. This widening food gap in the Arab region is expected to further increase, particularly if appropriate measures are not taken, at both national and regional levels, to meet the rapid growth of food demand (FAO, 1993).

In addition to the above mentioned constraints, the other factors that affect food production are: (1) the problem of land fragmentation, which hinders the application of modern technology in food production, e.g. Tunisia, Jordan and Egypt; (2) the land tenure system, which is a special problem affecting food production as in Egypt; (3) inadequate water control and management combined with inefficient drainage systems which has led to progressive loss of cultivated land in many countries; (4) insufficient use of agricultural inputs such as improved seeds, fertilizers and insecticides, e.g. Sudan and Yemen; (5) continuous and high rates of urbanization, which has led to the loss of more and more of the good agricultural land, e.g. Egypt, Syria and Jordan; (6) desertification and deforestation are becoming real threats to the life of rural populations and food production capacities, e.g. Somalia and Sudan; (7) agricultural credit facilities have not been always used in favour of small farmers; (8) the marketing system of basic foods from producers to consumers has always been to the disadvantage of producers; and (9) the wide gap between agricultural research and agricultural extension services, has had a negative effect on the transfer of modern technology in several countries of the region (FAO/RNEA, 1992).

As a consequence of these factors, the income gap between rural and urban communities has encouraged rural migration to the cities, which has resulted in new food consumption patterns for those migrants.

Factors affecting changes in food consumption patterns in the Arab Middle East countries

In examining the factors affecting changes in food consumption in the Arab Middle East countries, it should be observed that there are vast differences in socio-economic, ecological and cultural conditions in these countries. The region contains the poorest countries (Somalia, Sudan) and the richest countries (United Arab Emirates, Qatar) in the world; the overpopulated (Egypt) and the least populated (Qatar), and from those of highest illiteracy rates (Yemen, Mauritania) to those with some of the lowest rates (Jordan, Tunisia). In addition, differences in government policies and programmes (particularly in regard to the socio-economic development plans in the countries of the region and their implications), also significantly affected food consumption and nutrition.

Finally, in the context of the Middle East, food carries special social and cultural meanings in various communities and also carries psychological significance well beyond consideration of nutritional value or physiological needs.

Economic factors

The food consumption patterns in a given country are a function of food prices and consumer income. Food consumption patterns

change as income grows. In fact, there is a positive relation between GNP/capita and food energy derived from animal sources, fat and sugar. The low-income groups tend to be conservative in their food choices and resistant to change, while high-income groups show increased demand for convenience foods and for eating meals outside the home (FAO, 1989).

The food prices are affected by several factors. Locally produced food costs are initially affected by prices of agricultural inputs, such as fertilizers, insecticides, high-yielding varieties, as well as by rainfall and the price of water for irrigation. They are also affected by the marketing and distribution systems, seasonal variations, food taxation or subsidies, price control or free market, storage and processing, food losses and wastage, use of by-products (as in the case of wheatbran, or molasses in the case of the sugar industry) and international market demand (as in the case of olive oil in Tunisia or potatoes and rice in Egypt). Several countries ration basic food commodities such as Jordan, Egypt and Syria, especially for vegetable oils, sugar and rice. The price of imported food is affected by the international market (supply and demand) and by agreements between governments as in the case of wheat prices (FAO, 1989).

Many governments of the region have certain food policies especially as regard to price control mechanisms for basic food commodities as in the case of wheat bread in Egypt, couscous in Tunisia, sugar in Syria and rice in Jordan. These food policies need to be reviewed and modified. Recently, Egypt has adopted structural adjustment programmes for both the producers and consumers. These programmes have affected supply and demand for several food commodities. In addition, economic factors such as devaluation of local currency, inflation, and exchange rates affect prices.

Consumer income plays a fundamental role in determining food choices. It is 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.

Environmental factors

The amount of rainfall and its distribution affect food production and, in turn, food prices and farm income. Certain countries such as Sudan, Somalia and Morocco sometimes suffer from drought. As the price of sorghum increases in Sudan, the price of livestock decreases due to the shortage in animal feed and its high price. Floods also affect food production. Seasonal variations determine food availability as in the case of fruits and vegetables.

Social and cultural factors

Social and cultural factors affect food consumption patterns. The level of education, family size, employment of women, health and nutrition education are important determinants. In addition, cultural factors including religion, beliefs and taboos and local traditions are also significant. This is seen in the spread of bottle-feeding replacing breast-feeding in many parts of the region as well as the widespread adoption of street foods for low-income groups and of fast and convenience foods for high-income groups. Along with the changes in lifestyles, particularly in countries importing labour, new food habits have emerged. This is especially noticeable in the Arab Gulf countries that employ large numbers of Asian workers.

Food industries and advertisements

The expansion of food industries and advertisements for a certain food, play a vital role in changing consumption patterns in several countries of the Arab Middle East. This is exemplified in the widespread consumption of soft drinks and 'empty calorie' foods. Furthermore, the canning and freezing industries make it possible for the consumer to have access to several food choices all the year round. The development of the dairy industries has also contributed to the increased consumption of dairy products for certain income groups. The food industries also change consumption patterns by improving food appearance such as colour, texture, odour and flavour and accordingly the food demand increases. In most countries of the Arab region food industries are expanding at a very fast rate. As a result of these expansions, more urban as well as rural consumers are becoming users of processed foods such as biscuits, sweets, soft drinks, and snack foods.

Disasters

The Arab region faces both man-made disasters, especially wars within or among the countries and inter or national conflict, as in Iraq, Sudan and Somalia, as well as natural disasters such as drought and flood. These disasters have short- and long-term implications on changes in food consumption patterns. Food aid has also contributed to these changes as in Sudan where wheat (which was not previously known to the nomadic population) replaced sorghum (FAO/RNEA, 1992).

Trends in food consumption patterns for different food groups in the Arab region during the last 25 years

The trends in food consumption patterns in the Arab region are derived from the FAO Food Balance Sheets showing per capita food availability by commodity in a year (FAO/AGROSTAT, 1996). Only very limited numbers of countries in the region have data on national household food consumption derived from surveys based on representative samples of their communities. Food consumption surveys, however, tend to overestimate actual consumption, particularly for some commodities that can be subject to partial loss and wastage during preparation and consumption. Such overestimation also includes other commodities that can be stored at household level such as cereals, oil and sugar.

The changes in the consumption patterns of food groups of plant resources, which are sources of fibre, are examined and compared with food groups which are sources of energy and those which are of animal sources.

Food groups of plant sources

Cereals contribute more than half the food energy and protein supply to the population of the Arab countries. The most consumed cereal in many of these countries is wheat which is largely imported and heavily subsidized. Rice follows wheat in importance, while sorghum is the basic cereal for Sudan. Barley is also consumed in limited quantities in North African countries.

The changes in the consumption of cereals, pulses, vegetables and fruits in the Arab countries during the last 25 years are presented in Table 1. It should be noted that per capita consumption of cereals varied in 1992–94 from 113.6 kg/y in the case of Djibouti up to 254 kg/y in Morocco. In some countries such as Djibouti, Kuwait, Jordan, Saudi Arabia and United Arab Emirates (UAE) the consumption decreased, whereas as in other countries such as Iraq and

Table 1. Changes in per capita consumption of food groups which are sources of fibre in the Arab countries (kg/yr) for the period 1969–94

	Cereals		*Pulses*		*Vegetables*		*Fruits*	
Country	*1969–71*	*1992–94*	*1969–71*	*1992–94*	*1969–71*	*1992–94*	*1969–71*	*1992–94*
Algeria	148 5	228.5	2.6	5.7	18.5	61.3	54.4	51 0
Djibouti	120.0	113.6	2.6	0.8	15.7	42.7	38.8	6.3
Egypt	178 6	251.5	8.2	6.3	103.3	126.0	66.2	91 3
Iraq	160.5	161 1	4.9	3.0	119.8	104.1	98.7	93.8
Jordan	166.6	162.0	7.3	6.6	83.7	87.1	64.5	76.7
Kuwait	138 7	132.9	6.9	6.1	107.0	147.3	127.7	120 3
Lebanon	135 3	138 7	4.4	14.0	92.7	236.2	120.0	302 6
Libya	148 9	164.8	3.5	4.6	80.8	130.7	88.3	90.2
Mauritania	108 1	176.0	12.8	7.1	1.8	11.3	11.8	12 0
Morocco	215.7	254.2	3.8	9.1	26.6	71.4	45.8	80.0
Saudi Arabia	135 2	128.9	2.7	3.2	41.9	106.0	137.5	122 8
Sudan	139.3	152.3	4.7	4.8	33.1	26.3	43.0	30.2
Syria	161.0	229.2	11.3	7.1	82.3	83.3	105.4	105 6
Tunisia	170.4	206.4	4.1	9.1	83.2	127.0	51.2	105.5
UAE	163.3	133.6	1.2	8.3	69.1	237.0	91 9	202.9
Yemen	151 7	173.6	8.7	6.4	15.3	27.6	21.9	40 0

Source: FAO/AGROSTAT (1996).

Lebanon, no significant change was noted in the per capita consumption. The other countries showed a significant increase, up to 54% as in the case of Algeria.

The per capita consumption of pulses varies from 0.8 to 14.0 kg/y. It should be noted that pulses are generally consumed with cereals in several traditional dishes. However the per capita consumption decreased in almost half the countries of the region.

The consumption of vegetables varies between 11.3 kg/y in Mauritania up to 237.2 kg/y in UAE. A decline in consumption is noted for countries such as Iraq and Sudan.

The per capita consumption of fruits varies from as low as 6.3% kg/y in Djibouti up to 302 kg/y in Lebanon. It decreases in certain countries such as Algeria, Djibouti, Iraq, Kuwait, Sudan and Saudi Arabia, whereas no changes are noticed for Libya, Mauritania and Syria. The remaining Arab countries showed an increase of up to almost 150%.

Thus generally a decline in the consumption of pulses, fruits and vegetables is noticed in several countries. In fact, this decline is mostly related to the lack of consumer awareness, and the replacement by other food groups such as sugar, fat and foods of animal origin, rather than income, prices, production and availability.

Food groups of energy sources

Changes in the availability of sugar, fat and oil in the Arab countries for the period 1969–94 are shown in Table 2. The per capita sugar consumption varies from 15.6 kg/y in Sudan up to 45.5 kg/y in Djibouti. The table indicates that all countries have an increase in per capita consumption of sugar, with the exception of Iraq and Sudan (due to present circumstances).

The consumption of fat and oil varied from 6.9 kg/y in Sudan up to 33.2 kg/y in Libya. All countries, with the exception of Sudan and UAE, showed an increase in the availability of fat and oil amounting to about 200 to 400%, such as in the case of Algeria, Lebanon, Libya, Mauritania, Saudi Arabia, Tunisia and Yemen (Table 2).

Food groups of animal origins

The changes in consumption of animal foods in the Arab countries for the period 1961–94 are presented in Table 3. Meat consumption (white and red meat) varies form 9.9 kg/y in Iraq up to 79.3 kg/y in UAE. A decrease in per capita consumption is noticed in Iraq, Sudan, Djibouti and Mauritania. In other countries such as Algeria, Jordan and Saudi Arabia, the consumption is doubled.

Table 2. Changes in per capita consumption of sugar, honey, fats and oils in the Arab countries (kg/yr) for the period 1969–94

	Sweet (sugar and honey)		*Fats and oils*	
Country	*1969–71*	*1992–94*	*1969–71*	*1992–94*
Algeria	18.1	26.4	8.4	19.2
Djibouti	42.7	45.5	8.1	9.1
Egypt	15.7	29.4	9.2	10.8
Iraq	33.2	20.0	7.0	13.8
Jordan	29.8	39.2	11.3	15.7
Kuwait	37.9	35.3	13.3	16.5
Lebanon	29.4	31.4	12.4	22.2
Libya	31.4	32.0	15.0	33.2
Mauritania	17.3	26.6	2.9	11.6
Morocco	27.0	34.6	9.7	13.0
Saudi Arabia	16.3	30.6	4.8	14.9
Sudan	18.1	15.6	9.8	6.9
Syria	23.1	35.6	12.4	18.2
Tunisia	19.8	30.5	14.8	23.5
UAE	49.4	34.2	18.4	14.6
Yemen	15.3	21.3	4.1	8.5

Source: FAO/AGROSTAT (1996).

Table 3. Changes in per capita consumption of food groups of animal source in the Arab countries (kg/yr) for the period 1989–94

Country	Meat and offals		Eggs		Fish and seafood		Milk	
	1969–71	1992–94	1969–71	1992–94	1969–71	1992–94	1969–71	1992–94
Algeria	9.5	20.5	0.8	4.6	1.6	3.4	52.3	111.0
Djibouti	32.2	19.3	0.0	0.8	2.0	1.9	27.6	57.6
Egypt	11.9	19.2	1.3	2.0	2.9	7.0	33.4	37.6
Iraq	14.4	9.9	2.5	2.0	2.9	1.2	58.8	20.9
Jordan	18.2	34.9	5.2	9.8	1.7	3.2	63.8	69.7
Kuwait	40.5	70.0	9.7	10.7	8.0	12.0	134.3	179.7
Lebanon	26.4	31.1	3.2	16.6	3.6	0.7	82.9	86.0
Libya	28.6	28.1	1.8	5.8	6.0	4.0	61.1	84.6
Mauritania	38.4	28.9	1.4	1.6	21.2	16.8	190.2	152.7
Morocco	14.8	18.9	2.5	6.2	3.2	7.9	28.6	31.1
Saudi Arabia	12.2	42.7	1.4	5.2	4.4	5.9	41.2	52.1
Sudan	24.7	21.7	1.0	1.2	1.6	1.5	85.0	164.3
Syria	13.6	18.6	3.0	6.1	1.1	0.6	58.0	82.9
Tunisia	12.6	19.3	2.3	5.3	4.8	8.4	49.2	72.7
UAE	59.8	79.3	5.7	12.8	18.9	24.5	116.8	152.7
Yemen	7.9	13.0	0.4	1.3	2.9	6.5	20.2	30.1

Source: FAO/AGROSTAT (1996).

The consumption of eggs per capita varies from 0.8 kg/y in Djibouti up to 12.8 kg/y in UAE. Most countries showed an increase in egg consumption, with the exception of Iraq.

The consumption of fish varies from 0.6 kg/y in Syria up to 12.5 kg/y in UAE. The per capita consumption decreased in the case of Iraq, Lebanon, Mauritania and Syria. Other countries showed an increase which sometimes reaches to more than double the amount consumed, as in the case of Yemen, Morocco and Algeria.

Milk consumption varies from 20.9 kg/y in Iraq up to 176 kg/y in Kuwait. The per capita consumption of milk decreased in the case of Iraq and Mauritania and does not show a significant change in the case of Egypt, Jordan, Lebanon and Morocco. However, it doubled in the case of Algeria and Djibouti.

In view of the above, it can be concluded from the food availability data that:

- There has been an overall increase in the availability of all food groups at the region level over the last 25 years.
- Sugar, fat and meat (red and white) show significant increases in availability, while there have been only slight increases in the per capita supply of pulses, fruits and vegetables over the same period.
- There have been large variations between countries in the food availability trends. High rates of increase have been noted in Algeria, Lebanon and Egypt, while very low increases, even sometimes negative, have been noted in Sudan, Djibouti and Iraq.
- Changes in per capita GNP and lifestyles have affected changes in food consumption patterns of several countries.
- The expansion of fast food, advertisement and food industries have contributed to change in the food consumption.
- The prevalence of under-nutrition (particularly micronutrient deficiencies) and of over-nutrition in the different countries have been associated with changes in the per capita average availability of different food groups.

Trends in average per capita per day consumption of food energy, proteins and fats in selected countries of the Arab region

Food balance sheets data reflects national per capita food availability according to the sources of different food commodities as converted into food energy, proteins and micronutrients. Table 4 shows food balance sheet data for countries in the Arab region. Food energy, protein and fat

Table 4. Changes in availability of calories, protein and fat per capita in the Arab countries

	Calories (kcal)		*Protein (g)*		*Fat (g)*	
Country	*1969–71*	*1992–94*	*1969–71*	*1992–94*	*1969–71*	*1992–94*
Algeria	1816	2959	47.4	81.7	35.9	68.8
Djibouti	1929	1886	42.5	39.9	38.9	42.3
Egypt	2351	3228	63.9	85.1	47.1	58.5
Iraq	2258	2264	60.5	52.7	42.5	53.1
Jordan	2436	2728	66.8	72.8	58.5	79.2
Kuwait	2637	2924	75.1	89.1	71.4	95.7
Lebanon	2356	3275	60.0	83.4	62.9	106.0
Libya	2457	3288	59.4	74.5	74.1	124.0
Mauritania	1937	2578	76.2	76.5	51.9	66.2
Morocco	2418	3114	64.0	84.3	42.7	61.1
Saudi Arabia	1876	2395	48.6	63.3	32.3	70.1
Sudan	2180	2275	61.9	72.5	66.3	67.8
Syria	2342	3245	63.3	84.4	61.9	89.0
Tunisia	2279	3167	60.3	82.8	56.8	91.7
UAE	3093	3323	83.5	103.8	85.6	106.6
Yemen	1779	2129	50.2	57.7	30.2	41.4

Source FAO/AGROSTAT (1996).

availability per capita per day increased at different rates in most countries from 1969–71 to 1992–94. For example, the daily per capita food energy availability in Algeria increased by over 50% from 1810 kcal in 1969 to 2959 kcal in 1994. For the same country, protein supply ranged from 47.4 g in 1969 to 81.7 g in 1994 (almost doubled). In Saudi Arabia, food energy availability increased from 1879 kcal in 1969 to 2395 kcal in 1994 and protein supply increased from 48 g in 1969 to 63.3 g in 1994. Both the above countries also experienced a very high increase in fat availability. For example, in Saudi Arabia, fat availability per capita per day increased from 32.3 g in 1969 to 70.1 g in 1994, more than a twofold increase. In Libya, fat availability increased from 74.1 g in 1969 to 124.9 g in 1994. However, other countries in the region, such as Egypt, Jordan, Lebanon and Tunisia, showed a steady increase in food energy, protein and fat availability, but were not as high as those for Libya and Saudi Arabia (FAO/AGROSTAT, 1996).

Some countries in the region such as Sudan showed a limited increase in food energy supply but still remained below average daily requirement. For Djibouti there was a negative change in the availability of food energy and protein during the same period.

It should be pointed out that while food balance sheets data indicate the trend of availability for different food commodities in different years, this data does not reflect the distribution of such foods among different socio-economic groups or illustrate interfamily distribution. Therefore, the food balance sheet data should be supplemented with survey data of both household food consumption and household budget expenditure of different socio-economic groups at family level. Food balance sheets, by themselves, do not demonstrate differences that may exist in the diets consumed by different population groups or by different socio-economic groups, ecological zones and geographical areas within a country; neither do they provide information on seasonal variations in the available total food. Nevertheless, food balance sheets constitute the main source of data used for the assessment and appraisal of the global food situation. High food energy intakes per capita per day, coupled with a large increase in fat consumption and low energy expenditure are known to be associated with the prevalence of non-communicable diseases of affluent societies, such as cardiovascular diseases, hypertension, diabetes and cancer, and hence such data may be used to alert the countries involved to take the necessary action.

On the other hand, low average per capita daily food energy availability reflects the prevalence of under-nutrition among large numbers of the population and is especially significant for the vulnerable groups.

Conclusions and recommendation

- The Arab region has witnessed enormous changes in its food consumption patterns during the last 25 years. Such changes for different food groups have not occurred previously throughout the long history of the region. These changes have not only occurred in the oil-rich countries, but have also occurred in the poor countries of the region such as Sudan and Mauritania in which wheat and rice are replacing the traditional cereal sorghum.
- The greatest changes were seen in the consumption of sugar, fat and meat which are mostly imported. Changes for pulses, fruits and vegetables were less significant than for the other food groups.
- The absence of a clear and well-defined food and nutrition policy, as well as the lack of nutritional awareness are both contributing to widening the production–importation gap for food in the Arab region which is increasing at an alarming rate, as food production is failing to meet the increasing demand for certain food commodities.
- In some countries present policies, especially regarding subsidies for wheat, rice, sugar and vegetable oils, are encouraging over-consumption and in consequence increasing food waste.
- There is an urgent need to raise the level of awareness of policy makers, planners, communities and the public regarding food and nutrition issues. Food and nutrition awareness must also be expanded to cover all segments of the population, rich and poor, as well as those from urban and rural areas.
- Programmes for the promotion of nutrition education and the creation of consumer awareness which are intended to introduce dietary modification characterized by the increase in consumption of food rich in fibre and low in fat and sugar should be encouraged and supported. This practice should be combined with increased exercise and energy expenditure.

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Dietary fibre in Saudi Arabian diet

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Variations in the composition of the Saudi diet meal pattern were discussed. They varied mainly according to region, lifestyle and socio-economic status. The most common dish of all of the regions in the Kingdom is the kabsa. It is made mainly of rice and meat (mostly poultry and mutton). Its dietary fibre content ranged from 0.6 to 1.1 g/100 g, according to the type of rice and method of preparation. In the central region, matasia, gearish, marazize and saliage are popular dishes. They contain 4.62, 2.58, 1.93, 1.74 and 0.34 g/100 g of fibre, respectively. Legumes are common all over Saudi Arabia. They are mainly foul, houms, adas, and fasolia, and provide 3.9, 3.4, 3.2 and 4.3 g/100 g of fibre, respectively. Harees, which contains 2.66 g/100 g of fibre is a popular dish in the southern region. According to the eating patterns, these dishes are consumed frequently during the three meals each day. Generally speaking, cereal grains are major contributors of calories to the Saudi diet (bread and confectioneries). Although it seems that the Saudi diet provides a reasonable amount of fibre, recent studies have indicated possible deficiency of dietary fibre in special groups.

Introduction

The role of dietary fibre in protection from many metabolic diseases such as diabetes and hypertension has been suggested as a result of the proven association of these with low intake of fibre (Burkitt, 1973; Anderson & Tietyen, 1986). Numerous studies within the past two decades have focused on the beneficial effects of dietary fibre, particularly soluble fibre (SF), upon carbohydrate and lipid metabolism (Ranhotra *et al.*, 1988). Many recent works have documented that the source rather than the amount of fibre generally affects absorptive and metabolic parameters of nutrients. Factors such as changing food consumption patterns, food preferences and socio-economic factors in the Gulf countries make the situation more complicated to determine the intake of nutrients, in particular fibre intake.

Most of the studies in Saudi Arabia were focused on crude fibre intake in general (Mousa *et al.*, 1992; Al-Kanhal *et al.*, 1994) and dietary fibre level in foods (Al-Mania & Mahmoud, 1991; Al-Khalifa, 1993a, 1993b; Abal-Hassan, 1996). Some studies on the dietary intakes have revealed deficient intakes of fibre (Zahran & Zahran, 1994; Al-Shagrawi *et al.*, 1995a; Al-Jassir, *et al.*, 1996).

In Saudi Arabia, cereals provide 46 and 42% of the total available food energy and protein in the diet, respectively (FAO, 1990). Wheat is the major cereal grown and consumed in the Kingdom (Ministry of Agriculture and Water, 1989).

Dishes and foods consumed in the Gulf region have been studied extensively (Khalil *et al.*, 1984; Al-Jebrin *et al.*, 1985; Musaiger &

0963-7486/98/000S31-05

Sungpuag, 1985; Sawaya *et al.*, 1985; Musaiger *et al.*, 1990; Al-Faer *et al.*, 1991; Khashlan *et al.*, 1991). Apart from the display of breads and confectionery products made from wheat flour, and consumed in all regions of the Kingdom, six wheat-based Saudi dishes (marassia, harees, qoarsan, margoog, gerish and mataziz) are commonly eaten in the central region of the Kingdom. Rice-based dished are ranked second to breads and wheat-based dishes and constitute an important component of the Saudi food being consumed by people in almost all regions. Legume-based foods which are common all over the Kingdom come in the third.

This article highlights fibre content in some Saudi dishes and of raw food material used in preparing foods as well as fibre intake by different age groups of the Saudi population.

Source of fibre in Saudi foods

Soluble, insoluble and total dietary fibre in wheat and its fractions consumed in Saudi Arabia are presented in Table 1. The highest level of soluble dietary fibre (SDF) was found in bran (2.81 g/100 g), whereas the lowest level was found in jareash (crushed wheat with meat), 1.51 g/100 g. Insoluble dietary fibre (IDF) was predominant in bran (38.5 g/100 g), while sameed had the lowest percentage of IDF (0.49 g/100 g).

Studies on crude fibre content in breads commonly consumed in Saudi Arabia showed variations in fibre content even between the same type of breads. This can be attributed to sample design, methods of preparation of breads and analytical methods. In general the crude fibre level in Saudi breads ranged from 1.84 to 10.6 g/100 g. However, the average fibre content of the bread most commonly consumed in Saudi Arabia is about 2.5 g/100 g (Mousa *et al.*, 1992; Al-Kanhal *et al.*, 1994; Al-Mohizea *et al.*, 1994).

Table 1. Soluble (SF), insoluble (IF) and total dietary fibre (TDF) in wheat and its fractions consumed in Saudi Arabia (g/100 g)

Product	*SF*	*IF*	*TDF*	*SF/TDF*
Whole wheat flour	2.13	9.36	11.49	18.5
Bran	2.81	38.54	41.35	6.8
Jareash	1.51	7.24	8.75	17.6
Harees	1.61	6.93	8.33	19.3
White flour	1.72	1.08	2.80	61.4
Sameed	1.42	0.49	1.91	74.3

Table 2. Soluble (SF), insoluble (IF) and total fibre (TDF) in bread and related products (g/100 g)

Product	*SF*	*IF*	*TDF*	*SF/TDF*
Korsan bread	1.93	7.28	9.21	21.0
Tameaze bread	0.94	1.47	2.41	39.0
Loaf bread	1.30	2.59	3.89	33.5
Whole wheat bread	1.46	6.71	8.17	17.8
Bran bread	1.18	7.55	8.93	15.5
White bread	0.99	1.19	2.18	45.4
Turkian bread	1.01	1.23	2.24	45.0
Samouli bread	1.20	1.75	2.95	40.6
White toast	1.17	1.72	2.89	40.5
Whole wheat toast	1.09	3.86	4.95	22.0
Whole wheat rusk	1.82	5.14	6.95	26.0
White wheat rusk	1.20	0.61	4.81	25.0
Bran wheat rusk	1.12	10.10	11.42	23.0
Bran biscuit	2.15	12.44	14.50	14.8

Recent study on dietary fibre contents of bread and related products consumed in Saudi Arabia (Al-Mohizea *et al.*, 1994) showed that the total dietary fibre level in these products varied between 14.5 g/100 g in bran biscuit to 2.18 g/100 g in white bread. The SF was the highest in bran biscuit (2.15 g/100 g) and lowest in white bread (1 g/100 g). However, the lowest content of IF was found in white wheat rusk (0.6 g/100 g) and also the highest in bran biscuit (12.4 g/100 g) as shown in Table 2.

The crude fibre content of several Saudi dishes is shown in Table 3. Dishes made from whole wheat flour and legumes had the highest content of crude fibre compared to dishes made from white wheat flour or rice. In general the crude fibre level varied between 0.6 to 5.9 g/100 g.

Two studies were carried out on fibre contents of fast foods in Saudi Arabia (Al-Khalifa, 1993a; Abal-Hassan, 1996). There was a big variation in the level of fibre between the same fast foods in the two studies. For example, the crude fibre in falafel (based on chick peas) was 0.76 and 6.0 g/100 g in the two studies, respectively (Table 4). This may indicate the need for a standardized method of selection and prepara-

Table 3. Crude fibre content of rice-based, wheat-based, and legume-based Saudi dishes

Dish	*Ingredients*	*Fibre content (g/100 g)*
Bokhari	Rice, meat or chicken sauce, oil, tomato juice, carrots, spices, salt	1.1
Bariani	Rice, water, oil, natural colour (korkoom)	1.0
Cabsah	Rice, meat or chicken sauce, dried grapes (zabib)	0.8
Mandi	Rice, chicken or meat sauce	0.6
Saliagh	Egyptian rice, milk, salt, sugar	0.34
Marassia	Whole wheat flour, egg, whole milk, butter, honey or syrup	4.6
Matazaz	Whole wheat flour, mutton, carrots, peas, onion, tomato, corn oil, salt spices	1.7
Harees	Whole wheat grits, mutton, corn oil, onion, salt and spices	2.7
Marqooq	Whole wheat flour, mutton, carrots, peas, beans, tomato, corn oil, salt and spices	2.6
Gerish	Whole wheat grits, laban (sour milk), butter, onion, corn oil and salt	1.9
Qorsan	Wheat flour (white), mutton, carrots, peas, onion, tomato, corn oil, salt and spices	2.7
Beans	Egyptian beans, water, vegetable oil, salt, spices	5.9
Homaus	Chick pea, sesame, lemon, vegetable oil, water, salt	3.4
Adas	Lentils, water, oil or gee, spices, onion	3.2
Fasolia	Kidney beans, meat, onion, vegetable oil, spices, salt, tomato sauce	4.3

tion of the samples, as well as method of analysis. Except for legume-based fast foods, the crude fibre content of fast foods consumed in Saudi Arabia was low when compared to many traditional dishes listed in Table 3.

Dietary fibre intake

Studies on dietary fibre intake in Saudi Arabia are few and limited. Al-Shagrawi *et al.* (1995b) reported that the daily intake of fibre for Saudi

Table 4. Crude fibre content of some fast foods consumed in Saudi Arabia

Dish	*Ingredients*	*Fibre content (g/100 g)*	
		Abal-Albasan (1996)	*Al-Khalifa (1993a)*
Hamburger	Meat, plant protein, onion, spices, salt, bread	1.94	—
Chicken burger	Poultry, plant protein, spices, crumbs, bread	1.91	—
Liver sandwich	Liver, oil, spices, salt, onion, etc., bread, tomato	1.42	—
Ground meat sandwich	Meat, oil, spices, salt, onion, etc., bread, tomato sauce	1.30	—
Cheese sandwich	Cheese, bread	0.99	—
Mixed falafel sandwich	Falafel (from beans or chick peas), potato, eggplant, tahinah, oil	2.38	0.49
Mixed falafel	Falafel (from beans or chick peas), potato, eggplant, tahinah, oil	—	0.56
Falafel	Beans or chick peas, spices, parsley, oil	6.0	0.76
Beans sandwich	Beans (Egyptian), oil, salt, spices, etc	6.99	—
Balilah (boiled)	Chick peas, vegetables, vinegar, oil	4.87	—
Broasted chicken	Chicken, oil, salt, spices, potato, homaus (chick peas) sesame, lemon juice oil	0.28	0.39
Kabab	Meat, vegetables, onion, oil	1.5	—
Motabak ma-, lahm meat pasta	Flour, egg, meat, oil, spices, parsley	1.24	0.39
Motabak ma-, moz banana pasta	Flour, egg, banana, sugar, oil	1.65	0.31
Motabak ma-, jibin	Flour, egg, cheese, oil	0.83	—
Shawarma b-, dajaje	Round sliced chicken	—	0.27
Shawarma b-, lahm	Animal fat, spices, round sliced meat, fat	—	0.22

Table 5. Contribution of different foods to daily dietary intake of fibre per head in Saudi Arabia

Item	*Fibre (g)*	*Contribution (%)*
Cereals and products	6.37	26.1
Dairy products	0.00	0.0
Fats and oils	0.00	0.0
Meat, poultry and fish products	0.11	0.4
Legumes and seeds products	3.02	12.4
Nuts and their products	0.19	0.8
Vegetables and their products	7.61	31.2
Fruits and their products	6.03	24.7
Beverages	0.07	0.3
Sweets	0.34	1.4
Sandwiches	0.65	2.7
Total intake (g) per head per day	24.37	100.0

University females was 3.4 g. This represents 11% of daily requirements (Pilsh, 1987; FNB, 1989).

Zahran and Zahran (1994) have examined the relationship between daily intake of iron, fibre, vitamin C and haemoglobin and their levels in the blood of a group of elderly males and females residing in a Riyadh nursing home. They found that the average daily consumption of fibre was almost equal among both sexes (13.2 and 13.14 g for males and females, respectively). These intakes were determined using diet history and dietary recording over a 7-d period. Food composition tables for the Middle East in addition to the American RDAs were also used in the analysis. Elderly intakes were higher than intakes of adult patients in the Riyadh Ministry of Health hospitals (13.9 vs 9.37 g) (Al-Jassir *et al.*, 1996).

The national nutrition survey (Al-Mohizea *et al.*, 1994) reported that the average daily intake of a fibre of Saudi adult was 24.4 g/100 g (Table 5). This figure is higher than those reported by other studies (Al-Kanhal *et al.*, 1994; Zahran & Zahran, 1994; Al-Shagrawi *et al.*, 1995b). The main contribution to fibre intake came from vegetables and their products (31%), followed by cereals and their product (26%) and fruits and their products (25%).

Conclusion

Vegetables, fruits and cereal products are the main sources of dietary fibre in Saudi Arabia. However, the methods of preparation of foods, such as peeling the vegetables and using low extraction rate of wheat flour in breads, in addition to low consumption of rich fibre foods are responsible for low intake of dietary fibre, especially by children, adolescents and older people. The total daily intake of fibre reported in the national nutrition survey should be interpreted with caution, due to the lack of appropriate methods to estimate the total food intake among the family members in the Arab Gulf countries, including Saudi Arabia. It is highly recommended that an appropriate technique to measure the actual food intake in this region should be found.

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Dietary fibre in breads and faba beans consumed in Egypt

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A sample of 14 types of breads and 10 faba beans or faba bean-based products commonly consumed in Egypt were analysed to determine their dietary fibre contents. The highest level of dietary fibre was found in Sun bread which is made from a mixture of wheat flour and bran (10.5%), while the lowest level was found in French bread (2.4%). With the exception of two types of breads, soluble dietary fibre was not available in the breads analysed. The level of dietary fibre in faba beans and faba bean-based dishes ranged from 3.7 to 17.5%. However, soluble dietary fibre was also found to be low in these products.

Introduction

Bread and faba beans are the most important plant foods consumed in Egypt. Wheat is the main cereal used for preparation of the bread; however, maize and sometime fenugreek flour are also added to the wheat for making bread. There are various types of bread commonly consumed in Egypt and this depends on socio-economic, cultural and geographical factors. Faba beans are a traditional legume consumed in this country. This legume is eaten in different ways, alone or mixed with other foods. It is also eaten in different stages of maturation during growing.

Studies on the dietary fibre contents of breads and faba beans consumed in Egypt are at most scanty. Most of the work done was on crude fibre contents, but not on dietary fibre. The aim of this study was to determine dietary fibre composition in various types of breads, faba beans and faba bean-based foods commonly consumed in Egypt.

Materials and method

A national survey was done by the National Research Centre to find out the plant foods consumed by Egyptian families. It was found that there were 57 kinds of cereal and cereal products, 9 kinds of roots and starchy roots, and 34 kinds of legumes commonly consumed in Egypt.

The present study includes the analysis of 14 types of breads and 10 types of faba beans or faba bean-based products. Samples were collected from markets in different regions in Egypt. Some samples were obtained from households due to unavailability in the market. Two to four samples of each kind of food were obtained and pooled in one sample. The cooked samples were frozen directly at –20°C. Raw cereals and faba beans were ground in a mixer to particles fine enough to pass through a 1 mm mesh.

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0963-7486/98/000S37-03

Table 1. Dietary fibre contents of breads in Egypt (g/100 g as purchased)

Various breads	*Water*	*IDF*	*SDF*	*TDF*
Sun bread (wheat flour + bran)	18.19	10.18	0.32	10.51
Saidi beraw bread (9.5 maize flour: 0.5 fenugreek flour)	10.20	6.80	0.08	6.88
Baladi bread (87% extraction)	21.84	4.44	1.17	5.60
Fallahi bread (9 wheat flour : 1 fenugreek flour)	42.22	4.92	0.00	4.92
Baharı beraw bread (9 wheat flour: 1 maize flour)	15.16	4.87	0.02	4.89
Fallahi bread (1 wheat flour : 1 maize flour)	10.86	4.81	0.00	4.81
Schamsy bread (wheat flour)	41.28	4.57	0.23	4.80
Fallahi bread (wheat flour)	10.89	4.21	0.00	4.21
Fahhehe beraw bread (2 maize flour : 1 wheat flour)	39.32	4.10	0.00	4.10
Aish merahra (9 maize flour : 1 fenugreek flour)	42.75	3.59	0.01	3.60
Rokak bread (wheat flour)	10.69	2.70	0.00	2.70
French bread (wheat flour)	28.00	2.40	0.00	2.40

Moisture was determined by dry method using an oven at 105°C for about 4 h (AOAC, 1990). Dietary fibre analysis was done by enzymatic-gravimetric methods of AOAC, which is modified to allow the determination of the soluble (SDF) and insoluble (IDF) fractions of dietary fibre (Prosky *et al.*, 1988). Total dietary fibre was calculated as the sum of the soluble and insoluble fractions. Samples were analysed in triplicate and the average was considered in this study.

Results and discussion

Moisture and dietary fibre contents of breads consumed in Egypt are presented in Table 1. The moisture level ranged from 10.7% in Rokak bread to 42.2% in Fallahi bread. Total dietary fibre was the highest in Sun bread (10.5%) which is usually made from wheat flour and bran, while the lowest level was found in French bread (2.4%). Insoluble dietary fibre was very similar in seven types of breads (4.1–4.9 g/100 g) and low in three types of breads (2.4–3.6 g/100 g). Two breads, namely Sun and Saidi breads, had a higher level of insoluble dietary fibre (10.2 and 6.8 g/100 g, respectively). Soluble dietary fibre was not available in most breads analysed, except for Sun, Saidi and Baladi breads (0.3, 0.1 and 1.2 g/100 g, respectively).

Most breads containing high levels of dietary fibre are consumed in rural areas, indicating that the fibre intake of urban areas is lower than rural ones. French breads are commonly consumed in cities, and we can notice from the analysis it contained the lowest concentration of dietary fibre. Although some of the high-fibre

Table 2. Dietary fibre contents of faba beans and faba bean-based dishes in Egypt (g/100 g as purchase)

Faba beans and faba bean-based dishes	*Water*	*IDF*	*SDF*	*TDF*
Mature corticated raw faba bean	9.98	17.13	0.32	17.46
Mature decorticated raw faba bean	9.91	7.71	0.45	8.31
Foul medames (boiled faba beans)	73.42	5.47	0.46	5.92
Bisara (stewed, pasted faba beans)	70.42	3.67	0.44	4.12
Nabet (sprouted soup)	70.82	6.79	0.42	7.21
Falafel (stewed faba beans fried with vegetables)	25.19	6.23	1.74	7.97
Flafel (raw faba beans with vegetables)	66.84	3.55	0.16	3.71
Herate (immature faba beans raw)	74.46	5.40	0.72	6.12
Herate (stewed faba beans)	71.57	5.44	1.12	6.56
Herate (boiled faba beans)	71.25	6.05	0.90	6.95

breads are available in cities, the low social class are the main consumers of these breads, because of their low price.

In general the moisture level in faba beans products is higher than in breads, with the exception of raw faba beans. Excluding the raw faba beans, the moisture contents ranged from 25 to 75 g/100 g. Although the moisture content is high in faba bean dishes, the fibre level was higher in most of these dishes than breads. The level of IDF ranged from 3.6 to 7.7 g/100 g, excluding mature corticated raw faba beans which contained 17.1 g/100 g. However, the SDF was also found to be low in all faba bean-based products (0.3–1.7 g.100 g), as shown in Table 2.

It is worth mentioning that the faba bean-based dishes are very popular in Egypt and consumed by the majority of the population. High social class people do not normally eat these products at lunch, but these products are preferred at breakfast and sometimes at supper. As for the low social class, the faba bean-based dished are commonly consumed in the three daily meals, simply because their price is very cheap.

In general we can conclude that most breads and faba beans-based dishes consumed in Egypt contain appropriate amounts of dietary fibre, and therefore people may consume a good quantity of dietary fibre. However, this conclusion should be investigated. The interaction of dietary fibre with other nutrients such as iron, zinc and calcium should also be investigated to find out the biological factors associated with intake of these nutrients.

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Food and dietary fibre consumption pattern in Lebanon

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A review of the trend in food consumption pattern in Lebanon suggests that the traditional diet is eroding in favour of a growing population. In the 1960s, cereals contributed to more than half of the dietary energy in urban and rural areas in Lebanon with the percentage reaching over 60% in the poorer sectors of the population. At present, the percentage contribution of cereals to daily calories has dropped and is being replaced by high-fat items. Cereals, legumes, and vegetables are rich in dietary fibre which is an important ingredient of the traditional diet and its low intake has been correlated to emergence and increased prevalence of many diseases including hyperlipidemia, obesity, cardiovascular diseases, appendicitis, and colonic cancer. Dietary management of such diseases calls for the use of diets with high content of dietary fibre. Most foods contain a mixture of soluble and insoluble fibres. Present data on food consumption patterns in Lebanon do not provide an estimated of intake, and quantitative data on dietary fibre content of the traditional dishes commonly consumed in Arab countries is not available. Preliminary studies have shown that traditional dishes have far higher dietary fibre content than the popular westernized foods, and favourable glycemic and insulin indices were reported in response to such dishes. A database on dietary fibre content of traditional dishes consumed in the Arab region appears to be of paramount importance and of a high priority in order to estimate dietary fibre consumption, recommend the intake of certain dishes, and improve dietary prevention and management of diseases.

Introduction

The beneficial effects of dietary fibre on preventive and therapeutic aspects are well documented. The public is increasingly concerned about the effect of the diet in general and consumption of dietary fibre in particular on their future health. Numerous health care organizations recommend diets that emphasize fibre as a dietary ingredient for management and prevention of many diseases such as cardiovascular diseases, colon cancer, diabetes, and weight management. As a result, demand for data on the dietary fibre content of foods and estimates of its consumption by the population have arisen. Epidemiologists, research scientists and dietitians need the information on dietary fibre content of food in order to accomplish their goals. The changing dietary habits of the Middle East population, and the emergence of diet-related diseases makes it of paramount importance to study the consumption of dietary fibre by this population as one possible risk factor which might have contributed to the increased frequency of some diet-related diseases.

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Available data on traditional dishes in the region does not include estimation of dietary fibre content and hence most dietary consumption surveys do not provide an estimate of its consumption. However, since fibre is present mostly in the complex carbohydrate portion of the diets (cereals, legumes, roots and tubers, pulses, nuts and oil seeds) and from fruits and vegetables, it is safe to conclude that the contribution of dietary fibre to the Middle Eastern diet is declining. Recent food consumption surveys on the Lebanese population have shown that a drastic drop in consumption of cereals has occurred and preliminary estimates report concomitant low intake of dietary fibre especially in the urban population. Geographic and socio-economic factors were shown to contribute to such changes in food consumption patterns.

Food availability

A considerable improvement in food availability has been reported in all categories over the period 1960–92. Total daily calorie availability rose from approximately 2400 in the 1960s to 2800 in 1983 to 3200 kcal/capita/d in 1992. Data from food balance sheets showed that total protein available in the diet increased from 62.3 g/capita/d in the 1960s to 81.2 g in 1992. The contribution of cereals to total energy availability decreased from 49% in the 1960s to 36.4% in 1992. The contribution of various categories of food to the increase in energy and protein supply is shown in Table 1. Percent energy from fat increased from 22 to 26% during the same period.

As data from food balance sheets does not accurately reflect the actual consumption by the population, additional data should be collected from food consumption surveys. However, such studies in Lebanon are scarce. They are characterized by being carried out on specific population groups and in identified regions and therefore they do not reflect the intake of the population and should be treated with caution.

The only nation-wide food consumption survey was carried out in Lebanon in 1962 on 129 families, (civilians, refugees and military) from different parts of the country (ICNND, 1962). A later report by Cowan *et al.* (1964) showed that the total energy consumption by the Lebanese in rural areas was about 2300 kcal/d, half of which was derived from cereals mostly in the form of bread (Table 2). A report of the FAO (1995) confirms the heavy consumption of bread in Lebanon and showed that legumes such as broad beans, chick peas, faba

Table 1. Average food availability for Lebanon

Average food availability (% from)	*1961–63*	*1971–73*	*1981–83*	*1990–92*
Energy (kcal/capita/d)	2396	2319	2844	3144
Cereals	49.3	45.7	39.9	36.4
Roots and tubers	1.3	1.7	3.2	3.6
Sugars and honey	9.5	12.3	10.2	10.4
Pulses, nuts, oil seeds	5.6	4.6	6.8	6.8
Fruits, vegetables	9.6	9.5	8.8	14.4
Meats, fish, dairy, eggs,	10.9	11.1	14.4	10.5
Oils, fats	11.3	12.7	14.4	15.6
Miscellaneous	2.5	2.3	2.4	2.3
Proteins (g/capita/d)	62.3	58.2	80.2	81.2
Cereals	50.1	48.1	37.3	37.1
Roots and tubers	0.8	1.1	1.8	2.2
Pulses, nuts, oil seeds	9.7	7.9	13.6	12.6
Fruits, vegetables	8.1	8.3	7.6	14.6
Meats, fish, dairy, eggs	29.8	32.6	37.5	31.6
Miscellaneous	1.5	2.1	2.1	1.9
Percentage energy				
Proteins	11	10	12	11
Fat	22	23	27	26

Table 2. Daily energy intake (% calories) contributed by various food groups of Lebanese adults according to sex and areas

	Male		*Female*	
	Urban	*Rural*	*Urban*	*Rural*
Cereals and bread	25.76	31.45	27 20	23.20
Meat and meat products	23.52	13 45	16.24	15.05
Milk and milk products	8 82	8 61	9 20	7 23
Eggs	1.46	1.28	1.32	1 41
Oils and fat	7 45	6.08	8.27	10 73
Fruits	4.53	5 52	6.66	5 83
Vegetables	8.07	7 62	12 29	9.80
Legumes, nuts, seeds	7.25	12.03	4.57	9.35
Sugars and sweets	12.95	13.97	14 25	17.40
Others	0 18	0.00	0.00	0 00

beans and lentils are staple items while consumption of red meat and poultry is low.

Geographic factors and food consumption pattern in Lebanon

It is well established that the nutritional status of a population and the food consumption pattern are affected by socio-economic parameters such as education, poverty, geographic area (urban vs rural), affluence and living conditions prevailing in the country. Recent studies have investigated the effects of such parameters on the food consumption pattern and nutritional status of the Lebanese from various age groups and from different locations in the country. Studying Bedouin children living in different areas of Lebanon showed that this rural group suffer from stunting and underweight which was accompanied by a low intake of most macro- and micronutrients (Baba *et al.*, 1994). This deprived nutritional status varied in severity between locations, being more pronounced in children of settled Bedouins who received rations from the government, and less severe in Bedouins with more advantageous socio-economic activities integrating livestock, crop production, and off-farm income. Being settled under harsh conditions made it difficult for these people to benefit from the extra cash provided by the government due to unavailability of market areas in the neighbouring locations. Travelling vendors represented the sole source of food items for this population to choose from. For example, excessive consumption of tea sweetened with extra amounts of sugar was reported. Food consumed at breakfast included mainly labneh (strained yogurt), yogurt, or shanklish (dried cheese with herbs). At lunch or supper, cooked cereals and potatoes constituted the main dishes. Bread was highly consumed at all meals accounting for about 40–60% of total energy intake. Meat was rarely served except in ceremonies of special occasions. No fruit consumption was noted in the desert area and it was rarely consumed by the Bedouins and mostly depending on seasonal availability. The arid region with frequent drought years, the difficult living conditions, the scarcity of fruits and vegetables and absence of extra income sources were reported to explain these findings. The Bedouins of the Bekaa area had a better nutritional status being an agro-pastoral community living in an area where extra income can come from limited cultivation of land for cash crops, from selling livestock produce and from seasonal labour. These Bedouins seemed to benefit from increased demand for agriculture labour as a result of intensive rural urban migration. This comes in accordance with reports published earlier that children of wage-earning rural families have better nutritional status than full-time farmers (Mokbel & Pellett, 1987).

Socio-economic factors and food consumption pattern in Lebanon

Investigations on nutritional status of pre-school children aged 1–5 years in Lebanon demonstrated significant effects of socio-economic factors on nutritional status, food frequencies and eating patterns (Baba *et al.*, 1996). Pre-schoolers from lower socio-economic classes showed more stunting and wasting than those from higher socio-economic classes. This was accompanied by a lower intake of basic nutrients such as vitamins A, D and calcium. It was found that families from lower socio-economic backgrounds fed their children a large proportion of their daily calories (27%) as snacks (potato chips, chocolates, candies, cream biscuits, soft drinks) which were low in essential nutrients. Milk and milk products were consumed less by children from low socio-economic backgrounds, compared to high socio-economic groups.

Hence, the socio-economic factor was shown to be important in explaining the poor nutritional status and food consumption pattern of children. Relatively low income families in Lebanon may not be able to meet the high cost of a nutritionally adequate diet. Data on least-cost nutritionally adequate diets has shown that the cost of such a diet is higher than the minimum wage prevailing in the country, implying that such diets are beyond the reach of many families belonging to low socio-economic backgrounds.

A study on the interaction between social class and geographical location on nutritional status and weaning habits of urban and rural infants in Lebanon showed that socio-economic factors have more impact on the nutritional status and food selection than geographic locations (Mahboub, 1997). The mother's education and income were the factors that interacted with the nutritional status of the group. Intake of cereal and starchy products was higher in urban infants, whereas vegetables and fruits contributed more to dietary calories in rural ones.

Diet-related chronic diseases

Increased prevalence of diseases related to overnutrition is being reported from many developing countries as well as developed ones. Recent data from Lebanon is scarce and the relationship between prevalence of such disease and the diet has never been studied. Recent unpublished data have shown that heart disease is number one killer in the country and that the incidence of diabetes is similar to the developed world. The data on dietary habits could provide one explanation of changes. Sources of dietary calories which have occurred over the years and higher percentage of calories from fat were recorded (Baba, 1992). Moreover, preliminary data from recent household food consumption on the food consumption pattern in the Lebanese population showed that a changing and alarming new pattern is emerging in favour of reduced cereals intake and increased fat and snacks in both urban and rural populations. Legume consumption in rural areas remained higher than urban ones and a high intake of sugars was also reported in both groups. This emerging trend could be one of the underlying factors in the increased prevalence of diet-related diseases.

Dietary fibre content of selected Lebanese dishes

In order to study the possible contribution of dietary fibre content of the Lebanese diet to diet-related non-communicable diseases, information on the dietary fibre content of Lebanese dishes is necessary. A study on the composition of 34 Lebanese composite dishes was carried out (Habib. 1995). A mean of 4.8 g dietary fibre per 100 g dish was reported (Table 3). the dietary fibre ranged from 1.0 g/100 g in rice to

Table 3. Calculated and analyzed total dietary fibre content of 34 composite Middle Eastern dishes on wet basis

	Total dietary fibre g/100 g edible portion	
Composite dish	*Analyzed*	*Calculated*[a]
Artichoke in oil	5.8	4.6
Beet salad	4.3	2.8
Bread salad	4.9	3.0
Broad bean dip	10.1	6.0
Cabbage salad	3.7	2.2
Cauliflower stew	3.0	1.3
Chick peas dip	10.1	6.0
Chick peas with rice	3.2	2.1
Chicory in oil	6.3	NA
Egg plant dip	8.6	5.0
Falafel sandwich	10.7	5.0
Fatteh	5.0	3.5
Green beans in oil	4.0	1.6
Jew's Mallow stew	5.7	1.5
Kibbe	7.5	3.0
Kishk soup	2.7	1.1
Lentil soup	5.0	4.8
Lentils with rice	3.8	2.8
Lima bean salad	9.6	6.0
Manaeesh with cheese	3.6	3.0
Moghrabieh	3.0	2.0
Okra in oil	6.1	2.0
Pea stew	4.0	4.0
Potato salad	1.7	1.3
Rice	1.0	0.5
Rosary of the dervish	2.1	1.1
Shawarma sandwich	1.3	2.0
Spinach stew	4.4	1.7
Spinach turnovers	3.7	2.0
Stuffed cabbage	1.3	2.3
Stuffed grape leaves	5.0	NA[a]
Stuffed swiss chard in oil	6.0	2.2
Tabbouli	4.3	3.2
Vegetable soup	1.8	1.5

[a]NA. Data not available.

Table 4. Soluble and insoluble dietary fibre content of eight Middle Eastern dishes (g/100 g edible portion)

Dish	*Soluble fibre*	Insoluble fibre
Broad bean dip	1.0	9.0
Chick pea dip	0.9	9.2
Falafel	1.4	10.2
Fatteh	1.0	4.0
Green beans in oil	0.8	3.2
Kibbeh	ND	7.4
Kishk soup	0.4	2.3
Tabbouli	0.7	3.4

ND = Not detected.

10.7 g/100 g in falafel (Table 3). Legume dishes scored the highest fibre values with an average of 7.2 g/100 g. Vegetable dishes gave varied values of fibre with the highest in egg plant dip followed by chicory, okra, and swiss chard in oil. The soluble and insoluble fibre fraction of light dishes was also analyzed and it was observed that the soluble fibre was approximately 20% of the total dietary fibre content of vegetable dishes (tabbouli, green beans) and 10% in legume dishes (Table 4). The insoluble fibre was the major dietary fibre fraction in the light dishes. Comparing these results with three frequently consumed western dishes in the Lebanon (hamburger, pizza and chicken nugget), the values for the dietary fibre content of these dishes did not exceed 2 g/100 g.

Conclusion

Diet-related non-communicable diseases are emerging health hazards in Lebanon. Similar to westernized communities, coronary heart disease was reported as the main cause of death in the country. A changing dietary pattern could be one of the factors contributing to these diseases. A review of the trend in food consumption patterns have shown that with the change in lifestyle the tradition diet is diminishing and is being replaced by high-fat fast foods mostly preferred by the young population. In Lebanon in the 1960s cereals contributed more than half of the dietary energy in urban and rural areas with the percentage reaching over 60% in the poorer sectors of the population. At present, the percentage contribution of cereals to daily calories has dropped and is being replaced by high-fat items. More studies are needed to investigate the relationship between the emerging diet-related diseases of affluence and food consumption pattern in the country.

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Dietary fibre in Jordanian diet

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Dietary fibres are important in the prevention of many diseases of affluence. In particular, soluble dietary fibres reduce serum lipids and cholesterol and have a role in the regulation of sugar absorption. As is the case in most countries of the world, the food consumption pattern has changed in Jordan; the consumption of fats, sugars, and refined wheat flour has increased, whereas the consumption of whole bread and whole cereals, legumes, and to a lesser extent fruits and vegetables has decreased. However, in spite of the drop in dietary fibre intake especially in urban areas of Jordan, the average per capita intake is still acceptable (30.9 g/d) with a range of 26.9–42.3 g/d in different governorates of the country. This is probably due to the availability and relatively high consumption of locally produced vegetables and the use of straight grade flour (al-mowahhad) of about 78–80% extraction rate. Recently, the lifting of subsidization of bread encouraged the consumption of high extraction bread with subsequent increase in fibre intake. An evaluation of the intake of soluble dietary fibres contributed by different local foods is recommended. Also it is very important to counsel people, particularly in urban areas, to use and appreciate the role of dietary fibres in the prevention of diet-related diseases.

Introduction

Malnutrition of affluence and diseases of modern lifestyle are of higher incidence in the Arab countries than they used to be (Alwan, 1993; Miladi, 1996). Dietary habits have been changed and consumption of high-energy foods which are rich in fats and free sugars but low in complex carbohydrates and fibre has by now become common in developed as well as many developing countries (WHO, 1990a; Pellett, 1994; Musaiger, 1996). The non-communicable diseases of highest incidence associated with modern food habits are cardiovascular diseases, diabetes mellitus, cancer and obesity (WHO, 1990b; Alwan, 1993).

Dietary fibre has a well-established role in the prevention of many modern diseases of affluence (Glore *et al.*, 1994) particularly cancer, cardiovascular diseases and diabetes mellitus. Fibres, especially the soluble types, have a hyperlipidemia-lowering effect (Glore *et al.*, 1994; Lupton *et al.*, 1994; Shane & Walker, 1995; Truswell, 1995; Pick *et al.*, 1996). They achieve their function through binding bile salts, production of volatile fatty acids which may inhibit hepatic cholesterol synthesis (Glore *et al.*, 1994), and the possible increased catabolism of LDL- cholesterol (Turner *et al.*, 1990; McCall *et al.*, 1992; Mee & Gee, 1997).

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Jordan, one of the Middle East region countries, has a good primary health care system and high level of literacy rate, though of relatively low to medium annual per capita income of US $600–3000 per year (Musaiger, 1996; UNICEF, 1997). Infant and child mortality rates have been greatly reduced compared to other countries in the region (Faqih & Hijazi, 1993; UNICEF, 1997), yet it has an increasing incidence of chronic non-infectious diseases, many of which are known to be associated with low fibre intake (Takruri, 1994; HKJ/MOH, 1996). Accordingly, it is interesting to look into the fibre intake of Jordanians and to try to evaluate its dietary sources.

Changing food consumption pattern in Jordan

Like many other Arab countries, the food consumption pattern has changed in Jordan. Table 1 shows that cereals contribute about half of the dietary energy in different governorates of the country. Sugar consumption is considered high (Takruri, 1994) since the mean available supply is 107 g/capita/d and contributes about 16% of total energy consumption (FAO, 1996).

In Jordan, wheat is the main cereal. It is mainly consumed as bread that has been made, for more than a decade, from moderately extracted flour (straight grade or Muwahhad of 78–80% extraction rate). The high consumption of this type of bread has kept the fibre intake acceptable. It is worth mentioning that brown bread (from whole wheat flour) sales have increased and those of white and Muwahhad bread decreased after the subsidization of bread was lifted and bread prices were raised in August 1996. This could be due to the difference in price of the two types of bread. However, bread from Muwahhad flour sales have returned to normal and those of brown bread increased a few months later.

Fat consumption, mainly as vegetable oil, is relatively high. Animal products contribute about 13% of daily energy intake and 38% of daily protein intake (Table 2). The consumption of vegetables and fruits seems to be adequate (210 and 239 g/capita/d respectively) as the local production of these foodstuffs is high, especially the production of vegetables such as tomatoes, squash, cucumber and egg plant.

The government subsidization of high-carbohydrate food commodities, particularly sugar and rice, together with abject poverty in many areas of the country are the main reasons responsible for the high consumption of these subside food components. However, the obligatory use of the 78–80% extraction rate flour is the main factor responsible for the acceptable fibre intake.

Dietary fibre in the Jordanian diet

The dietary fibre intake was estimated from figures of the latest Household Income and Expenditure Survey conducted in 1992 (HKJ/DOS, 1993). Such a survey, which is conducted every 5 years, includes data on household

Table 1. Contribution of main food groups to total energy supply in Jordanian diet in various governorates (% calories)

Governorate	*Population (%)*	*Total supply kcal/capita/d*	*Cereals*	*Meat and eggs*	*Dairy products*	*Fats and Oils*	*Fruits and vegetables*	*Sugar and sweets*
Amman	38	3380	47	10	5	12	7	13
Irbid	25	3740	49	8	4	14	8	13
Zarqa	18	2775	49	10	4	10	9	12
Balqa	6	3488	61	7	3	8	4	15
Mafraq	4	3184	54	6	2	7	6	22
Karah	4	4279	61	6	3	8	3	16
Ma'an	3	3803	53	7	4	12	5	15
Tafila	2	2971	48	9	4	11	6	17
Kingdom	100	3400	50	9	4	12	7	14

Source: Tukan (1996).

Table 2. Contribution of food groups to protein and fat in Jordanian diet according to governorates

Governorate	*Nutrient*	*Protein supply (g/capita/d)*	*Cereals (%)*	*Meat and eggs (%)*	*Dairy products (%)*	*Fats and oils (%)*	*Total calories*
Amman	Protein	99	44	32	11	–*	12
	Fat	157	5	51	7	29	42
Irbid	Protein	105	48	28	9	–	11
	Fat	170	5	49	5	34	41
Zarqa	Protein	83	46	32	8	–	12
	Fat	128	5	55	5	25	41
Balqa	Protein	99	62	23	6	–	11
	Fat	114	7	56	5	26	29
Mafraq	Protein	80	60	25	5	–	10
	Fat	107	7	60	4	24	30
Karak	Protein	124	64	22	7	–	12
	Fat	143	8	56	6	26	30
Ma'an	Protein	108	53	26	11	–	11
	Fat	156	6	51	6	31	37
Tafila	Protein	90	47	34	9	–	12
	Fat	156	5	64	4	24	47
Kingdom	Protein	98	49	29	9	–	12
	Fat	150	6	52	4	29	40

*Amount is negligible.
Source: Tukan (1996)

income and expenditure on purchased and produced commodities including food. Thus, it deals with the net available food for household consumption.

Table 3 shows the main food sources of dietary fibre in the Jordanian diet. It is clear that commercial bread tops the list providing 38.2% of fibre, whereas flour used in homes to produce bread and for other purposes comes next (16.8% of total dietary fibre). Thus, fibre of wheat origin constitutes 55% of dietary fibre in Jordanian diet. Total dietary fibre intake amounts to 30.9 g/capita/d and comes mainly from cereals (72%) and next from vegetables (15%) (Table 4).

Table 3. Main sources of dietary fibres in the Jordanian diet

Foodstuff	(%) Contribution
Bread	38.2
Flour	16.8
Rice	7.9
Jew's mallow	3.2
Potatoes	2.9
Tomatoes	2.4
Lemon	1.4
Egg plant	1.3
Oranges	1.1
Lentil	1.0

Source: Data calculated from HKJ/DOS (1993)

There is a variation of fibre intake according to governorates, with Karak being of highest intake followed by Irbid and Balka (42.3 and 34.3 g/capita/d, respectively). These three governorates have a good percentage of population living in rural areas. On the other hand, Tafila and Mafraq had the lowest fibre intake (26.9 and 28.6 g/capita/d, respectively). It is worth noting here that these two governorates were reported to have the highest number of families below the poverty line (Faqih & Hijazi, 1993), and that the main calorie source in those areas is subsidized sugar and white rice in which fibres are either lacking or very low.

Also there was a variation in dietary fibre intake between rural and urban areas (37.1 and 29.1 g/capita/d, respectively). The high fibre intake in rural areas is expected due to increased use of brown bread and whole wheat flour. The

Table 4. Per capita daily consumption of dietary fibres in Jordan according to Governorates

Governorate	*Dietary source*[a]				Total fibre (g)	% of recommended intake[b]
	Cereals	*Fruits*	*Vegetables*	*Legumes and nuts*		
Amman	20.7 (70.0)	1.80 (6.3)	4.7 (15.8)	1.5 (5 2)	29.4	73.5
Irbid	24 1 (70.4)	1.90 (5.7)	5.5 (16.0)	2.1 (6 1)	34.3	85.8
Zarqa	18 3 (68.6)	1.65 (6.2)	4.8 (18.0)	1 4 (5.1)	26.7	66.8
Balka	28 5 (83.8)	1.10 (3.2)	3.2 (9.3)	0.9 (2.6)	34.0	85.0
Mafraq	21.7 (75.8)	1 20 (4.2)	3.8 (13.4)	0 8 (2.9)	28.6	71.5
Karak	36.4 (86.1)	1 10 (2.7)	2 8 (6.6)	1.2 (2.8)	42.3	105.8
Ma'an	25.3 (77.1)	1 50 (4.6)	3 6 (10.8)	1.7 (5 0)	32.9	82.3
Tafila	19.9 (74.1)	1.30 (4.8)	4.1 (15 3)	0.9 (4.4)	26 9	67 3
Urban	20.4 (70.0)	1.80 (6.2)	4.7 (16.0)	1.6 (5.6)	29.1	72.8
Rural	28 0 (87.2)	1.40 (3.8)	4.5 (12.1)	1.4 (3 8)	37.1	92 8
Kingdom	22 4 (72.0)	1.70 (5.5)	4.7 (15.0)	1.3 (5 0)	30.9	77.3

Data calculated from HKJ/DOS (1993)
[a]Numbers in parentheses denote % contribution
[b]Recommended daily intake is 40 g/d.

intake of dietary fibre for rural areas could even be a higher due to higher consumption of wild edible plants than in urban areas.

If the adequacy of dietary intake of fibre is considered, and values obtained are compared with recommendations, it is obvious that the intake of fibre is fairly acceptable. Although there is no agreement on a recommended figure for daily dietary fibre intake (Williams & Anderson, 1993; Truswell, 1995), many investigators recommended intakes ranging from 25–40 g/d (McLaren & Meguid 1988; Williams & Anderson, 1993). McLaren & Meguid (1988) consider that intake of fibre over 30–40 g/d is not safe and may lead to mineral deficiencies. Thus taking a figure of 30–40 g/d to be a safe range of dietary fibre intake, it becomes obvious that the dietary intake calculated for Jordanian diet is generally acceptable (ranging from 26.9–43.3 g/d in different governorates).

Comparable results of fibre intake were obtained by Takruri and Hamdan (1989) who studied mineral, vitamin and fibre intakes in the city of Amman and Irbid governorate through a food consumption survey employing a representative sample of their population. Food account method was applied in 240 households in Amman and 278 households in Irbid area. Fibre intake was found to be 35 g/capita/d for Amman and 39.3 g/capita/d for Irbid (Table 5). Values were discussed in association with phytate and zinc intakes. The phytate to zinc molar ratio was high (15.5 and 17.1 for Amman and Irbid, respectively), and the authors raised the question of mineral availability for persons with higher intakes of fibre and phytates in diets having most calories from cereals and plant foods. Oberleas and Harland (1981) recommended that the phytate/zinc molar ratio should not exceed 10 : 1.

It should be noted that the type of dietary fibre is important as well. Soluble fibre was not calculated in the study and many factors are reported to affect the beneficial effect of fibres such as their role in lipidemia lowering. These

Table 5. Average per capita intakes of zinc, fibres and phytate in Amman City and Irbid District in 1982

	Amman City			*Irbid District*		
Food component	*Animal*	*Plant*	*Total*	*Animal*	*Plant*	*Total*
Fibres (g)	0.0	35	35	0.0	39	39
Phytate (mg)	0.0	1968	1969	0.0	2207	2207
Zinc (mg)	3.7	8.9	12.6	2.9	9.9	12.8
Phytate/Zn (molar ratio)		15.5			17.1	

Source: Takruri and Hamdan (1989).

factors include the type of fibre, its amounts, soluble fibre content, viscosity of the supplement, mean baseline of cholesterol concentration, age and gender of subjects and changes in body weight (Glore *et al.*, 1994; Truswell, 1995).

Wheat flour, which is the main contributor to dietary fibre in Jordanian diet, has a relatively good amount of soluble fibre from the total dietary fibre (Ellis, 1985; Ranhatra & Gelroth, 1988). However, the types of fibre in Jordanian diet and their detailed composition need to be studied in a comprehensive way.

Conclusions

Although the dietary fibre intake has decreased in the diets of contemporary communities, including many Arab countries, this intake seems to be normal or fairly adequate in Jordanian diet. This is principally due to the high contribution of bread to the diet and to the types of bread consumed – mainly the one made from straight-grade flour of 78–80% extraction rate – and also to the adequate consumption of vegetables and fruits. However, the soluble fibre content and the effect of fibre on micronutrient availability in the Jordanian diet should be assessed.

Furthermore, the influence of changes in policies regarding subsidization of the basic commodities, namely flour, rice and sugar, should be evaluated. The magnitude of the use of whole wheat flour and its impact on fibre intake in Jordan should be assessed. Finally, education and counselling of different sectors of the community are to be focused on to encourage consumption of high sources of soluble dietary fibres such as fruits, vegetables and certain legumes and nuts.

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Factors associated with obesity among women attending health centres in Quatar

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The aim of this study was to estimate the prevalence of obesity and factors associated with it among women in Qatar. A cross-sectional survey was carried out on 628 women aged 17–67 years who attended health centres in Doha, the capital. The findings revealed that 62.6% of women were overweight or obese based on body mass index ≥ 25. Socio-economic factors such as age, marital status, education and age at marriage were significantly associated with obesity. There was no significant association between dietary habits and obesity. Chronic diseases such as diabetes and hypertension were significantly associated with obesity. However, the association between obesity and heart disease was not statistically significant. A multisectorial programme to prevent and control obesity is highly recommended.

Introduction

Qatar, like other Arab Gulf States, has experienced a drastic change in its socio-economic situation and food habits during the past three decades. These changes have affected the way of living and pattern of diseases. The incidence of non-communicable diseases has increased and that of infectious diseases has decreased (Musaiger *et al.*, 1994a).

Obesity is considered a risk factor for several chronic diseases. Studies in the Arab Gulf States showed that the prevalence of overweight and obesity is relatively high, especially among adult females (Musaiger & Miladi, 1996). In Saudi Arabia, for example, it was reported that 45% of adult males were overweight and obese, compared to 52% of adult females, based on body mass index (BMI) (Al-Nuaim *et al.*, 1996). In the United Arab Emirates, the prevalence of overweight and obesity was 56 and 70% among married adult males and females, respectively, using the same indicator of BMI (Musaiger *et al.*, 1994b).

The factors associated with the occurrence of obesity among population in the Arab Gulf States are not well studied, especially in Qatar, Oman and the United Arab Emirates. Investigations in Saudi Arabia (Khashoggi *et al.*, 1994), Bahrain (Musaiger & Al-Ansari, 1992) and Kuwait (Al-Awadi & Amine, 1989) reported several social, economic and dietary factors associated with obesity. The aim of this article, therefore, is to determine some social, dietary and health factors that may be associated with obesity among women attending health centres in the State of Qatar.

Methods

The target group for this study was adult females aged between 17–67 years, who atten-

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ded the main health centres (four centres) in Doha, the capital of the State of Qatar, during 1–15 July 1992. Pregnant women were excluded to avoid the increase in weight due to pregnancy. The total number of target women attending health centres during the study period were 696. However, 48 women refused to participate and 20 women were excluded because of incomplete information, making a drop of 68 women (10% of total). The total sample of women included in the study was thus 628 women.

Women were interviewed by female medical students using a pre-tested questionnaire. Information obtained included socio-economic background, dietary habits, weight and height measurements. Weight was measured using a Deteco scale having a capacity of 140 kg. The weight was measured to the nearest 0.05 kg with women wearing the minimum clothes and no shoes. The height was measured without shoes to the nearest 0.1 cm by using the stadiameter attached to the scale.

The obesity was determined using the body mass index (BMI) which is defined as the weight in kilograms divided by square height in metres (weight (kg)/height $(m)^2$). Women with BMI equal or above 25 were considered obese (overweight and obese), while those with BMI less than 25 were considered non-obese (Garrow, 1983).

Data was stored in Dbase file and analysed using EPI-INFO Programme (WHO/CDC, 1990). Chi-square was used to test the statistical significance, and odd ratio (OR) was used to test the strength of the association.

Results

Socio-economic factors associated with obesity among women in Qatar are presented in Table 1. As the age of women increased, the prevalence of obesity increased. Of women aged 30 years and over, 80% of them were obese, compared to 48.6% of women aged less than 30 years (OR = 4.24, $P < 000$). Educational level, material status and age at marriage were all found to be significantly associated with obesity among women. Illiterate, currently married and women who got married at an early age (< 16

Table 1. Socio-economic factors associated with obesity in women attending health centres in Qatar

Factor	Obese		Non-obese		Odds ratio	P value
	No.	%	No.	%		
Age (years)						
<30	169	48.6	179	51.4	1.00	0.000
30+	224	80.0	56	20.0	4.24	
Educational level						
Illiterate	89	75.4	29	24.6	1.00	
Educated	304	59.6	206	40.4	0.48	0.001
Marital						
Currently married	340	72.0	132	28.0	1.00	
unmarried	53	34.0	103	66.0	0.20	0.000
*Age at marriage (years)**						
<16	112	82.4	24	17.6	1.00	
16+	228	67.9	108	23.1	0.45	0.002
Nationality						
Qatari	225	61.6	159	38.4	1.00	
Non-Qatari	138	64.5	76	35.5	1.28	NS
Employment						
Unemployed	292	61.6	182	38.4	1.00	
Employed	101	65.6	53	34.4	1.19	NS

*Excludes women who were not married.
NS = not significant.

Table 2. Association between dietary habits and obesity among women attending health centres in Qatar

	Obese		*Non-obese*			
Dietary habits	*No.*	*%*	*No.*	*%*	*Odds ratio*	*P value*
Breakfast						
Intake	283	63.5	163	36.5	1.00	
Non-intake	110	60 4	72	39.6	0 88	NS
Morning snack						
Intake	229	61.2	145	38.8	1.00	
Non-intake	164	64.6	90	35.4	1.15	NS
Evening snack						
Intake	294	59.3	191	40 7	1.00	
Non-intake	99	68.6	44	31.4	1.46	NS
No. of meals perday						
One	20	74 1	7	25 9	1.00	
Two	125	65.1	67	34.9	0.65	NS
Three	220	62 5	132	37.5	0 58	NS
Four or more	28	49 1	29	50.9	0.34	0.05

NS = not significant

years) were more prone to be obese than educated, unmarried and women who got married at age 16 years and over. There was no significant association between nationality and employment status of women with obesity.

Intake of breakfast, morning and evening snacks, and number of meals per day were the main dietary habits studied. In general women who ate breakfast and skipped morning and evening snacks were more likely to be obese, even though there was no significant association between these dietary habits and obesity. Interestingly, as the number of meals per day increased the prevalence of obesity decreased. The prevalence of obesity among women who ate one meal a day was 74%, and decreased to 65, 62.5 and 49% for women who ate two, three and more than three meals per day, respectively (Table 2).

The association between obesity and some chronic non-communicable diseases (diabetes, hypertension and heart disease) is presented in

Table 3. Association between obesity and history of chronic diseases in women attending health centres in Qatar

	Obese		*Non-obese*			
Chronic disease	*No.*	*%*	*No.*	*%*	*Odds ratio*	*P value*
Diabetes						
No	324	82 4	228	97 0	1 00	0.000
Yes	69	17.6	7	3.0	6.94	
Hypertension						
No	332	84 5	223	94 9	1 00	0.000
Yes	61	15.5	12	5.1	3.41	
Heart disease						
No	376	95.7	228	97.0	1.00	NS
Yes	17	4.3	7	3.0	1.47	

NS = not significant.

Table 3. The risk of diabetes and hypertension was higher among obese women (OR = 6.94 and 3.41, respectively). However, the association between heart disease and obesity was not statistically significant.

Discussion

The overall prevalence of obesity among women in Qatar is 62.6%. This prevalence compared favourably with that reported in other Arab Gulf countries (Musaiger & Miladi, 1996). This indicates that obesity is a problem of concern and measures should be taken to prevent and control this problem. However, the lack of information on risk factors associated with obesity in the Arab Gulf countries does not currently allow us to establish an effective preventive programme.

The present study showed that some socio-economic factors are important risk factors associated with obesity. Older women have a higher risk of obesity than younger women. Several studies in the region (Khashoggi *et al.*, 1994; Musaiger & Al-Ansari, 1992) supported this finding. This may be attributed to other confounding factors such as marital status and lack of physical activity.

Social status in the Arab Gulf countries can be better determined by educational level than occupation or income (Musaiger, 1990). Investigations in the region (Musaiger & Al-Ansari, 1992) as well as in other countries (Noppa & Bengtsson, 1980; Hazuda *et al.*, 1988) have shown that women who belong to a low socio-economic status run a higher risk of obesity than women who belong to other social classes. Our finding is comparable with these studies as obesity is more prevalent among illiterate women than educated women. As the women become educated, they become more aware about the health risk of obesity, and this may lead them to reduce their weight.

Employed women have less risk of obesity than unemployed women. This can be explained by the fact that most of employed women in this study were educated. Another important factor is that employed women are more susceptible to exposure to society, and therefore more interested in maintaining their weight and taking care of their figures.

The risk for obesity is greater among married women than unmarried women. In Qatar, as in other Arab Gulf States, many women prefer to stay at home once they get married. This may reduce their physical activity as they spend their leisure time watching television, eating snacks and visiting their relatives and friends. Additionally, multiple pregnancies play an important role in gaining weight, as Qatari women have a high fertility rate, and most of them did not give sufficient spacing between pregnancies. The gain in weight during pregnancy in many women in the Arab Gulf States is very high and exceeds the recommended weight gain for normal women. The association between parity and obesity was reported by other investigators in the region (Musaiger & Al-Ansari, 1992).

Dietary habits are among the factors that are associated with overweight and obesity among both children and adults. In this study few dietary factors were considered and these mostly concentrated on qualitative rather than quantitative indicators. It is interesting to find that women who ate breakfast had less prevalence of obesity than those who skipped breakfast, but the difference was not statistically significant. This may indicate that skipping breakfast has no effect on the prevalence of obesity among the women studied. A similar finding was reported among university females in the United Arab Emirates (Musaiger & Radwan, 1995).

The prevalence of obesity was higher among women who skipped morning and evening snacks, but again the difference was not statistically significant. It is highly probable that a person who skips morning or evening snacks may be susceptible to eat more at lunch or supper. Musaiger and Radwan (1995) showed that obesity was more prevalent among females who ate lunch and skipped evening snacks, than those who skipped lunch and ate evening snacks. However, the quantity of foods eaten is the main issue. Many women may eat one or two meals a day and become overweight compared to women who eat three or four meals a day. This is clearly shown in Table 2, where the obesity decreased steeply among women who ate four or more meals a day.

The finding that obese women were more prone to get diabetes and hypertension is well documented (Bray, 1996), but the link between heart disease and obesity in our study was weak. The precise role of obesity in the aetiology of cardiovascular disease (CVD) remains con-

troversial (Sharpnel *et al*, 1992). However, obesity was found to be positively associated with other risk factors, especially diabetes and hypertension (NDC, 1991) as indicated in this study. Therefore, obesity may be associated with CVD indirectly by increasing its risk factors.

The fact that several social, dietary and environmental factors are associated with obesity means that more studies are needed to find out the main risk factors for obesity among children and adults in Qatar, and other Arab Gulf States. At the same time a multisectorial intervention programme should be established to prevent and control obesity as well as other diet-related chronic diseases. Such a programme should consider the dietary intervention to modify food habits, education through the mass media, encouraging habitual exercise, and professional training of health and social workers.

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Avoidable risk factors of cancer in Bahrain

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Cancer is the second leading cause of death in Bahrain (40.8 per 100,000) and constitutes 3.4% of in-patient discharges from the Salmaniya Medical Centre, the major general hospital. Hematopoeitic and reticuloendothlial cancers, cancer of the female breast, colorectal cancer, stomach cancer, lung cancer and cancer of the urinary bladder are the commonest cancers among Bahraini population. Data on the avoidable causes of cancer in Bahrain are limited. The prevalence of smoking among adult Bahraini males was 30.6 and 9.5% among their female counterparts in the early 1980s with the corresponding figures for regular smoking 22.1 and 4.7% respectively. The latter figures in 1991 were 21.9 and 6.9% respectively. Nearly 36% of men aged 30 to 79 years and over were overweight and 21.2% were obese in contrast to 31 and 48.6% in women in the same age group. Corresponding figures for adult (20–65 years) male and female population respectively were 26.3, 16% and 29.4, 31.4%. Excess intake of foods rich in fat and free sugars might mask the health protective effect of eating fruits and vegetables. Sedentary lifestyle measured by lack of physical exercise and watching television is prevalent in both sexes. Although Bahrain has started developing a national Cancer Control Programme and commendable efforts have been made in cancer control, a serious need for accurate and complete data arises when cancer and cancer risk factors are examined.

Introduction

Cancer is a major killer in developed countries and it is second only to cardiovascular diseases accounting for over one-fifth of all deaths. Although in developing countries 9% of all deaths are due to cancer (WHO, 1995), the burden of these cancers on health services will be increasing as incidence rates of several cancers rise resulting from increasing urbanization and the westernization of lifestyle (Magrath & Litvak, 1993; Boffetta & Parkin, 1994).

Tobacco, alcohol, diet, reproductive and sexual behaviour, infection, physical activity, medicines and medical procedures, electromagnetic radiation, occupation and pollution are causes of cancer which can be avoidable (Doll & Peto, 1981; Doll, 1996). Modification of lifestyle seems to be able to reduce the age-specific risk of cancer by about four-fifths (Doll, 1990). Tobacco and diet alone are responsible for two-thirds of cancer cases in developed countries (Doll & Peto, 1981). Smoking is capable of causing disease in about 14 organs and diet in a comparable number. Excess calorie intake, high consumption of fat, meat and salted food and low

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intake of fibre, fruits and vegetables have been incriminated in the etiology of several cancers (Doll, 1990; Trichopoulos *et al.*, 1996).

The estimated population of Bahrain in 1995 was 586, 110 of whom 61.8% were Bahraini and 30.8% below 15 years of age (MOH, 1995). The expatriate population in Bahrain is transient and is mainly from the Indian subcontinent and the Far East. Bahrain has experienced rapid economic developments as a consequence of the discovery of oil and the establishing of a good banking system, telecommunications and air transport facilities. Thus, Bahrain became the hub of commercial and financial activities in the region.

Rapid improvement in socio-economic status and change in food habits and lifestyle have accompanied the economic development. There were substantial modifications in the traditional diet which is constituted of dates, fresh vegetables, whole wheat bread and fish (Musaiger, 1987, 1990, 1994). Fast foods which are very high in cholesterol and animal fat became popular particularly among the young (Musaiger & Cossack, 1991).

Moreover, manufactured cigarettes gained popularity over the traditional waterpipe (Hamadeh, *et al.*, 1992). Sedentary lifestyle patterns prevailed with the increase in availability of cars, television, household and home appliances (Musaiger, 1994).

Improvement in standards of living and health services have contributed to a long life expectancy and a decline in infant mortality rate. Infectious diseases declined and the importance of non-communicable diseases like cardiovascular diseases, obesity, diabetes mellitus, and cancer has risen (Musaiger, 1990). A Bahrain Health Information Centre was established in the early 1980s and a National Cancer Registry in August 1994 as part of the efforts made to rectify deficiencies in the recording system.

The aim of this article is to review the prevalence of preventable risk factors of cancer among the Bahraini population. The non-Bahraini population were excluded due to their heterogeneity and their transient nature.

Current status of cancer

The incidence of cancer in Bahrain is not known except for the incidence of tobacco-associated cancers for the periods 1973–77 and 1978–82. Comparison with reported cancer incidence figures for other countries around the same time period shows that Bahrain has higher rates than many developing countries, but lower rates than most developed countries (Hamadeh, 1987).

Neoplasms constitute 3.4% of in-patient discharges of the Salmaniya Medical Centre, the major general hospital in the country.

Table 1. Sites of the most frequent cancers among the Bahraini population, 1995 and 1996 combined

Male		*Female*		*Total*	
Site	*%*	*Site*	*%*	*Site*	*%*
Haematopoeitic and reticuloendothelial	26.8	Female breast	35.4	Haematopoeitic and reticuloendothelial	18.9
Colon/rectum	9.8	Haematopoeitic and reticuloendothelial	11.3	Female breast	18.1
Stomach	8.1	Stomach	6.6	Colon/rectum	8.2
Lip, oral cavity and Pharynx	7.3	Colon/rectum	6.6	Stomach	7.4
Urinary bladder	6.9	Cervix	6.6	Lung	6.2
Lung	6.5	Ovary	6.6	Urinary bladder	5.0
Prostate	6.1	Lung	5.8	Lip, oral cavity and Pharynx	4.8
Kidney	4.9	Thyroid	5.1	Thyroid	4.6
Thyroid	4.1	Urinary bladder	3.1	Cervix	3.4
Connective tissue	3.7	Liver	2.7	Ovary	3.4

Source: Bahrain Cancer Registry, Ministry of Health, Bahrain

Cancer is the second leading cause of death in Bahrain with a mortality rate of 40.8 per 100,000 population. The cancer proportional mortality ratio among the Bahraini population has slightly increased over time. It has risen from 11% in 1982 to 13.5% in 1995 in males, and from 7.1 to 13.3% among females and from 9.4 to 13.4% in both sexes combined (MOH, 1982, 1995).

A more pronounced rise is noted in the cancer death rates over the 14-year period (MOH, 1982, 1995). The rise among the females was 2.3 times and 1.4 among the males between 1982 and 1995. The pronounced increase over time in the cancer death rate can not completely be accounted for by the improvement in reporting of deaths.

Cancer of the female breast is the site with the highest frequency among all cancers. It ranks first with respect to all cancers in females and second in both sexes combined. Hematopoeitic and reticuloendothelial cancers rank first in males, second in females and first in both sexes combined. Stomach cancer occupies the third rank in both sexes while colorectal cancer ranks second in males, fourth in females and third in both sexes combined (Table 1). The Bahrain Cancer Registry was operational in August 1994 and the completeness of the reporting has not yet been assessed. Thus, the possibility that it is incomplete for some sites remains.

Table 2. Proportion of smoking and diet-related cancers among the Bahraini population (combined 1995 and 1996)

	Male (%)	Female (%)	Total (%)
Smoking-related cancers			
Lung	6.5	5.8	6.2
Lip, oral cavity and pharynx	7.3	2.3	4.8
Larynx	1.6	0.0	0.8
Urinary bladder	6.9	3.1	5.0
Esophagus	1.6	0.4	1.0
Pancreas	0.0	0.4	0.2
Liver	3.3	2.7	3.0
Stomach	8.1	6.6	7.4
Cervix	–	6.6	3.4
Total	35.3	27.9	31.8
Diet-related cancers			
Breast	–	35.4	18.1
Prostate	6.1	–	3.0
Colon/rectum	9.8	6.6	8.2
Gall bladder	0.4	0.0	0.2
Stomach	8.1	6.6	7.4
Pancreas	0.0	0.4	0.2
Total	24.4	49.0	37.1

Based on the combined 1995 and 1996 reported cases in the Bahrain Cancer Registry.

Avoidable causes of cancer

Cancer has a multifactorial etiology with some cancers having several risk factors. However, some factors are associated with several sites. Smoking and diet-associated cancers alone account for not less than 60% of the cancers in the Bahraini population. In Bahraini males smoking-related cancers occupy over one-third of the cancers whereas half of the cancers occurring in women are diet related (Table 2).

Smoking

The prevalence of smoking among the Bahraini adult males (≥ 15 years) was 30.6% and that of their female counterparts 9.5% in 1982 (Hamadeh *et al.*, 1992). Recent population comparable data are not available. However, 21.9% were daily smokers among adult males (≥ 15 years) and 6.9% of the females in the 1991 census in contrast to 22.1 and 4.7% respectively in the earlier study (Hamadeh *et al.*, 1992; CSO, 1993). A quarter of the Bahraini male medical students are smokers and none of their female counterparts (Hamadeh, 1994). Smoking among Bahraini male primary care physicians is 22.7% in contrast to 6.3% among the female physicians (Hamadeh, 1997). These results indicate that the prevalence of smoking in the Bahraini adult male and female population is lower than in Kuwait and Saudi Arabia and most of the other developing countries (WHO, 1996), while that of the male medical students is higher than their counterparts in developed countries. The prevalence of smoking among male primary care physicians however is similar or lower to that of general practitioners in some developed countries except for the United Kingdom and United States (Adriaanse & Van Reek, 1989; Davis, 1993).

Diet

Several studies (Musaiger, 1987, 1990) reported that the intake of fat is high while that of fibre is

low in Bahrain. Saturated fatty acids, dietary cholesterol and sodium are high in Bahraini foods and dishes. Furthermore, the transition that has occurred in the diet from traditional to western is likely to result in a significant increase in them due to the increase in the consumption of animal food (Musaiger & Cossack, 1991: Musaiger, 1993). The consumption of vegetable oils, red meat, poultry and fish have increased as well as fresh fruits and vegetables. A similar percentage of men (63.5%) and women (65.4%) consume fruits daily, 23.8 and 18.9% weekly, and 12.7 and 15.7% do not consume fresh fruits at all. The corresponding percentages for vegetables are 78.9, 81.1% daily and 12.7, 13.4% weekly and 8.4, 5.5% not at all, respectively (Musaiger & Al-Roomi, 1997). In another study Musagier and Gregory (1992) report that fresh fruit consumption at lunch is almost double in school girls (31.9%) than boys (17.1%). Although daily fruit and vegetable intake is reported in these studies, the number of daily servings is not specified.

Obesity

Obesity has become a major public health problem in Bahrain especially among adult females. Amine (1980) reported that 40% of adult females in Bahrain were obese in the 1970s while Al-Mannai *et al.* (1996) have recently shown that 29.4% of Bahraini women 20–65 years of age are overweight and 31.4% obese. The corresponding figures for men were 26.3 and 16%. Overweight and obesity in the 30–79 age group are 35.9, 21.2% in men and 31, 48.6% in women respectively (Musaiger & Al-Roomi, 1997). Moreover, 15.6% of male and 17.4% of female secondary students have been reported to have a body mass index ≥ 25 (Musaiger *et al.*, 1993).

Physical activity

Sedentary life habits and low physical activity in the Bahraini population were reported by Musaiger (1990, 1994). The data are limited to practising exercise or not and hours spent on television viewing. 87% of men and 92% of women aged 30–79 years do not practise exercise at all (Musaiger & Al-Roomi, 1997). Television viewing occupies most of the leisure time of people in the Arabian Gulf, in different age groups. Of men aged 30–79 years, 77% and of women 79% in that age group watch television daily (Musaiger and Al-Roomi, 1997). A third of mothers spend more than 3 hours daily watching television and 29.5% 1 to 2 hours. Moreover, about two-thirds of children spend 3 hours and over watching television daily (Musaiger *et al.*, 1986).

Other risk factors

Data on the occurrence of other possible preventable risk factors are scarce. The available data on viral hepatitis and AIDS show that the case rate of viral hepatitis is on the decline. The reported AIDS case rate, however, has increased from 0.2 per 100,000 in 1990 to 1.4 in 1995 (MOH, 1994, 1995).

Moreover, the Islamic culture may well bestow certain benefits particularly with regard to alcohol, multiple partners and extramarital sexual relationships thus limiting their contribution in cancer etiology in Bahrain.

Cancer control

Table 3 shows the preventive efforts in the country with respect to cancer control. A government decree was passed regarding an anti-smoking law in 1994, the cancer registry was established in the same year, and the Minister of Health recently formed a Food and Nutrition Committee.

A Home Health Care Program Committee was set up in 1994 to promote the delivery of optimal palliative care at home to cancer

Table 3. National Cancer Control Programme in Bahrain

1. National Cancer Control Committee
2. Population Based Cancer Registry
3. National Antismoking Committee
4. Bahrain Cancer Society
5. Antismoking Society
6. Food and Nutrition Committee

Strategies:

- Tobacco control: legislative action and health education
- Regular monitoring of air, water and food quality
- Hepatitis B vaccination
- Promotion of healthy diet
- Screening for breast cancer
- Breast self examination (BSE)
- Physical examination (30–64 years)
- Screening for cancer of cervix
- Cancer treatment
- Palliative care

patients in the terminal stages of the disease. The Maternal and Child Health Units also began several strategies with respect to breast and cervical screening in 1993. Breast screening by clinical examination is offered to all women aged 30–64 years once a year. A community-based self-examination programme to train members of the community on breast self-examination, so that they can teach other women how to screen themselves was initiated. The Maternal and Child Health Units also started screening women aged 35–64 years for cervical cancer.

A national immunization programme of newborns for hepatitis B was initiated in 1991 and the percentage of the population that have been immunized with Hepatitis B vaccine by 1 year of life is 96% in 1996 (MOH. 1997).

Conclusion

The commendable efforts made in the establishment of a National Cancer Registry and the developing of a National Cancer Programme cannot go without completeness and accuracy of data. Registry data do not seem to be complete for some sites and efforts to identify these weaknesses should be given top priority.

Moreover, the data on risk factors are limited and historical data on specific risk factors are scarce. The need to establish baseline data and to monitor the prevalence of risk factors periodically necessitates the use of comparable methods at different points in time. Nevertheless, available data indicate that cancers associated with smoking and diet are the commonest cancers in Bahrain and control efforts should be directed in that direction particularly among the young who are at a high risk of acquiring and maintaining a western diet and whose smoking behaviour indicates that smoking is still prevalent among them. Smoking, unhealthy diet, obesity and sedentary lifestyle warrant concern in the Bahraini community.

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Risk factors for cardiovascular disease in the United Arab Emirates

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Cardiovascular disease (CVD) has become the major cause of death in the United Arab Emirates (UAE) representing 30% of total deaths. Factors associated with cardiovascular disease in UAE have not been well studied. The diet of the population has become more westernized. The consumption of fresh vegetables and fruits has declined at the expense of meat, poultry, sugar and fat. About 25% of adult men were smokers compared to only 1.6% of adult women. A preliminary study on cholesterol level in blood showed that 20% of UAE adults had high cholesterol level, 34% had borderline, and 46% had desirable blood cholesterol. The prevalence of obesity (BMI $\geq$ 30) was 15.8 and 38.3% among adult men and women, respectively. The overall prevalence of systolic hypertension was 23.9 and 19.7% in men and women, respectively. Diabetes mellitus is also of concern. In general, the known risk factors for CVD such as change in diet, smoking, high blood cholesterol level, hypertension, diabetes and obesity are highly prevalent among the Emirati population, indicating an urgent need for programmes to prevent and control CVD in the UAE.

Introduction

The socio-economic transition has been well identified in many Middle East countries, including the United Arab Emirates (UAE). Economic development and improved health care has played a significant role in increasing life expectancy of the Emirati population. Changes in lifestyle and food consumption pattern have also occurred and contributed to change in diseases patterns. As a result, diet-related chronic diseases such as cardiovascular diseases, cancer, diabetes, hypertension and obesity have become major public health problems (Musaiger *et al.*, 1994).

Cardiovascular disease (CVD) is the major cause of death in UAE, representing 30% of total deaths. The registration of death in UAE has improved remarkably during the past 5 years and therefore more information on CVD mortality has become available. Acute myocardial infarction (AMI) is the main type of CVD leading to death in UAE (37%), followed by cerebrovascular disease (24.5%) and ischaemic heart disease (18%). No significant differences were reported between males and females in death due to various types of CVD except for rheumatic heart disease and hypertensive disease. Deaths due to rheumatic heart disease occurred more in males (17.8%) than females (6.6%). In contrast, deaths due hypertensive disease occurred more in females than males (17.6 and 9.7%, respectively). The proportion of deaths due to several types of CVD indicated no difference between Emirati and non-Emirati females, whereas the Emirati males were more

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susceptible to deaths due to cerebrovascular and hypertensive diseases. The non-Emirati males were more likely to die due to acute myocardial infarction and rheumatic heart disease (Musaiger *et al.*, 1994).

There is no obvious explanation for the difference in CVD between Emirati and non-Emirati. It could be related to different age and sex distribution. The non-Emirati living in UAE are composed of many nationalities, each with various ethnic groups and this could make any explanation a difficult task. WHO (1990) reported that there are sharp contrasts among countries or among social or ethnic groups within a country and these special or environmental conditions can well place a population at risk for CVD.

Factors associated with cardiovascular diseases

Changes in food habits

Studies on food habits in UAE are limited. The Preventive Medicine Department (1995) reported that the food consumption pattern in UAE has become more varied. The intake of traditional foods has declined steeply while that of food rich in fat and refined sugars has increased dramatically. A study on food frequency intake of university girls in UAE (Musaiger & Radwan, 1995) showed a high proportion of girls skipped morning and afternoon snacks, and the intake of fresh vegetables and fruits was low. In general, the diet of these girls has become more westernized. This trend in food habits may contribute to some chronic diseases at a later stage of life. A recent study in Bahrain (Al-Roomi *et al.*, 1994) reported that patients with myocardial infarction tended to consume fresh vegetables and fruits less frequently per week than community controls.

Musaiger and Abuirmeileh (1998) studied the food consumption patterns of Emirati men and women over 20 years of age. They found that the intake of fresh fruits and vegetables is low. About 46% of men and 52% of women reported daily consumption of fruits, while the corresponding percentages for vegetables were 60 and 65%, respectively. A high intake of food rich in dietary fibre such as fruits and vegetables is thought to reduce the risk of CVD through several mechanisms, including lowering serum cholesterol (Sharpnel *et al.*, 1992).

Smoking

Cigarette smoking is the most preventable cause of CVD morbidity and mortality. Smoking has been associated with a two- to fourfold increased risk of coronary heart disease, a greater than 70% excess rate of death from coronary heart disease, and an elevated risk of sudden death (Lakier, 1992). Little attention has been given to studies on the prevalence of smoking in UAE. Musaiger (1998) found that 25% of Emirati men aged 20–80 years were smokers, compared to 1.6% of women at the same age. In a preliminary study it was found that 9% of women aged 20–80 years were current smokers; however, 37% of these women were exposed to a smoking environment at home, making them passive smokers (Musaiger & Hanaya, 1997). Leone (1993) reported that both active and passive smoking seem to act negatively on the heart causing atherosclerotic coronary alterations, focal myocardial lesions and arhythmias. Acute exposure to passive smoking impairs cardiac performance in healthy people and subjects who survived a first acute myocardial infarction.

A study by Bener *et al.* (1993) demonstrates that smoking is highly prevalent among physicians in the UAE, although the majority (91%) agreed that smoking was hazardous to health. Of 275 physicians studied, 36% were current smokers, and 12.7% were ex-smokers. This is a source of worry as physicians should have good health behaviour to be examples for others and anti-smoking campaigns should start with physicians.

Hypercholesterolemia

The relationship between elevated serum cholesterol and cardiovascular disease has been well documented in a number of studies, both within and between countries (La-Rosa, 1992). A preliminary study in UAE showed that the prevalence of hypercholesterolemia varied from 47 to 53% in the Arab nationals in UAE and from 22.7 to 44.5% in the non-Arabs. There was no statistical difference in the distribution of cholesterol levels among Emiratis and other nationalities which indicates that hypercholesterolemia is a problem in most nationalities living in the UAE. As for Emirati nationals, 20% had high cholesterol level (≥ 240 mg/dl), 34% had borderline (200–239 mg/dl) and the remaining 46% had desirable blood cholesterol

Table 1. Prevalence of obesity among married men and women aged 15–70 years in the United Arab Emirates*

			Age (years)					
Obesity	*Sex*	*Sample size*	*<20 (%)*	*20– (%)*	*30– (%)*	*40– (%)*	*50+ (%)*	*Total*
Underweight	Men	(29)	–	7.8	1.5	3.1	4.5	3.6
(BMI < 20)	Women	(36)	5.9	6.7	3.3	2.7	–	3.9
Normal	Men	(322)	–	37.5	47.0	34.7	40.6	40.3
(BMI 20–24.9)	Women	(232)	35.3	34.6	19.2	24.9	–	25.0
Overweight	Men	(322)	–	35.9	36.5	44.0	41.0	40.3
(BMI 25–29.9)	Women	(304)	47.1	31.7	33.9	31.5	–	32.8
Obese	Men	(126)	–	18.8	15.0	18.2	13.9	15.8
(BMI ≥ 30)	Women	(355)	11.8	26.9	43.6	40.8	–	38.3

*The range of age for men was 20–70 years, while that for women was 15–49 years.

(<200 mg/dl). Overall, it affects nearly 50% of the adult population (Agarwal *et al.*, 1994).

Overweight and obesity

Across the Emirati population, over recent years there has been a steady increase in food-energy consumption; a lack of physical exercise is also apparent (Musaiger, 1987). Overweight and obesity, therefore, have risen dramatically in UAE over the past decade. The recent data from National Nutrition Survey which was carried out in 1992 revealed that 33% of married women were overweight and 38% were obese, based on body mass index (BMI) criteria (Table 1). The prevalence of obesity among women increased rapidly with age, and reached its peak at age 30–39 years, and then declined slightly at age 40 years and above. The prevalence of obesity for married men was much less when compared with women. Of men studied, 40.3% were overweight, but only 15.8% were obese (Musaiger, 1992).

Moussa *et al.* (1994) studied the effect of body fat and fat localization on blood pressure level in school children aged 7–18 years from Al-Ain city, UAE. They found that there was significant difference of systolic and diastolic blood pressure means between obese and non-obese children ($P < 0.001$) in both boys and girls. Applying the multiple linear regression analysis to fix the confounding effect of age, sex and social factors, the fatness index (BMI) was significantly related to systolic ($P < 0.0004$) and diastolic ($P < 0.0001$), while waist-to-hip circumference ratio (WHR) was not significant ($P = 0.803$). This indicates that WHR may not be a reliable indicator of body fat distribution in school-age children.

A cross-sectional study of 215 university female students aged 18–30 years was undertaken in 1993 to examine some factors associated with obesity among this group of females. Based on BMI (wt/ht^2), 19% of females were overweight and 9.8% were obese. The proportion of obesity was the highest in females aged 18 years (31%) compared to those aged 19 and 20 years and above (23.8 and 27.6%, respectively). Although there was no significant association between obesity and social factors studied, the prevalence of obesity was higher in non-national, those with educated mothers, having no housemaid, and having a family history of obesity. Skipping meals and snacks had no significant association with obesity; however, obesity was more prevalent among females who did not skip lunch. In contrast, females who ate afternoon snacks and supper were more likely to be obese than females who skipped these events. Median BMI for university females was higher than that reported in USA for the same age group, while median values for weight and mid-arm circumference for females studied were similar to that reported in their counterparts in western countries (Musaiger & Radwan, 1995).

In a community-based study among Emirate Bedouin-derived adults, it was found that the prevalence of obesity (based on BMI more than 29.9) was 10.7 and 27.4% among men and women, respectively (El-Mugamer *et al.*, 1995).

The prevalence of obesity among Bedouin-derived women was unexpected, and could be attributed to the sedentary lifestyle occurring after the oil boom. All the Bedouin in the UAE have moved to urban areas and they are living in westernized-style homes with all sophisticated home appliances.

In general, the prevalence of obesity in UAE is similar to that reported in other Gulf countries (Al-Awadi & Amine, 1989; Musaiger & Al-Ansari, 1992), but it is higher than that reported in most western countries for the same age group (Bray, 1990). Obesity is a major public health problem in the UAE community, and may play an important role in increasing the occurrence of other chronic diseases. It is debatable whether obesity is an independent risk factor for CVD, but it is associated with an increased prevalence of risk factors such as hypertension and diabetes. Overweight and obese subjects also tend to be less active and may have lower glucose tolerance (NDC, 1991).

Hypertension

It is well documented that hypertension is one of the major risk factors for CVD (NDC, 1991). The statistics of the Ministry of Health (MOH, 1993) showed that deaths due to hypertensive disease occurred more among men aged over 59 years (86%), while 50% of women died due to this disease at age 45–59 years, and 32% at age over 59 years. El-Mugamer *et al.* (1995) showed that the prevalence of systolic hypertension increased significantly with age among both Emirati men and women aged 20–80 years. The overall prevalence of systolic hypertension was 23.9% in men and 19.7% in women. As for diastolic hypertension, the highest prevalence was observed among men and women aged between 40–59 years (Table 2).

Alwan (1993) reported that the prevalence rates of hypertension in the eastern Mediterranean region have been found to range from 10% to over 17% of the adult population. The prevalence of hypertension in this region appears to parallel affluence. In many of the countries in the region, including the UAE, the present epidemiological and clinical patterns of hypertension do not appear to differ markedly from those in western countries.

Diabetes mellitus

The incidence of diabetes mellitus in UAE is increasing, and makes a high demand on the existing health services. Diabetic patients occupied 8% of available day-bed units in Al-Ain Hospital and the average stay of a diabetic was 14.6 days (Omar *et al.*, 1985). The Ministry of Health (MOH, 1993) reported that 3.5% of deaths in 1992 in UAE were due to diabetes mellitus. About 55% of deaths due to diabetes were among citizens, and the rest among non-citizens. Omar *et al.* (1985) found that 41% of hospitalized diabetics were nationals, while the rest were expatriates. Most of the nationals were females (62%), but the

Table 2. Age specific and prevalence of cardiovascular disease risk factors among adults of Bedouin origin in Al-Ain, UAE (n = 123 males and 199 females)

Factors	Sex	Age (years) 20–39 (%)	40–59 (%)	≥ 60 (%)	Total (%)
Diabetes	Male	1.9	15.8	3.1	5.8
	Female	1.9	11.3	7.7	6.1
Obesity*	Male	11.3	13.2	6.3	10.7
	Female	28.0	37.7	12.8	27.4
Systolic hypertension	Male	15.1	26.3	40.6	23.9
	Female	7.5	26.4	38.5	19.7
Diastolic hypertension	Male	11.3	26.3	21.9	17.0
	Female	2.8	24.5	20.5	12.8

* Obesity based on BMI ≥ 30

expatriates showed a greater proportion of males (67%). Type II diabetes mellitus featured predominantly (71.7%) in the national group, but was only 57% for non-nationals. The remaining patients in each group were Type I diabetes mellitus.

In a study among a Bedouin-derived Emirate population in Al-Ain city in UAE it was found that the prevalence of non-insulin dependent diabetes mellitus (NIDDM) was higher among age group 40–59 years compared to those at age 20–39 years and more than 59 years (Table 2). Overall diabetes prevalence was 5.8% in males and 6.1% in females (El-Mugamer *et al.*, 1995). These figures are considered low when compared to the figures reported in other Arab Gulf countries (Musaiger & Miladi, 1996), indicating that Bedouin people may have less incidence of diabetes than urban people.

Conclusion

Cardiovascular disease is the major cause of death among the adult population in UAE. Indicators from several small-scale studies suggest that the standard international risk factors such as hypertension, diabetes and high blood cholesterol level are widely present in the UAE. It is essential, therefore, to conduct a community-based study to determine the prevalence of non-communicable diseases, and the risk factors involved. Such a study should not be done without a well-designed plan and fully agreed co-ordination among several sectors.

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Notes for Contributors

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