

## Review

# Type 2 Diabetes in the Sultanate of Oman

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## ABSTRACT

During the past four decades, Oman has undergone a rapid socio-economic and epidemiological transition leading to a substantial reduction in the prevalence of various communicable diseases, including vaccine-preventable diseases. Health care planning together with the commitment of policy makers has been a critical factor in this reduction. However, with rapid social and economic growth, lifestyle-related non-communicable diseases have emerged as new health challenges to the country. Diabetes and obesity are leading risks posed by the chronic diseases. The burden of diabetes has increased sharply in Oman over the last decade, rising from 8.3% in 1991 to 11.6% in 2000 among adults aged 20 years and older. The World Health Organization (WHO) predicted an increase of 190% in the number of subjects living with diabetes in Oman over the next 20 years, rising from 75,000 in 2000 to 217,000 in 2025. There is a lack of awareness of the major risk factors for diabetes mellitus in the Omani population generally. As education is often the most significant predictor of knowledge regarding risk factors, complications and the prevention of diabetes, health promotion in Oman is deemed critical, along with other prevention and control measures. Suitable prevention strategies for reducing the prevalence of diabetes in Oman are discussed. Recommendations are made for reforms in the current health care system; otherwise, diabetes will constitute a major drain on Oman's human and financial resources, threatening the advances in health and longevity achieved over the past decades.

**Keywords:** Non-communicable diseases, Oman, type 2 diabetes

## INTRODUCTION

Diabetes mellitus is a group of disorders characterised by chronic hyperglycemia due to defective insulin action, leading to characteristic abnormalities in the metabolism of carbohydrate, lipid, and protein. The supply of insulin may be affected

by a reduction in pancreatic  $\beta$  cell mass and/or functional disturbances of  $\beta$  cells. Some cases of diabetes mellitus can be ascribed totally to the deficiency of insulin supply, but in other cases there is insulin resistance in addition to a relative lack of insulin.

Oman is an Arab country located in the south-east corner of the Arabian Peninsula.

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The total population of Oman is 2.3 million. Approximately 40% of the Omani population are between 0–14 years, 56% are 15–64 years and 3% are 65 years and above. All Omani nationals enjoy free education (Ministry of National Economy, 2004).

The vast social and economic developments in Oman since 1970 have led to cultural changes including unhealthier eating habits, decreased physical activity and manifestation of a wide range of non-communicable diseases. Type 2 diabetes mellitus is one of the most prevalent conditions (11.6% in the year 2000), and has become a health challenge in Oman (Al-Lawati *et al.*, 2002).

In this review, the situation regarding type 2 diabetes in Oman is reviewed with the aim of increasing the understanding of the need for type 2 diabetes management in Oman. Recommendations are suggested for the future care for diabetic patients in Oman.

### **Burden of diabetes in the Middle East**

Several epidemiological studies have demonstrated that diabetes and pre-diabetes are highly prevalent among the Arab populations of the Middle East (Abdulbari *et al.*, 2009). Six Arab countries in Middle East and North African are among the 10 countries in the world with the highest diabetes and pre-diabetes prevalence. These countries are Saudi Arabia, Oman, Bahrain, Kuwait, United Arab Emirate, and Egypt (International Diabetes Federation, 2009).

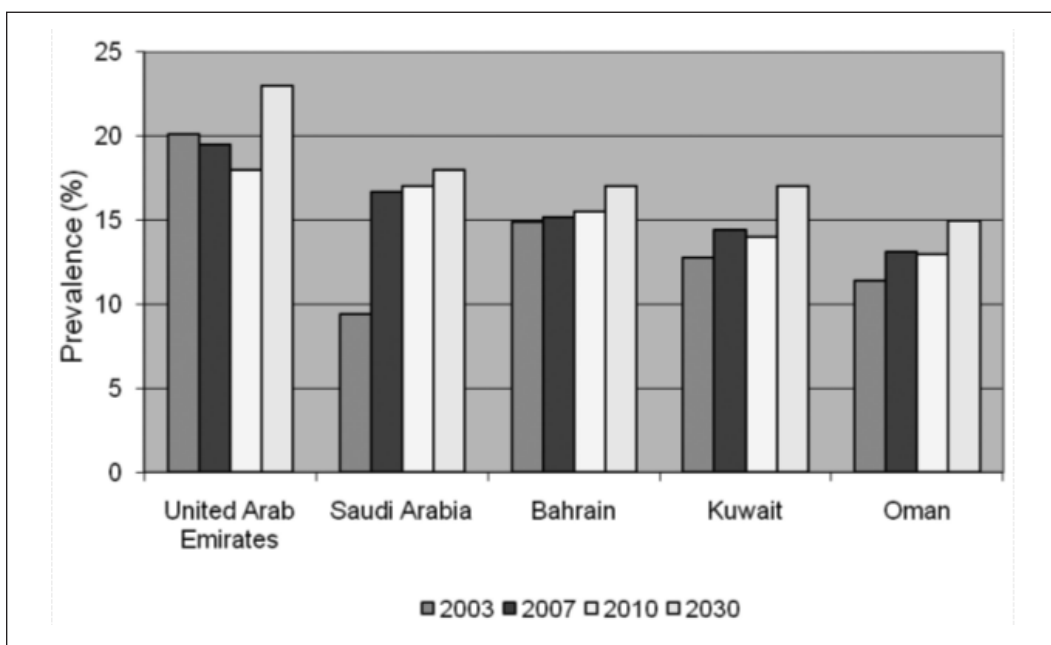
Around 26.6 million people, or 7.7% of the Middle East adult population, will have diabetes in 2010, with the number expected to nearly double in the next 20 years. Similarly, the number of people with pre-diabetes is also expected to rise markedly by 2030, raising the likelihood of further increases in the prevalence of diabetes as the century proceeds (Al-Nozha *et al.*, 2004).

Rapid economic development, especially among wealthy oil-producing countries, has led to major modifications in lifestyle, including the tendency to a

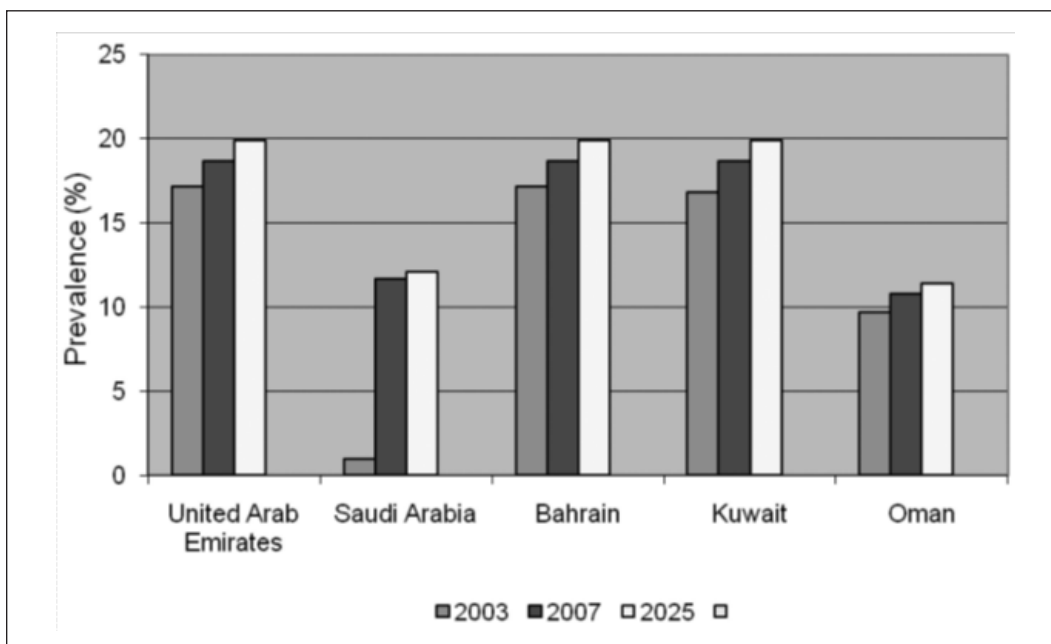
westernised diet, less physical activity, overweight and the smoking habit (International Diabetes Federation, 2009). The increase in diabetes mellitus in the Middle East region is mainly due to type 2 diabetes. Like many other regions in the world with high diabetes prevalence, the occurrence of type 2 diabetes is increasingly occurring at a relatively young age. Figure 1 compares the reported incidence of diabetes in adults (20–79 years) in countries in the region alongside the projected prevalence for the year 2030 (Malik *et al.*, 2005). The incidence of diabetes in most Middle-Eastern countries is already well above the world average and is set to increase markedly in the region by 2030. While the worldwide prevalence of diabetes in 2030 will be almost 25% higher than that in 2003, the prevalence of diabetes in Middle East and North Africa region is set to increase by 81% during this period. This means that diabetes cases in the Middle East are expected to increase by more than twofold (Malik *et al.*, 2005).

The Middle-East comprises highly developed and westernised areas coexisting with relatively undeveloped regions having high rates of poverty. Epidemiological studies in the region are complicated by the relatively high proportions of expatriate workers in some Middle-Eastern countries. A study in Saudi Arabia showed that the prevalence of individual cardio-metabolic risk factors (dyslipidaemia, smoking, obesity, high blood pressure and poor glycaemic control) differed little among Saudi and non-Saudi patients with type 2 diabetes (Abchee, Puzantian & Azar, 2006). Another study in the United Arab Emirates found that the burden of diabetes was higher in Emirate citizens than in expatriates (25% vs. 13–19%) (Saadi, Carruther & Nagelkerke, 2007).

A substantial burden of prediabetes provides a large reservoir of patients at high risk of progressing to type 2 diabetes in the Middle East (Malik *et al.*, 2005). A high incidence of undiagnosed diabetes also contributes to the problem. Figure 2 shows



**Figure 1.** A comparative prevalence (%) of diabetes (20-79 years population), 2003, 2007, 2010 and 2030 in 5 Middle East Arab countries (IDF Diabetes Atlas 2003 and 2007; Malik *et al.*, 2005).



**Figure 2.** A comparative prevalence (%) of impaired glucose tolerance (IGT), 2003, 2007 and 2025 in 5 Middle East Arab countries (IDF Diabetes Atlas 2003 and 2007).

the prevalence of impaired glucose tolerance (IGT) in 5 Middle East Arab countries (IDF Diabetes atlas 2003; 2007). Population-based surveys in Saudi Arabia and Egypt and the United Arab Emirates have demonstrated the presence of a high prevalence of undiagnosed diabetes and IGT (World Health Organization, 2008).

The Middle East countries have undergone rapid economic development within the past three decades, mainly due to oil revenues. This economic growth has been accompanied by major changes in lifestyle involving diet and physical activity (World Health Organization, 2008).

### **Rising burden of non communicable diseases in Oman**

Like many other countries in the world, the Sultanate of Oman bears a high burden of non communicable diseases (NCDs). Many studies have documented the distribution of risk factors related with NCDs in this country (Khatib, 2004). In the Sultanate of Oman, immunisation coverage has been maintained at approximately universal levels (greater than 95%) for all vaccine-preventable diseases within the WHO's Expanded Programme on Immunization (EPI). Polio and diphtheria have not been reported in Oman since 1990. These interventions have contributed to the high decline in mortality rates among infants from 118 death per 1000 live births in 1970 to 10.3 death per 1000 live births in 2005, and children under age 5 years at 181 death per 1000 births in 1970 to 11.0 death per 1000 births in 2005 (Annual Health Report MOH Oman, 2005).

From 1995 to 2005, the number of malaria cases in Oman decreased from more than 32,000 cases to 544 cases. All of the 544 cases were imported cases, mostly from East Africa and the Indian subcontinent. A significant but slower decrease occurred in the total cases of pulmonary tuberculosis, from 258 cases in 1985 to 131 cases in 2005 (Annual Health Report MOH Oman, 2005).

In contrast, non communicable diseases in Oman accounted for more than 75% of hospital deaths and a similar percentage of disability-adjusted life years (DALYs) lost in 2002 (World Health Organization, 2007). In 2005, 55% of outpatient and 40% of inpatient morbidities were attributed to chronic diseases, compared with 43% and 36% in 1995, an increase of 28% and 11%, respectively (Annual Health Report MOH Oman, 2005).

The incidence of hypertension (blood pressure >140/90 mm Hg) among the genders aged 20 years or older has risen from 27% in 1995 to 32% in 2000. The incidence of high cholesterol (total serum cholesterol >5.2 mmol/L) was 41% in 2000 (Annual Health Report MOH Oman, 2005). Another study in the city of Nizwa (in Oman) in 2001 revealed that more than 35% of those surveyed had high total cholesterol, 25% had high triglyceride levels, and 77% had abnormally high-density lipoprotein (Al-Lawati & Jousilahti, 2004). The same study shows that 21% of adults had metabolic syndrome as defined by the National Institutes of Health Adult Treatment Panel III. Similar percentages of metabolic syndrome have been reported among the U.S. adult population. More than 28% of adults in Nizwa city reported no physical activity during working hours, and 60% of the subjects surveyed did not engage in any leisure time physical activity (Al-Lawati *et al.*, 2002).

Approximately 30% of Omani adults are overweight (body mass index (BMI) 25.0 to 29.9 kg/m<sup>2</sup>) and around 20% of adults are obese (BMI ≥30.0 kg/m<sup>2</sup>) (Al-Lawati & Jousilahti, 2004). Data on some food items imports (Table 1) indicate an increasing trend of consumption of refined sugar, dried and evaporated whole milk, chicken, cheese, and chocolate products over the previous decade. The consumption of fruits increased only slightly during the same period (Food and Agricultural Organization, 2007).

**Table 1.** Changes in imports of selected food products and cigarettes, Oman (1993 & 2003)

<i>Commodity</i>	<i>1993 (Metric Tons)</i>	<i>2003 (Metric Tons)</i>	<i>% Change</i>
Chicken	17.2	27.4	59%
Dry whole cow milk	5.2	18.1	248%
Wheat	77.6	82.7	7%
Oranges	16.9	17.1	1%
Whole milk (evaporated)	6.8	10.9	60%
Sugar (refined)	16.7	24.8	49%
Palm oil	11.7	10.7	9%
Sheep milk cheese	2.1	3.4	62%
Chocolate products	2	2.5	25%
Cigarettes	5.9	7.4	25%

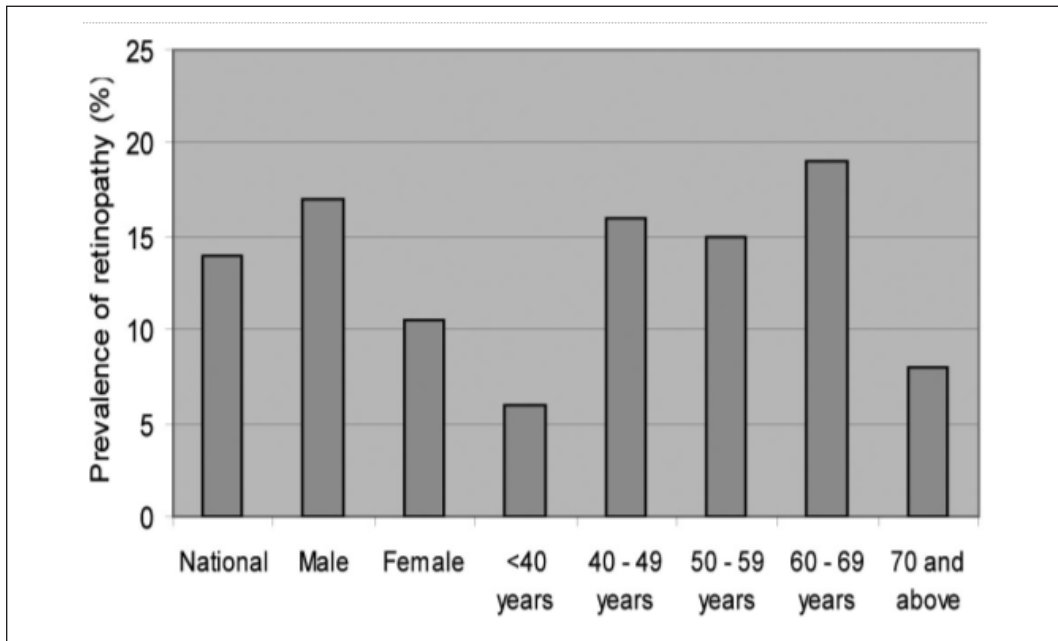
### Burden of type 2 diabetes in Oman

The first National Diabetes Survey in the Sultanate of Oman was conducted in 1991 (Asfour *et al.*, 1995). Subsequently, a nationwide survey on non-communicable diseases and risk factors, including type 2 diabetes mellitus was conducted during the first quarter of 2000. The burden of diabetes mellitus in Oman increased from 8.3% in 1991 to 11.6% in 2000 among adults aged 20 years and older (Al-Lawati *et al.*, 2002). The 2000 survey also reported that 7.1% of males and 5.1% of females had pre-diabetes. Only one-third of the subjects with diabetes knew that they had the condition (Khandekar *et al.*, 2003). The World Health Organization (WHO) predicted an increase of 190% in the number of subjects living with diabetes in Oman over the next 20 years, rising from 75,000 in 2000 to 217,000 in 2025 (Khandekar *et al.*, 2003).

Diabetic subjects in Oman have high rates of diabetes-related complications. As shown in Figure 3, more than 14% of Oman population with diabetes was found to have diabetic retinopathy compared with 11.6% of Saudis and 6.7% of Indians (Al-Futaisi *et al.*, 2006). About 27% of Omani citizens with type 2 diabetes had microalbuminuria (Al-Futaisi *et al.*, 2006). It was found that more than 50% of amputations in Oman are

attributed to diabetes mellitus (Annual Health Report MOH Oman, 2005).

The highest combined incidence of type 2 diabetes and pre-diabetes was found in the national capital city of Muscat (26%), followed by Al-Dhahirah (22%) and Dhofar (21%) regions. The burden of type 2 diabetes and pre-diabetes in the 9 administrative regions of the Sultanate of Oman ranged from 8% to 18% for type 2 diabetes and 2% to 8% for pre-diabetes (Al-Lawati *et al.*, 2002). In general, type 2 diabetes mellitus was more common in urban than in rural places (urban to rural ratio prevalence rates was found to be 235 : 100). The higher incidence rates of type 2 diabetes found in the urbanised regions of Oman compared with more remote and rural regions may be explained by the thrifty hypothesis. People living in prolonged dry and starvation prone conditions such as the Sultanate of Oman environment (mostly desert) may have developed an efficient metabolism mechanism to survive such conditions. However, with increased availability of food, this genotype has become detrimental to health, leading to a high incidence of overweight and obesity. Obesity and low physical activity are the major risk factors propelling the current epidemic of type 2 diabetes globally.



**Figure 3.** Prevalence of diabetic retinopathy in Oman by gender and age groups

### Diabetes and urbanisation in the Omani population

Epidemiological studies show rising rates of type 2 diabetes all over the world, notably in developing countries that are undergoing epidemiological transition from communicable to chronic diseases (Hennis *et al.*, 2002). This has also been observed in certain communities that have undergone a relatively rapid transition from a rural to an urban lifestyle. Research in middle-income countries has shown that risk factors for chronic diseases are more prevalent in urban than in rural areas (Al-Nozha *et al.*, 2004). Urbanisation has been found to be a significant independent factor for diabetes in Oman (Al-Moosa *et al.*, 2006), perhaps owing to lifestyle and work-related factors.

Changes in lifestyles involving dietary intake and physical activity patterns have been taking place in the past 30 years in Oman, as witnessed by the increasing migration of Omanis to the capital city of

Muscat (Al-Lawati *et al.*, 2002). The social and economic developments in Oman are associated with sharp increases in car ownership, consumption of high fat caloric-dense food, refined sugar and salt, and decreasing physical activity (Al-Lawati & Jousilahti, 2004).

Al-Moosa *et al.* (2006) reported that an increase in blood pressure is significantly associated with diabetes, particularly among urban-dwellers. Also, the prevalence of hypertension is higher in Muscat city than in the rural areas. These findings are consistent with that of other studies (Al-Mahroos, Al-Roomi & McKeigue, 2000; Njolstad, Arnesen & Lund-Larsen, 1998), indicating that individuals in the capital region are at higher risk of developing both diabetes and cardiovascular diseases, due to elevated prevalence of coronary risk factors, than those in rural regions of Oman.

Almost one-fifth of the adult Omani population is obese. During the past decade, the rate of obesity and overweight among



Omani men has increased, while a declining trend has been observed among Omani women (Al-Lawati & Jousilahti, 2004). In the urban areas, this high incidence of diabetes could be attributed to rural to urban migration after the 1980s oil boom which led to many socio-economic changes in the Omani community (Al-Lawati & Jousilahti, 2004). Although higher than among men, the lower rate of overweight among women has been explained by increasing educational levels, declining fertility rates and improved awareness of self-image.

Estimations indicate that illiterate and less educated people are more likely to suffer from diabetes, high blood pressure and high cholesterol. It was found that higher educated individuals were less likely to have diabetes particularly in the rural population (Al-Moosa *et al.*, 2006). The prevalence of type 2 diabetes defined through blood test is considerably higher than the self-reported prevalence in Oman. Less than half of the number of diabetes patients, as defined by fasting blood glucose, reported having diabetes. In the urban parts of Muscat, 11.1% of the urban population who thought they did not have diabetes actually did according to blood tests, compared to only 6.2% among those outside Muscat. This finding shows the importance of diabetes education and frequent testing in order to prevent individuals from developing diabetes or complications associated with the disease (Al-Riyami & Afifi, 2003).

### **Influence of culture**

The effect of culture on Omani behaviour and beliefs with regard to health and nutrition cannot be ignored. Islam, as the main religion in Oman, is one of the major dimensions of culture and social structure of the Omani community, that affect the patterns, and practices within a culture. Culture must be seen in this particular context, that is, culture is also made up of historical, ritual, family structure, food habits, social and geographical elements that mutually

influence culture and are also influenced by culture.

We have to take into consideration that individual differences in age, gender, education (including education in a religious sub-culture), personality, intelligence, experience, occupation and socio-economic factors make it difficult to make too broad a generalisation in explaining people's beliefs and behaviours (Hofstede, 1991).

In Oman there are common food habits which are related to culture, such as consumption of dates served with coffee. Dates might be taken frequently during the day. There is a strong cultural belief about the nutritional and economic value of dates. From the nutritional point of view, dates are useful and nutritious, but the high sugar content makes them unsuitable in larger amounts for diabetic subjects. It is important to understand that Islam considers health to be achieved through physical and mental health. Islamic literature mentions that a healthy diet should be promoted, as well as not eating too much, with emphasis on wholesome food (Regional Office for the Eastern Mediterranean WHO, 2000).

In Oman, as in most Muslim communities, it is accepted that leaders will separate themselves from the general population, that there is a 'power distance' in the terms of Hofstede (Hofstede, 1991). According to Hofstede's theory there is also a dimension of 'uncertainty avoidance' in Muslim countries, i.e., lowering of ambiguity and uncomfortable situations. This can be observed in the relation between the physician and the patient, where the physician is considered as the main source of security and knowledge and that the patients have to ask their help and advice because they have the power and are responsible for their wellbeing. The concerns and suggestions expressed by the patients, that they should be responsible for their own health and not depend too much on the doctors, may signal a shift to a situation

where the patient is ready to take a more active role, although the cultural heritage will continue to influence the relationship.

These kinds of beliefs can have a negative impact on the development of a more patient-centred care. The same is true for the dimension of 'individualism versus collectivism' (Hofstede, 1991) where Muslim societies, including Oman, are characterised by 'dependent collectivism' in which people from birth onwards are integrated into strong, cohesive in-groups, often extended families (with uncles, aunts and grandparents), which continue protecting them in exchange for unquestioning loyalty. On the other hand, a patient-centred approach has traditionally been of an individual character. Health care team work may therefore be particularly appropriate in the Omani community.

Diabetes health care providers must be aware of the impact of culture on patients behaviour, dietary habits and practices before these beliefs and practices can be modified or improved, as these elements play a role in decision making processes in the patients' everyday life with diabetes.

### **Health care system in Oman**

Oman's health care system faces several challenges in its efforts to prevent chronic diseases from eroding the achievements of the past four decades. Population increases will lead to an estimated 210% increase in the demand for health care by 2025, and treatment of cardiovascular diseases alone will account for 21% of total health expenditure (McKinsey & Company, 2006). The Omani health care system suffers from an overuse of health services, both by patients, with 5.6 visits per person per year, and by physicians, with 70% of tests requested being unnecessary (Abri, West & Spinelli, 2006). Omani patients' expectations for quality of health care and outcomes are increasing.

Furthermore, the rapid rate of health care costs has led to a great concern for

sustainability of health care services, especially given the rapid rate at which costs are increasing. The health care expenditures in Oman increased by 64% from 1995 to 2005 (Khoja, 2004). Improving the health care for chronic diseases such as diabetes would put incrementally increased financial demands on health care resources. There is a great need to turn the direction of health care services in Oman from acute and episodic treatment to treatment that meets the ongoing needs of people with chronic conditions, with more focus on health promotion and chronic disease prevention.

Preventive medical services were emphasised in every 5-year plan of the Oman Ministry of Health (The Seventh 5-Year Plan for Health Development, 2006-2010). Secondary-care services are available in all regions of Oman and there is a public health centre network throughout the country. However, the current primary medical care is still geared more to combating infectious diseases, providing immunisations, and providing prenatal care rather than to meeting needs arising from the growing burden of NCDs. Most primary care physicians are not educated beyond their basic training to deal with common complex diseases like diabetes, hypertension, asthma, and psychiatric conditions. Medications necessary to treat common conditions such as hyperlipidemia, hypertension (angiotensin-converting enzyme inhibitors), depression, and other common chronic conditions are dispensed in primary care facilities where most people access health care, as well as in secondary and tertiary care facilities (Oman National Drug Policy, 2004). Tobacco-cessation and anti-obesity drugs have yet to be added to the national formulary and can be obtained only through private-sector pharmacies at appreciably higher costs (Al-Lawati Mabry & Mohammed, 2008).

The major risk factors of the current epidemic of type 2 diabetes in Oman, namely low physical activity and obesity, can be



curbed through implementation of appropriate strategies, such as the WHO Global Strategy on Diet, Physical Activity, and Health (WHO, 2007). Furthermore, the call by Strong *et al.* (2005) to set a target to reduce deaths from chronic diseases by an annual rate of 2% deserves due consideration and integration into Oman's national health goals.

Omani health planners need to have greater commitment to the provision of services for people with diabetes. Commitment is likely to be forthcoming if more evidence is produced nationally demonstrating the increasing burden of diabetes. More commitment to providing diabetes services will result from national research and from continuous dialogue between advocates of diabetes control and policy makers. The emphasis on health promotion will enable Omani individuals, both the chronically ill and the healthy, to increase control over their health and to improve it.

Omani policy makers make decisions that have an impact on major risk factors and, ultimately, on the health of the nation. However, collaboration and joint planning among different government sections need to be strengthened through development of a national planning framework under the leadership of the Ministry of National Economy. Health programmes with a preventive nature would have better outcomes if policies on taxation, trade, food, urban planning, and the like are evidence-based and set with due consideration of public health.

### **Diabetes care challenges in Oman**

Habiba *et al.* (2010) studied the barriers and facilitators of weight management among people in the region. They found that people are generally aware of the health complications of excess body weight, including the numerous obesity-related chronic diseases, as well as its effect on normal daily activity, for example,

difficulties in movement during work. Despite this awareness, most of the population did not engage in regular physical activity or were not following eating patterns consistent with a healthy diet. Personal, social and physical environmental barriers were identified, including social norms (outdoor exercise restrictions and social gatherings involving eating), low social support from families, lack of culturally acceptable exercise facilities and hot weather. Similar results were found by Berger & Peerson (2009). They reported social and environmental barriers to physical activities among college students, including low social support, lack of culturally acceptable exercise facilities and hot weather conditions. Shuval *et al.* (2008) conducted focus group interviews with Arab college students and reported that social environment and social support network have greater influence on the physical activity levels of Arab students than intrapersonal factors such as attitude and self-efficacy.

Suggestions that are consistent with the Social Ecological Model of health promotion may help in reducing the negative perceptions related to body weight and improve diet and physical activity levels. The Social Ecological Model for health promotion focuses on the importance of interventions directed at changing interpersonal, organisational, community and public policy and emphasises the importance of a supportive environment and policies for physical activity (McLeroy *et al.*, 1988). Suggestions such as peer walking, walking tracks and special culturally appropriate exercise facilities for women may help in reducing the negative perceptions related to body weight, diet and physical activity which may lead to effective diabetes management for the population.

An ageing population together with social, economic and lifestyle changes have led to a dramatic increase in diabetes prevalence. Over the past three decades,

progressive urbanisation, decreasing infant mortality and increasing life expectancy have occurred. As Oman continues through the epidemiological and socio-economic transition, the burden of NCDs, particularly diabetes, can only be expected to increase. Concerns about the economic implications of diabetes in the Arab countries have increased. The Regional Conference on Health Economics which was held in Riyadh in Saudi Arabia proposed to issue the 'Riyadh Declaration' as a guiding framework to address the challenges of diabetes particularly from an economic standpoint (Regional Conference on Health Economics, 2007). Objectives of the conference include (i) shedding light on all aspects of economics of diabetes including the medical and social issues at the international, regional and gulf level; (ii) illuminating the immense challenges imposed by diabetes on the health systems and healthcare costs (whether direct or indirect); (iii) proposing and presenting responses to confront these challenges, with presentation of effective models; (iv) involving key stakeholders in the management of diabetes and imparting significance to their role in combating diabetes; (v) increasing the knowledge of governmental officials and others concerned with and interested in the economic aspects of diabetes; and (vi) presenting outstanding international initiatives and experiences in the management of diabetes.

Type 2 diabetes, which accounts for 90% of diabetes, is largely rooted in reversible social and lifestyle factors. A medical approach alone is unlikely to be the solution. A collective medical approach provides predisposed persons with better protection from the environmental hazard of decreased opportunities for physical exercise and the abundance of 'energy-dense food'. It is important for the diabetes health strategy to include local communities, schools, and urban planners who have the potential to reduce diabetes incidence.

A significant number of Omanis seem to lack knowledge and information on preventive measures required to cope with diabetes (Al Shafee *et al.*, 2008). However, Al Shafee *et al* found that health education is the most significant predictor of knowledge and perceptions of diabetes risk factors, complications and prevention. The Omani Ministry of Health has ensured availability of Arabic-speaking diabetes doctors all over the country. Diabetes clinics, run by family doctors on specific days of the week, have been initiated in most primary health centres. Diabetes Management Guidelines have been developed and are regularly updated (Ministry of Health Oman, 2003).

As reported by McKinsey that, "In light of the Gulf Cooperation Council's unusual risk-factor profile" a substantial opportunity exists in primary care to better manage chronic diseases such as diabetes and obesity before they result in cardiovascular complications (McKinsey & Company, 2006).

It appears that Omani researchers are still under the notion that commitment for the provision of diabetes health services from decision makers and health planners is assured if more evidence is produced nationally by just demonstrating the increasing burden of diabetes.

Ministry of Health Oman (2003) admit that collaborations and joint planning among government sections in Oman are still rudimentary and need to be strengthened. They report that unless changes are introduced to the current health care system, type 2 diabetes will constitute a major drain on Oman's human and financial resources, threatening the advances in health and longevity achieved over the past four decades.

While Al Mandhari *et al.* (2009) have stated that given the background of a less than desirable quality of care of diabetes in Oman, one of the applications of their findings to patient care management is that interventions should focus on patient education, training of primary care

physicians and other patient care providers in behavioral change and redesign of local systems of delivery care. "We really need to think about the need to plan and execute better quality intervention studies in Oman with more emphasis on proven, cost-effective primary prevention services (to suit our local needs) that focus on lifestyle and behaviour change. These will result in a recommendations to conduct research on lifestyle modification interventions in order to prevent or reverse diabetes. The results will be useful for the decision makers to take appropriate steps to avert the threat mentioned above."

## CONCLUSION

Oman and other Middle East countries face an epidemic of type 2 diabetes. The rapid social and economic development coupled with several demographic changes over the past years reflect positively on the health indicators. Achievements in health care may be overshadowed by the dramatic rise in chronic diseases such as diabetes. Health planners in the Middle East region need to have greater commitment to the provision of services for people with type 2 diabetes. This will result from research and from continuous dialogue between advocates of diabetes control and policy makers.

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