DISSERTATION

DIABETES EDUCATION IN OMAN:

NEEDS ASSESSMENT AND DEVELOPMENT OF AN INTERVENTION FOR HEALTH CARE PROFESSIONALS

Submitted by

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WE HEREBY RECOMMEND THAT THE DISSERTATION PREPARED UNDER OUR SUPERVISION BY LYUTHA KHALFAN AL-SUBHI ENTITLED **DIABETES EDUCATION IN OMAN: NEEDS ASSESSMENT AND DEVELOPMENT OF AN INTERVENTION FOR HEALTH CARE PROFESSIONALS** BE ACCEPTED AS FULFILLLING IN PART REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY.

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ABSTRACT OF DISSERTATION

DIABETES EDUCATION IN OMAN: NEEDS ASSESSMENT AND DEVELOPMENT OF AN INTERVENTION FOR HEALTH CARE PROFESSIONALS

Oman is one of the countries faced with the challenge of an increasing rate of diabetes. The National Diabetes Control Program (NDCP), in Oman, aims to provide a suitable and quality health education to people with diabetes and the community. Diabetes management guidelines for Primary Health Care (PHC) in Oman point out that all members of the diabetes health care team share the responsibility of educating those with diabetes. Nevertheless, diabetes education has not been tackled systematically and the incidence of diabetes is on the rise in Oman. There is a pressing need for a diabetes education program for diabetes self management in the Sultanate of Oman.

In the first phase, an educational needs assessment was conducted with people with Type 2 diabetes in PHC. Structured open-ended one-on-one interviews were employed, based on the tenants of the Health Belief Model (HBM), to better understand patients' beliefs, motivators, and barriers associated with their diabetes self-management behaviors. Health professionals were also interviewed to identify their perspectives and suggestions on the diabetes education needs in PHC. Patient interviews identified four major barriers to appropriate self-care behaviors among people with Type 2 diabetes, inadequate knowledge, lack of self-efficacy, social commitments, and limited finances.

No diabetes education program was found to be in place in PHC. Professionals and patients expressed the need for educational materials that were pragmatic and culturally appropriate.

In the second phase of the study a comprehensive culturally appropriate diabetes education program and related printed materials were developed. The program was pilot tested with a group of health professionals from PHC in a quasi-experimental design. A closed ended questionnaire was used to evaluate the effectiveness of the program in equipping professionals with appropriate diabetes education knowledge and skills important in counseling patients. The program was also evaluated by the treatment group using an open-ended questionnaire. Knowledge of the treatment group increased significantly ($p < 0.0001$) from pre-test to post-test evaluation on all knowledge scales; it was retained at one-month follow-up. Self-efficacy was significantly ($p = 0.006$) increased at post-test in the treatment group and was maintained at follow-up. The comparison group did not show any change in knowledge or attitude scale at any testing point. Treatment participants provided positive feedback on the usefulness of the program. The diabetes education program should be piloted with a group of patients and evaluated before it is fully implemented in Oman.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF ABBREVIATIONS

Adult Treatment Panel III	ATP III
Body Mass Index	BMI
Diabetes Food Pyramid	DFP
Michigan Diabetes Knowledge Test	DKT
Diabetes Miletus Management Guidelines	DMMG
Fasting Plasma Glucose	FPG
Finnish Diabetes Prevention Study	DPS
Glycohemoglobin	HbA1c
Health Belief Model	HBM
High Density Lipoprotein	HDL
Impaired Fasting Glucose	IFG
Impaired Glucose Tolerance	IGT
International Diabetes Federation	IDF
Low Density Lipoprotein	LDL
Medical Nutrition Therapy	MNT
Ministry of Health	MOH
National Diabetes Control Program	NDCP
National Diabetes Survey	NDS

National Health Survey	NHS
National Institute for Clinical Excellence	NICE
Noninsulin Dependent Diabetes Mellitus	NIDDM
Oral Glucose Tolerance Test	OGTT
Oral Hypoglycemic Agents	OHA
Primary Health Care	PHC
Recommended Dietary Allowance	RDA
Triglycerides	TG
United Arab Emirates	UAE
UK Prospective Diabetes Study	UKPDS
United States Department of Agriculture	USDA
Waist-to-hip Ratio	WHR
World Health Organization	WHO

BACKGROUND AND SETTING

The epidemic of non-communicable diseases such as diabetes is not limited to developed, industrialized or Western countries. Globally, it was estimated that there were 171 million adults with diabetes in 2002, two thirds of whom lived in developing countries (World Health Organization [WHO], 2003). In 2025, 330 million adults are projected to have diabetes; the hardest to be hit will be adults in developing countries as a result of skyrocketing economic development, urbanization, and westernization (International Diabetes Federation [IDF], 2003).

Diabetes is a costly disease. If uncontrolled, it leads to long term progressive development of complications (World Health Organization [WHO], 1999) that directly affect the quality of life not only of those affected but of their family members as well (American Diabetes Association [ADA], 2002). Further, diabetes is an economically costly disease either directly by rising the medical cost of health care systems or indirectly by lose of productivity due to disability, lose of work and premature mortality linked to diabetes (Hogan, Dall, & Nikolov, 2003).

Oman, one of the countries undergoing rapid development, is faced with the challenge of an increasing rate of diabetes. For the first time, in 1990, the rate of diabetes in Oman was estimated by World Health Organization (WHO) consultants based on national statistics. Nationally the incidence of hospital-presenting diabetes (new cases) was 4.8/1000 population in 1988. Muscat, the capital region had the highest rate,

13.4/1000 population. The figures were high by international standards; as a result, WHO consultants concluded that the profile of the disease in Oman was similar to that of Western countries (Asfour, Samantray, Dua, & King, 1991).

In 1991, following the WHO report, a National Diabetes Survey (NDS) was initiated to systematically evaluate the incidence of diabetes in Oman. Of a total of 5,096 adults (≥ 20 years) the prevalence ranges were 7-13% for diabetes and 8-14% for Impaired Glucose Tolerance (IGT) for all regions in the country. Muscat, the capital province, had a combined prevalence of 23%. The survey reaffirmed that the profile of diabetes among adults in Oman matched that of adults in Western countries. Subsequent to the 1991 NDS, a national diabetes control program was initiated. The program aimed at appointing medical officers responsible for non-communicable diseases at regional referral hospitals, building detailed patient education material, establishing a central diabetes registry, and conducting a public information campaign (Asfour et al., 1995). About ten years later, in a National Health Survey (NHS) 2000, the trend of diabetes prevalence was reassessed. Across health regions, the prevalence ranges were 8-18% for diabetes and 2-8% for Impaired Fasting Glucose (IFG). Again, the capital area had a collective prevalence, diabetes and IFG, of 26% which was the highest nationally (Al-Lawati, Al Riyami, Mohammed, & Jousilahti, 2002).

Management of diabetes involves multiple aspects that include medical care, nutrition, and physical activity components (American Diabetes Association [ADA], 2004b). The need to address diet, lack of physical activity and obesity, factors associated with the epidemic of diabetes, in prevention and control programs has been strongly addressed by WHO (World Health Organization [WHO], 2004).

Education plays a central role in all aspects of diabetes prevention and management. Extra efforts have been made in designing different education approaches for diabetes behavior and dietary education in nations that experience a high prevalence of diabetes. Over all, significant decreases in glycohemoglobin (HbA1c) (-0.43%), fasting blood glucose (-24 mg/dL), and weight (-3 lbs) have been revealed in a meta-analysis of 18 randomized education and behavior trails. Educators, whether physicians, nurses or dietitians, all were able to guide patients to achieve lower HbA1c (Gary, Genkinger, Guallar, Peyrot, & Brancati, 2003). Diabetes education and dietary instructions in Primary Health Care (PHC) settings also provided promising outcomes. Significant decreases were observed in total cholesterol, HbA1c, and low density lipoprotein (LDL) in individuals with Type 2 diabetes when educated (Goddijn et al., 1999; Ridgeway et al., 1999). Even when an intervention was brief, during regular outpatient follow-ups, positive outcomes, including a significant decrease in percent of calories from fat and serum cholesterol, were observed (Glasgow et al., 1997).

To date, published data pertinent to diabetes in Oman merely emphasizes prevalence and risk factors. These data shows that diabetes in Oman increased at such a marked rate over a ten year period that it was set as one of the priority health issues, leading to the establishment of the National Diabetes Control Program (NDCP). The aims of the NDCP are to provide appropriate and quality health education to individuals with diabetes, their kin and their communities, to support research aiming to prevent and control diabetes mellitus, and to produce patient education materials. Also, the NDCP provides guidelines on all aspects of diabetes management, including nutrition and physical activity (Ministry of Health, 2003).

However, the NDCPs' educational strategic objectives were not found to have been systematically approached. The NDCP guidelines for nutrition and physical activity are in broad terms and basic - mainly describing the percentage composition of macronutrients in daily caloric intake and walking as the only exercise idea referenced. These recommendations and guidelines are neither adequate nor practical. No information was found on the type of education materials or programs designed or any sort of evaluation of such purposes. No previous research exists on the educational needs and health beliefs of people with diabetes in the Arab world, Oman included. The use of health theories and models in the region was not found to have been applied in studies of people with diabetes.

Planning and designing nutrition education and dietary instructions studies can greatly benefit from the use of theories and models as they form a knowledge base that is strong and organized (Achterberg & Clark, 1992). The Health Belief Model (HBM) is one of many health models that have been used to identify beliefs in planning for educational programs (Rosenstock, 1982). A systematically designed diabetes education program for use in the primary health care clinics is urgently warranted in Oman.

Statement of the Problem

The evidence shows that the incidence of diabetes in Oman is on the rise and that diabetes education has not been tackled systematically. There is a pressing need for a diabetes education program for diabetes self management in the Sultanate of Oman.

Objectives of the Study

The objectives of this study were to:

1. Conduct an assessment of diabetes educational needs of adults with Type 2 diabetes and their health professionals in PHC in Muscat, Oman, using one-on-one interviews to:
    a. Identify health beliefs relevant to diabetes management, based on HBM, of people with Type 2 diabetes.
    b. Document the current practice in diabetes education and to obtain the perspective and suggestions of health professionals on diabetes educational needs in PHC.
2. Adapt and pilot a culturally appropriate multi-media diabetes education program geared for health professionals, based on the findings of interviews with patients and health professionals in PHC:
    a. Develop a questionnaire to measure knowledge/efficacy/barriers/education importance of health professionals, based on the content of the education program.
    b. Develop program-related print materials for the education of patients with diabetes in PHC.
    c. Evaluate the effectiveness of the developed education program using a quasi-experimental design (nonequivalent group time series) (D. Ary, Jacobs, & Razavieh, 1996) to measure change in knowledge, self-efficacy, education importance, and barrier outcomes of health professionals at three intervals, pre, post and one month follow-up.

d. Conduct program and education material formative evaluation using an open-ended questionnaire with health professionals in the intervention group.

Basic Assumptions

1. Availability of diabetes education programs and materials is very limited in PHC clinics; available materials were not systematically developed, and are not easy to understand and to apply.
2. A large number of health professionals are not adequately trained in nutrition counseling.
3. Patients and health professionals have time constraints that limit the feasibility of offering elaborate self-management education programs. Thus they need practical educational materials that are easy and quick to apply.
4. Continuous education for health professionals is beneficial to empower them with sound knowledge and practical skills.
5. The number of dietitians and diet technicians is scarce in the country and their role is very new to the nation. Many PHC centers are left without a specialized professional in educating patients.
6. On average, patients have poor glycemic control.
7. Individuals with diabetes need to learn simple strategies to assist them in diabetes self-care.

Significance of the Problem

The study attempted to reveal health beliefs of adults with Type 2 diabetes pertinent to diabetes management in Muscat, Oman, based on tenets of HBM. This would establish a milestone for applying theories in health studies. Documenting the current practices of diabetes nutrition education in PHC provided useful information for comparison with practices of other nations. In addition, the project established a baseline for future diabetes education approaches and investigations appropriate to the culture and the community. Furthermore, this project established a common diabetes nutrition knowledge base among participating health professionals in PHC who are in direct contact with patients with Type 2 diabetes that would increase the chance of empowering affected individuals to better control their condition.

REVIEW OF LITERATURE

Introduction

Type 2 diabetes mellitus is a chronic metabolic disease arising due to disorders of insulin action and/or secretion. In other words, this describes a condition in which the pancreas can produce sufficient insulin but the body fails to utilize it or one in which the pancreas does not produce enough insulin. In either case, the net result is hyperglycemia, when cells are starved of energy, causing symptoms such as blurry vision, weight loss, thirst, and polyuria. It is very common for symptoms to be absent, or they might not be severe while blood glucose level is high for a long time before diagnosis of diabetes is actually made. In this situation, blood glucose is elevated enough to initiate functional and pathological changes and thus the development of diabetes complications (WHO, 1999).

In the long run, hyperglycemia (elevated blood glucose) is associated with progressive development of complications such as retinopathy and nephropathy, due to damaged small blood vessels, resulting in potential blindness and renal failure. The risk of cerebrovascular, cardiovascular, and peripheral vascular diseases is high for those with diabetes because of the accelerated development of atherosclerosis that could lead to strokes and heart attacks. Also, hyperglycemia increases the risk of neuropathy leading to potential amputation and autonomic dysfunction (ADA, 2004b). As a result of the

accompanying life-threatening complications, the prevalence of death attributed to diabetes is high. Globally, diabetes mellitus is ranked fourth among the leading causes of death by diseases (IDF, 2003).

In 2002, diabetes was estimated to be widely spread worldwide with its highest concentration being in developing countries (WHO, 2003). Global projections for 2030 do not demonstrate any plateau or regression in the prevalence of the disease; diabetes is certainly on the rise (Wild, Roglic, Green, Sicree, & King, 2004).

Type 2 diabetes is the most common form of diabetes. In developed countries approximately 85 - 95% of diabetes cases are Type 2. The proportion in developing countries is estimated to be even higher (International Diabetes Federation [IDF], 2007). Oman is one of the countries experiencing the spread of this metabolic disorder. Statistics revealed that the prevalence of diabetes in Oman has so drastically increased over a short period of time that it has been listed as one of the priority health issues there (Al-Lawati et al., 2002; Asfour et al., 1995).

Development of Type 2 diabetes is driven by several factors and requires treatment. The boom in the prevalence of diabetes mellitus cannot be entirely attributed to genetic factors and aging. Changes in lifestyles including unhealthy diets, overweight conditions, obesity, and the popularity of sedentary activities have all contributed to the frightening increase in the number of people with Type 2 diabetes (Maggio & Pi-Sunyer, 2003; WHO, 2004). Diabetes management involves multiple approaches including medical care, nutrition, and activity components. In managing Type 2 diabetes, the goal is to maintain near normal blood glucose levels through balanced diet and physical activity, which are essential factors in managing the disease regardless of medication

(ADA, 2002). The WHO urges that lifestyle triggers of Type 2 diabetes should be addressed in diabetes prevention and control programs (WHO, 2004). The International Diabetes Federation (IDF) recommends that structured patient education be an essential part of diabetes management of individuals with Type 2 diabetes (International Diabetes Federation [IDF], 2005).

Herein is a review of literature pertinent to the epidemic burden of diabetes, the cost of diabetes and some background information about the health care system in Oman. Also included are examples of the benefits of diabetes education in diet and physical activity. The importance of determining the need for and approaches to planning diabetes education and theory application in nutrition education are explored. Another area of investigation included in this chapter is theory application in nutrition education; the Health Belief Model (HBM) and its application in research pertinent to diabetes are visited. Finally, evidence of the importance of continuing education for health professionals and the need for the development of education materials are issues explored here as well.

The Sultanate of Oman: A Brief Geographical and Demographic Overview

The Sultanate of Oman is at the southeast of the Arabian Peninsula sharing borders with the Kingdom of Saudi Arabia and the United Arab Emirates on the west and the Republic of Yemen on the south. Oman overlooks the Gulf of Oman and the Persian Gulf to the north and the Arabian Sea to the east. It is the second largest country in the Arabian Peninsula with varying topography spread over 309,500 km^2 of total land area, which is about the size of New Mexico, USA (U.S. Department of State, 2006). Sand,

wadis (valleys), and desert constitute approximately 82% of the geography. Mountains (15%) and plains (3%) form the remaining area (Ministry of Health, 2006a).

Based on the general population census of 2003, Oman had a population of about 2.34 million, of which 76.1% were citizens and 23.9% were non-citizens. Statistics of the Omani population indicate a gender ratio of 102 male per 100 female. The major portion of the Omani population was young, with children < 15 years comprising 40.6% of which 12.1% were children < five years of age. About 56% of the nationals were between 15 to 64 years. The crude birth rate was 24.4/1000 in 2003. Females in the reproductive age group (15 - 49 years) comprised 25.1% of the total population with an average fertility rate of 3.56 children/woman. At birth, life expectancy averages 73.6 and 75.4 years for males and females, respectively (Ministry of Health, 2005; Ministry of National Economy, 2005).

The Health Care System in Oman

The government of Oman pursues a national health policy in which health care is provided by the government for citizens at no cost. As a government organization, the Ministry of Health (MOH) takes the lead in providing therapeutic and preventive health care to the Omani population. It forms the umbrella under which national health policies are enacted. For health administration purposes, better strategic planning capabilities, decentralization, and provision of supervision and coordination for each community's specialized needs, the country is divided into ten health regions. Namely the health regions are: Muscat, Dhofar, Musandam, Ad Dakhilyia, North and South Ash Sharquiyah, North and South Al Batinah, Adh Dhahira, and Al-Wusta. Figure 1

illustrates a map of the Sultanate of Oman and the division of the ten health administrative regions. Despite the fact that the health system is under government administration, it is decentralized (Ministry of Health, 2006a, 2006b).

Figure 1 (Ministry of Health, 2007) Oman: Ten health administrative regions

Further decentralization of health care management was initiated in the year 2000, when primary health care was decentralized, coming under the jurisdiction of the wilayats (counties) within each region in order to keep up with the needs of the people

locally, as there are many social and economical differences among the various parts of the country that influence needs and priorities accordingly (Ministry of Health, 2006b).

By the end of 2005, MOH was managing 49 hospitals and 140 health care centers across the nation. Independently from MOH, other government bodies manage four hospitals providing health services to their employees and dependents. These are managed by the Ministry of Defense, the Royal Oman Police, Petroleum Development Oman, and Sultan Qaboos University (SQU). The latter is a leading health entity in teaching and research and acts as a national referral hospital as well, accepting complicated cases nationally. The government is not the only source of health services in the nation. In addition to the government health services, four private hospitals are in operation, two in the Governorate of Muscat and two in the Governorate of Dhofar. Also, there are 384 private general practitioner clinics and 271 private specialized clinics in the Sultanate (Ministry of Health, 2006a).

The health institutions run by MOH are classified into two main groups: hospitals and health centers. Both groups contain subcategories of facilities. The first group is further classified into three categories based on the level of health care provided. The first subcategory of hospitals refers to regional hospitals. These provide secondary and tertiary care and act as national referral hospitals for critical cases stemming from other health institutes. The second subcategory is the Wilayat (similar to county in U.S.A.) hospital, which provides primary and secondary health care to the inhabitants of the Wilayat in which it is located and the Wilayats within the vicinity. The third subcategory includes the local hospitals. These are small hospitals that provide primary health services to the inhabitants of villages surrounding the facilities. Additionally, these

hospitals provide limited inpatient services for individuals requiring ongoing medical care. The second group, health centers, is subcategorized into three groups as well. The first group is labeled as health centers, and these provide PHC for the population surrounding the centers. The second type includes health centers with beds. In addition to providing delivery and/or observational health care, these provide similar services to the first type of health center. The third group is made up of extended health centers. They offer primary care and some specialized outpatient services (Ministry of Health, 2006b).

The Epidemic Burden of Diabetes

Global Prevalence of Diabetes

As stated earlier, the number of diabetes cases in the world is mounting. In 1985, 30 million people were estimated to have diabetes. The number reached 130 million in 1995, which represented a more than four-fold increase over ten years (IDF, 2003); then, it jumped to 171 million in 2002 (WHO, 2003). Currently in 2007, 246 million adults are estimated to have diabetes worldwide. Future projection of the epidemic of diabetes is high, 380 million in 2025 (IDF, 2007).

Prevalence of Diabetes in the United States of America

In the USA, the prevalence of diagnosed diabetes, all types included, was estimated to be around 5.8 million adults (≥ 20 years) in 1980, and the figure increased to about 13 million in 2002 (Centers for Disease Control and Prevention [CDCP], 2005). Taking into account the estimated number of people with undiagnosed diabetes (5.2

million), combined with those who have diagnosed diabetes, this number increased to 18.2 million persons exposing a prevalence of 6.3% of diabetes found among adults aged ≥ 20 years in 2002 (Centers for Disease Control and Prevention, 2003a, 2003b). In 2005, the number of people affected with the disease increased to 15.8 million (CDCP, 2005). In the Arab-American community in Detroit, Michigan, 33% of 105 adult volunteers were reported to have Non-insulin Dependent Diabetes Mellitus (NIDDM) and 8.6% were documented to have IGT by means of the Oral Glucose Tolerance Test (OGTT) (Jaber, Slaughter, & Grunberger, 1995).

The Burden of Diabetes in Oman

Following these world trends reflected in the statistics concerning diabetes in the world and the USA, Oman is facing the challenge of an increasing rate of diabetes among its population. Such a non-communicable disease imposes a great strain on the national economy which adversely affects the development of the country (IDF, 2003). Before 1990, there was no estimate of the prevalence of diabetes in Oman. Further, there were no standard criteria for the diagnoses of diabetes in practice. In 1990, on an ad hoc basis, a WHO committee finally attempted to estimate the rate of growth of this disease in Oman by studying routine health statistics and admission and discharge records from 1988 and 1989. The national rate of new cases of diabetes in 1988 was estimated at 4.8/1000 population.

In Muscat, the capital city, the rate was estimated at 13.4/1000 population for the same year, which was highest rate in the nation. In 1989, the Royal Hospital, a central referral facility in Muscat, had a 61% increase in its discharge rate of diabetes patients

over the rate in 1988. In that facility, diabetes was associated with about 9% of all adult admissions and 12% of bed occupancy. Additionally, 20 - 30% of all outpatient treatment in other district hospitals was linked to diabetes. Overall, the incidence of diabetes was shown to be high by international standards. This led WHO consultants to conclude that the profile of the disease in Oman was similar to that of Western countries. The committee recommended that resources be allotted to epidemiological research, professional, patient, and community education, and the use of standard criteria in diagnosing and monitoring diabetes (Asfour et al., 1991).

In 1991, following the WHO report, initiatives were taken to evaluate the incidence of diabetes in Oman systematically using a NDS. The survey employed the 1985 WHO criterion for diagnosing diabetes using the OGTT and included adults ($\geq$ 20 years) from all regions of the country (n = 5,096). Among the various regions, the prevalence of the disease ranged from 7% to 13% for diabetes and 8% to14% for IGT. There was a positive relationship between adjusted age and the prevalence of both diabetes and IGT in both genders. The findings of the NDS in 1991 initiated the implementation of a national diabetes control program in Oman. The program focused on appointing medical officers responsible for monitoring non-communicable diseases in regional referral hospitals, developing detailed patient education materials, establishing a central diabetes registry, and conducting public awareness campaigns (Asfour et al., 1995).

With increased concern about priority health issues, the NHS was carried out in 2000 to reassess the trend of increased cases of diabetes in the nation. The survey employed the 1999 WHO criteria for Fasting Plasma Glucose (FPG) and included adult

subjects (≥ 20 years) from all ten health regions across the nation (n = 5838). Across regions, the prevalence of diabetes ranged from 8% to 18%, and the prevalence of IFG ranged from 2% to 8% of all cases. The highest prevalence percentage (26%) of diabetes and IFG combined was found to be in Muscat, the national capital. Incidences of diabetes (11.8%) and IFG (11%) were reported to be higher in cities than in rural areas; and age was found to have a linear association with the rates of diabetes (Al-Lawati et al., 2002).

Tracking new cases of diabetes has become more feasible in Oman since the implementation of the diabetes registry after the findings of the NDS 1991. By the end of 2001, there were 27,432 people documented in the diabetes registry. For 2001 alone, there were 3,384 new cases of Type 2 diabetes of which 70% were 25 - 59 years old. This is, presumably, the most productive age group. Two regions had the highest incidences of Type 2 diabetes in 2001, Al Batinah with 1,025 people followed by Muscat with 769 individuals (Ministry of Health, 2002). By the end of 2005, the number of people registered with diabetes reached 48,972. In 2005 alone, there were 4,862 new cases of diabetes listed nationally, of which only 152 people were distinguished as having Type 1 diabetes while the rest were classified as having Type 2 diabetes. Of those with Type 2 diabetes, 180 patients were prescribed insulin therapy; 1,150 people were put on diet management; and 3,380 patients were prescribed Oral Hypoglycemic Agents (OHA) for diabetes management. The Muscat region had an incidence level of 1,077 new cases in 2005 (Ministry of Health, 2006a). This rapid increase in the prevalence of diabetes in Oman over a five-year period is alarming. Comparing registered cases of diabetes in

2005 to those documented almost five years before in 2001 showed a 78.5% increase in the number of people with diabetes.

Diabetes Risk Factors in Oman

As mentioned earlier, a number of factors have been found to be predictors for diabetes. With the increase in diabetes cases in Oman, it was essential to identify the specific risk factors that are causing the increase. Analysis of the 1991 NDS revealed several factors associated with the increased prevalence of diabetes in the country. Increased Body Mass Index (BMI) was found to be significantly related to the risk of diabetes after controlling for confounding factors: age, gender, physical activity, blood pressure, and family history. When BMI was controlled as a confounding variable in addition to the preceding factors, Waist-to-hip Ratio (WHR) and waist circumference were also positively associated with increased risk for Type 2 diabetes (Al-Asfoor, Al-Lawati, & Mohammed, 1999).

A very recent study indicates a high incidence of metabolic syndrome in Nizwa, a city in the Interior region in Oman. Among adults ($\geq$ 20 years), 21% (n = 1,419) were reported to have metabolic syndrome, based on the clinical definition of the Adult Treatment Panel III (ATP III) of North America (Lipsy, 2003). Females had a higher age-adjusted prevalence of metabolic syndrome than males, showing 23% and 19.5% respectively. The metabolic syndrome was largely characterized by low High Density Lipoprotein (HDL) (75.4%) followed by central obesity (24.6%). The latter, was more prominent in females (44.3%) than in males (4.7%). An increased trend of metabolic

syndrome is associated with increased incidence of non-communicable diseases including diabetes (Al-Lawati, Mohammed, Al-Hinai, & Jousilahti, 2003).

The prevalence of overweight and obesity has increased in Oman based on a study of a 10-year secular trend of obesity. In 1991, the prevalence of overweight (BMI: 25 – 29.9 kg/m^2) was 28% and that for obesity (BMI $\geq$ 30 kg/m^2) was 19% in a study sample of 5,086 adult Omanis ($\geq$ 20 years). In 2000, of 6,400 adult individuals ($\geq$ 20 years), 30.4% were found to be overweight, and 20.5% were identified as obese. The study shows that the average BMI among Omani men significantly increased from 24.3 kg/m^2 to 25.2 kg/m^2 over a ten year period, 1991- 2000. On the other hand, the mean BMI for females decreased from 26.3 kg/m^2 to 25.8 kg/m^2 in the same period. With such secular trends of overweight and obesity, increased incidences of metabolic complications and non-communicable diseases are bound to be observed (Al-Lawati & Jousilahti, 2004).

In summary, the NHS 2000 indicated that the incidence of diabetes has increased in Oman when compared to the results of the NDS 1991. BMI measures $\geq$ 25 kg/m^2 and IFG were found to be high among the total sample (5,838), 47% and 6.1%, respectively (Al-Lawati et al., 2002). In addition, a high prevalence of metabolic syndrome (21%, n=1,419) was reported among Omani subjects (Al-Lawati et al., 2003). Clearly, the anthropometric and metabolic trends observed suggest that there will be an increased subsequent development of Type 2 diabetes and that the disease will continue to be a major health problem.

Cost of Diabetes

With the high incidence rate of this disease and the multitude of complications it can lead to, diabetes contributes to the increasing cost of health care in many countries. As an indirect cost, WHO reported that one in every 20 deaths worldwide is attributed to diabetes. Furthermore, the direct cost of diabetes ranges from 2.5% to 15% of the annual health care budget while the indirect cost could be five times higher (WHO, 2003). In 2002, the total national cost of diabetes in the USA was estimated to be US $132 billion. Of the total cost, US $92 billion was direct medical costs, of which 41% was due to the cost of inpatient care: in-hospital care and nursing homes. US $40 billion was estimated as an indirect cost due to disability, work loss, and premature mortality linked to diabetes. The American Diabetes Association reported that the health care expenditure in 2002 for people with diabetes was more than double what the spending would have been without diabetes. Moreover, projection of the future cost of diabetes in the USA is high. It is projected that the national cost of diabetes in 2020 could reach US $192 billion with US $138 billion being the direct medical cost and US $54 billion being the indirect cost (Hogan et al., 2003).

In Oman, diabetes continues to impose a great economic burden on the health care system since its prevalence was first estimated by WHO experts in 1990. Although there is no published report on the current cost of diabetes in Oman, some statistics relevant to diabetes provide a clue and reflect on the cost of the disease. In 1989, 9% of adult hospital admissions and 12% of adult hospital bed occupancy in the Royal Hospital were attributed to diabetes. In other district hospitals, 20 to 30% of outpatient clinic visits were of people with diabetes (Asfour et al., 1991). In 2001, inpatient morbidity due to

diabetes was reported to be 3,796 cases of which 560 cases were reported in the capital city, Muscat; the majority of these subjects > 45 years (Ministry of Health, 2002). By the end of 2005, patients on dialysis were reported to have received an average of 12 dialysis sessions per patient per month (Ministry of Health, 2006a). This data indirectly reflects a high cost of diabetes in the nation which could provide valuable information when studied properly. With the increased prevalence of diabetes, the costs associated with it are expected to rise.

Diabetes Management and the Role of Professionals in Primary Health Care in Oman

In an effort to contain the epidemic of diabetes, MOH has adopted a "National Diabetes Prevention and Control Program." To reach a large population, the ministry has reengineered the structure of its primary health care system. Currently, there are primary health care centers where non-complicated follow-up cases of diabetes are monitored on a regular basis. Diabetes management guidelines are provided to health professionals, particularly general practitioners, at these centers in a printed manual called "Diabetes Miletus Management Guidelines" (DMMG) (Ministry of Health, 2003). The manual outlines decisional path processes for managing diabetes in primary care situations. Currently, the Sultanate puts into practice the 1999 WHO criteria in setting guidelines for diabetes diagnosis in the DMMG (WHO, 1999).

The DMMG specifies the responsibilities of health care professionals associated with diabetes care in PHC. Team members include physicians, nurses, dieticians/diet technicians and health educators. Doctors are encouraged to contribute educational activities geared towards patients and communities. Nurses are encouraged to provide

essential education for patients and to reinforce the education with educational materials. Dieticians/diet technicians are encouraged to "arrange" consultations of patients by coordinating with the nurses. In addition, dieticians/diet technicians have to provide "basic" dietary education to patients referred to them, document their recommendations in nutrition records, educate patients on how to deal with hypoglycemia, and provide dietary educational materials to patients. Health educators are encouraged to collaborate with physicians, nurses and dieticians/diet technicians to create essential education about diabetes and its complications, to educate the public or patients about diabetes care in emergencies, to provide educational materials that reinforce verbal messages, and to document findings in "records" (Ministry of Health, 2003).

Once diabetes mellitus is diagnosed in an individual, the process of documenting the person in the diabetes registry is initiated by a physician in conjunction with a nurse. In the course of this process, (a) patients' demographic information and medical histories are taken, (b) a series of physical assessment are carried out by the doctor, (c) a series of lab investigations are assessed for baseline data, (d) a treatment plan is discussed with patients, (e) and patients are given appropriate referrals for comprehensive management. Referrals include those to dieticians/diet technicians and/or health educators, ophthalmologists, and/or regional dialectologists when the case is presented with co-morbidities. Once a patient is registered in the diabetic registry, a person is given a diabetes/hypertension care booklet to keep and present to health professionals when visiting any health care facility (Ministry of Health, 2003).

Frequency of patient follow-up appointments or activities is not rigid. The interval between visits varies on an individual basis depending on how fast reasonable

metabolic control is achieved. In instances where patients are initiated with insulin therapy or when the insulin treatment plan is changed, the patient may be seen daily to achieve a desired level of control of glycemia. Patients started on diet and/or OHA are seen less often once a treatment plan is initiated, compared to those who are put on insulin therapy. Those on insulin are seen every week, every 2 weeks, or monthly at the beginning of the treatment plan. Once reasonable glycemia control is achieved, follow-up visits are tapered to every two months or every three months for all treatment plans, insulin, diet or OHA (Ministry of Health, 2003).

Annually, patients undergo comprehensive examinations with their physicians who evaluate the treatment plans and any co-morbidities and complications in depth. In addition to the routine physical assessments such as blood pressure and fasting blood glucose etc., the physicians also assess HbA1c, microalbuminuria, for patients with type 2 diabetes; fasting lipids profile (total cholesterol, LDL, HDL, Triglycerides [TG]); and ECG (Ministry of Health, 2003).

Treatment of all types of diabetes includes multiple aspects: education, nutrition, weight management, cessation of smoking, oral hypoglycemic drugs, insulin and aspirin therapy. As for nutrition and weight management, the DMMG for PHC lists recommendations on dietary intakes in general terms with very limited explanation and practical examples. The following represents the dietary intake recommendations listed in the DMMG available to health professionals in PHC services:

A. Carbohydrates should comprise 50-55% of daily caloric requirements, of which 85% is to be taken from starchy foods (complex carbohydrates) and only 10-15% is to be selected from simple carbohydrates.

B. Fat intake should account for less than 30% of the daily caloric requirement with < 10% being saturated, 10% being polyunsaturated, and 10% coming from monounsaturated fats. Cholesterol intake should not exceed 300 mg/day.

C. Proteins are recommended to comprise 10-15% of daily caloric needs. Based on body weight, adults are recommended to consume 0.8 g/kg/day of protein and people with nephropathy are recommended to consume 0.6-0.8 g/kg/day of protein (Ministry of Health, 2003).

Additional recommendations included in the manual are to advise people with diabetes to eat small meals consistently and regularly and to eat starchy food at every meal. Professionals are recommended to advise patients to cut down on and/or avoid sugar and sugary foods. Intake of one teaspoon of honey with starchy foods is allowed, preferably after meals. Five servings a day, about 400-500 gm, of fruits and vegetables are recommended. Serving sizes of example fruits and vegetables are provided in units including slices and weight in grams, such as one orange, one slice of melon, one small bowl (100 gm) salad, etc. It is advised that the intake of fat and fatty food be cut down by encouraging consumption of lean meats, baked foods, chicken from which the skin is removed prior to cooking, and margarine rather than butter. It is recommended that salt intake be < 5 g/day (1 teaspoon) (Ministry of Health, 2003).

Activity guidelines are provided for health professionals in the DMMG as well. Professionals are advised to encourage patients to start exercising gradually. However, walking 30 minutes/day five times or more per week is the only exercise referenced in the guidelines. It is recommended that the duration of exercise be gradually increased

over a six to eight week period. Additional recommendations are listed pertaining to hydration, glycemia, footwear, and medication (Ministry of Health, 2003).

Dietary and physical activity guidelines listed in the DMMG are basic and open to different interpretations. Not all of the examples of proper amounts of fruits and vegetables are clear as the size of one unit of orange or any other fruit varies with cultivars. What might count as a small bowl in one household might not be the same in another, and the use of units such as grams and milliliters is not comprehended by many people. Furthermore, the addition of terms such as *large* to tablespoons confuses the reader as it implies a size of tablespoon that is not exact or well known while a tablespoon is a standard household measure and is more easily comprehended.

Current Practices in the Management of Type 2 Diabetes

Diabetes Health Care Teams

Managing diabetes is a multidimensional process involving screening and diagnosis, education, psychological care, lifestyle management, clinical monitoring of relevant physical and clinical examinations, and laboratory work that requires a multidisciplinary team to achieve comprehensive care. The ADA recommends that diabetes health care teams should include, but should not be limited to, doctors, nurses, dietitians, pharmacists, and diabetes related mental health professionals (American Diabetes Association [ADA], 2003).

Many health systems have reengineered primary health care settings to achieve optimal quality of care for people with diabetes since the illness has reached an epidemic level, and this compounds great fiscal burdens on national budgets. Practice guidelines

have been devised and provided to health care teams as baselines from which to work (Haase & Russell, 2006). However, many nations lack national guidelines for diabetes care due to a lack of resources and/or expertise in devising such guidelines in an era that is marked by a large diversity of clinical practices. To help overcome this dilemma, the IDF in conjunction with WHO compiled evidence from research and provides global guidelines for managing all aspects of Type 2 diabetes (IDF, 2005).

Patient education concerning diabetes and lifestyle management, changing diet patterns and implementing physical activities as desirable habits, is the most important aspect of diabetes management. It is recommended that this education be provided to all diabetes patients, as data has shown that patients need information to empower them with understanding so as to control their condition and to prevent or delay the onset of debilitating complications (Anthony, Odgers, & Kelly, 2004; IDF, 2005). The education should be provided by professionals trained in diabetes education (Anthony et al., 2004; Conlon, 2001). Further, the IDF recommends that either dietitians/nutritionists or health professionals trained in nutrition should provide nutrition counseling to people diagnosed with diabetes (IDF, 2005).

In an ideal world, a trained dietitian would be the most appropriate one to deliver nutritional care (Bantle et al., 2006). However, lifestyle management education (diet and physical activity) is commonly provided by general physicians and nurses for different reasons, among various groups (Dyson, 2002; Olivarius, Palmvig, Andreasen, Thorgersen, & Hundrup, 2005). Regardless of who is involved in nutrition counseling, it is important that all members of the health care team provide consistent advice. Therefore, it is essential that all members associated with providing nutrition counseling

be knowledgeable and reasonably trained (Bantle et al., 2006). A trained dietitian is the most ideal option to provide educational material and training to other health professionals in empowering them to use their abilities and skills in the area and to ensure consistency and adequate quality of nutritional advice (Dyson, 2002).

Metabolic Control in Type 2 Diabetes

Diabetes metabolic control is characterized by maintaining blood glucose levels that are near normal or similar to the patterns seen in people without diabetes (Larsen, 1997). Plasma or serum glucose is relatively easy to quantify, and so is used to reflect the status of diabetes control over a short term. Glycated or glycosylated hemoglobin (HbA1c) on the other hand reflects the average status of diabetes control for up to 120 days or the lifespan of red blood cells. HbA1c is also used as a reference measure to assess the risk of the development of diabetes complications (Goldstein et al., 2004; Manley, 2003). The significance of HbA1c in diabetes monitoring is largely based on the United Kingdom Prospective Diabetes Study (UKPDS) in Type 2 diabetes. The UKPDS showed that every 1% reduction of HbA1c was significantly associated with a 21% reduction of the risk of death due to causes related to diabetes, a 14% decline in the risk of myocardial infarction, and a 37% decrease in the risk of developing microvascular complications (Stratton et al., 2000). In a positional statement, the American Diabetes Association recommends that patients control their glycemia to achieve HbA1c levels that are below 7% to prevent or delay the development of adverse complications of diabetes (ADA, 2003).

Medical Nutrition Therapy

"Medical Nutrition Therapy" (MNT) is a relatively new concept that was introduced in 1994 by American Diabetes Association to outline an effective process of nutrition therapy (American Diabetes Association, 1994). The process guidelines for MNT entail (1) assessing the knowledge and the skills of patients in nutrition and diabetes self-management, (2) identifying and setting nutrition goals for and with patients, (3) individualizing easy-to-apply meal-planning approaches and educational materials to meet patients' needs, (4) documenting in medical records and communicating the particular attempt at nutrition care selected to other members of the health care team, and (5) monitoring and evaluating outcomes of the care plan on a regular basis (Geil & Leonto, 2004).

The importance and effectiveness of MNT has been strongly supported by trials with people with Type 2 diabetes, and it has been much acknowledged that it makes a significant difference (Pastors, Warshaw, Daly, Franz, & Kulkarni, 2002). In a randomized control trial, the UKPDS group reported that HbA1c levels decreased by an average of 1.9% among 2,500 newly diagnosed patients with Type 2 diabetes when given intensive nutrition therapy over three months (United Kingdom Prospective Diabetes Study Group, 1990). Also, in a case-control study, HbA1c significantly decreased by 1.3% in case adults (n= 97) when the group was provided with a multidisciplinary team care that included a registered dietitian who provided MNT. In comparison, HbA1c only decreased by 0.2% in the control subjects (n= 88) who were not provided with MNT (Sadur et al., 1999). A systematic review of 72 randomized controlled trials revealed that self-management training in Type 2 diabetes resulted in improved glycemic control,

dietary intake and knowledge (Norris, Engelgau, & Narayan, 2001). Most recently, a meta-analysis of 18 randomized educational and behavioral trials of Type 2 diabetes showed that HbA1c was modestly, but significant ($p = 0.003$), reduced by an average of 0.43% (Gary et al., 2003).

The end goal of MNT is to assist individuals with diabetes in adapting changes in nutritional and exercise behaviors (Paul, 2002) that achieve optimal reduced glycemia (metabolic control), and in turn, prevent or slow the progress of diabetes complications (Bantle et al., 2006; Franz et al., 2003; Paul, 2002). Optimal metabolic control is achieved by helping patients address and achieve four main objectives: (1) attaining and sustaining a normal or near normal blood glucose, blood pressure, and lipid profile, (2) modifying dietary intake and lifestyle behaviors, (3) providing adequate nutritional needs that address cultural preferences and readiness to change (Bantle et al., 2006; Dyson, 2002; Franz et al., 2003), and (4) maintaining the pleasure of eating as long as there is no scientific evidence to limit food choices (Bantle et al., 2006).

To achieve the aforementioned objectives of MNT, the American Diabetes Association has been providing dietary guidelines that are revisited and updated regularly based on scientific evidence. The ADA recommends that people with diabetes eat regular meals and snacks if they have a BMI within the normal range (18.5 – 24.9 kg/m^2). Experts at the American Diabetes Association recommend that 60 – 70% of the daily caloric requirement be taken from carbohydrates and monounsaturated fats (Franz et al., 2004). Carbohydrates should not be consumed at a rate less than the average minimum Recommended Dietary Allowance (RDA) of 130 g/day. Also, individuals with diabetes are encouraged to select foods that are rich in fiber, usually $\geq$ 5 g fiber/serving (Bantle et

al., 2006). As long as the renal function is normal, protein needs for people with diabetes are the same as the general public, which is 15 – 20% of the daily caloric needs. Saturated fats should constitute less than 10% of the daily caloric intake, and cholesterol intake should be less than 300 mg/day (Franz et al., 2004). The last two elements have been changed recently to restrict intake of saturated fats to less than 7% and cholesterol to less than 200 mg/day (Bantle et al., 2006). If patients choose to consume alcohol, it should be taken with food and limited to one or less drinks/day for an adult female and two or less drinks/day for an adult male (Franz et al., 2004). Because overweight and obesity are very much linked to diabetes, the American Diabetes Association addresses these problems and provides pertinent recommendations. Further, structured programs emphasizing lifestyle changes are recommended. Such programs should include education, fat and total energy control, regular exercising, and periodic patient follow-up that, collectively, could generate long-term weight loss (Franz et al., 2004).

Physical Activity

Physical activity is a lifestyle component that works hand in hand with dietary management to attain metabolic control and hence to control the risk for diabetes complications (IDF, 2005). In its 2004 positional statement, the American Diabetes Association endorsed the importance of physical activity in boosting well-being, improving blood glucose regulation, reducing risk factors for cardiovascular complications, and maintaining weight loss (Franz et al., 2004). Besides these benefits for people with diabetes, regular exercise has been shown to benefit people in the pre-

diabetes stage because it improves insulin resistance and hence prevents or delays the onset of diabetes (ADA, 2003; Franz et al., 2004; Pastors et al., 2002).

In a randomized controlled trial, the Finnish Diabetes Prevention Study (DPS), an intervention group was provided with individualized dietary and physical activity counseling while a control group of similar subjects was not. All subjects were overweight (BMI > 25 kg/m^2) and had IGT. Significant decreases in several outcomes were reported. The intervention group had lost 4.6 kg at a one year follow-up exam while the control group had lost just 0.9 kg. Also, significant decreases in 2-hour OGTT, fasting and 2-hour insulin levels, TG and BP were seen in the intervention subjects as compared to the control subjects (Uusitupa et al., 2000). In follow-up studies of the Finnish DPS, subjects who had increased their physical activity level were found to be 63% to 65% less likely to develop diabetes. These findings led to the conclusion that lifestyle change can delay or prevent Type 2 diabetes (Hu et al., 2004; Laaksonen et al., 2005).

Meal Planning Approaches in Nutrition Education

Standardized meal plans do not work as well for or fit all people. Diabetes is a chronic condition, and thus, diabetes nutrition management is a lifetime process that needs to be individualized (Gehling, 2001). For this reason, meal planning needs to be flexible in order for it to be suitable for different people with different lifestyles, cultural backgrounds, and personal needs. Flexibility in teaching nutrition education means having access to a range of teaching tools and using multiple teaching approaches to apply these tools (Paul, 2002). Adherence to nutritional advice may increase when traditional foods and cultural dietary traditions are reflected in the educational messages

(Rezabek, 2001). In addition, it is highly recommended that nutrition messages be easy to understand (Pastors, 2003).

Preset diets are no longer in use; consistent-carbohydrate meal planning is the most acceptable approach to diabetes dietary management, currently. This strategy focuses on providing consistent amounts of carbohydrates in every meal, every day. Such an approach helps to regulate blood glucose levels and allows room for freedom of food selection based on preferences, eating habits, and customs (American Diabetes Association [ADA], 2000).

Several meal planning strategies and printed educational materials are available to aid people with Type 2 diabetes in achieving necessary lifestyle changes (Gehling, 2001; Rezabek, 2001). The level of complexity in application varies among the various approaches available. Two among many approaches that are widely used in the U.S. are the Idaho Plate Method and the Diabetes Food Pyramid (DFP) (Gehling, 2001). These two methods have been indicated to be helpful in assisting patients to identify and categorize high carbohydrate foods easily (Rizor & Richards, 2000) since consistent-carbohydrate meal planning is the recommended approach (ADA, 2000).

The Idaho Plate Method is an adaptation of the Swedish approach in meal planning called the "Plate Model" which is commonly used in Europe (Idaho Plate Method, 2005). The "Plate Model" is a visual instructional tool that allows the promotion of healthy meal patterns (Camelon et al., 1998), and it is suitable for adult learners, as visual messages have been shown to be very effective for adults (Kicklighter, 1991). It is a simple strategy based on a pictorial presentation of a centerpiece consisting of a plate, nine inches in diameter, which provides a vision of the type and the amount of

foods that should cover different segments of the plate. On paper, this centerpiece is represented as a pie chart divided into three sections to present the proportion of various food groups that are to cover the plate eliminating the need to measure or weigh foods (Camelon et al., 1998; Gehling, 2001). In this way, the pie chart acts as a blue print for patients to aid them in getting the suitable amounts of different foods regardless of traditional cuisines and food preferences. To one side of the plate, there is a cup to depict beverages or other foods such as ice creams and custards, which could be measured with cups. To the other side of the visual, there is a side dish to reflect fruits or snacks (Camelon et al., 1998). The simplicity of the plate model made the Idaho Plate Method the simplest approach in meal planning in comparison to other methods such as "Calorie/Fat Counting" and the "Diabetes Food Pyramid" among others (Gehling, 2001).

Furthermore, the model helps in teaching appropriate portion sizes because it is readily available. The visual presentation of the segments in the plate model forces people to think about proper proportions or portion sizes. The model could also be used in conjunction with household measures and other visual cues to provide additional aid in controlling portion sizes (Camelon et al., 1998; Rizor & Richards, 2000). In the United Kingdom, the Plate Model is highly recommended for encouraging people with diabetes to change eating behaviors, as diet is seen as the cornerstone for managing diabetes by achieving normal or near-normal blood glucose levels (Pennock, 2005).

Another method used in nutrition education is the DFP. It is a meal planning approach presented as a visual tool that provides a concept of food grouping and proportionality of foods from different groups (Paul, 2002). It was designed by the American Diabetes Association based on modifications of the United States Department

of Agriculture's (USDA) Food Guide Pyramid (Rezabek, 2001) to aid in teaching basic diabetes meal planning (Paul, 2002). In this model, foods are classified into six groups based on their carbohydrate and protein contents. It provides the recommended numbers of servings from five food groups based on specific ranges to accommodate diabetes goals, nutritional needs, and lifestyles (American Diabetes Association [ADA], 2005). Rizor and Richards (2000) indicate that the DFP is a helpful tool used in aiding patients to identify high-carbohydrate foods. The DFP was ranked third in its simplicity as a meal planning approach for people with diabetes (Gehling, 2001). As of April 2005, the USDA has replaced its Food Guide Pyramid with a new pyramid called "My Pyramid." This incorporates a physical-activity component into the pyramid with a new look to encourage exercise and to emphasize its role in preventing lifestyle-related diseases. Nevertheless, the American Diabetes Association only praised the release of "My Pyramid" but has not changed the DFP accordingly. It continues to post the DFP on the world wide web site to this date with its commentary on the new release and reemphasis on individualized meal planning for people with diabetes (ADA, 2005).

In addition to the above two approaches in meal planning, visual cues are helpful in assisting patients to visualize and estimate portion sizes in order to consume the desired amounts of foods. These provide reference points for comparison (Rizor & Richards, 2000). Having good reference points for portion sizes play a major role in estimating the amount of food to be eaten so as to avoid overeating, thus controlling weight and blood glucose levels (Rizor & Richards, 2000; Wang & Chan, 2005). Examples of visual references are the hand and the nine-inch plate (Rizor & Richards, 2000).

Nutrition Education and Metabolic Control

It has been recognized that most people with Type 2 diabetes do not make lifestyle changes for two reasons. First, they do not understand the link between the recommended changes and their health. Second, they do not make changes because of the difficulty of following guidelines that do not fit into their daily lifestyles (Cava & Cradock, 2004). Hence there have been several agencies such as IDF (2005), the National Institute for Clinical Excellence (NICE) (Cava & Cradock, 2004), and ADA (ADA, 2003; Franz et al., 2004) that have published standards and guidelines for educating patients in support of structured lifestyle education programs for individuals with diabetes, without preference for any specific educational model (Cava & Cradock, 2004).

A primary objective of educational programs for diabetes patients is to equip and empower patients with the right knowledge and skills proven to be necessary for effective day-to-day diabetes self-management. Therefore, since self-management is the patients' responsibility, patient education should be a major component in diabetes care (Anthony et al., 2004). Renders (2003) showed that incorporating structured patient education in diabetes care settings resulted in lower HbA1c levels that were noticeable for three and a half years compared to those results taken from settings that did not have the patient-education component. Also, Panja, Starr, and Colleran (2005) found that awareness of Type 2 diabetes patients was related to their metabolic control. When patients (n = 77) were given the Michigan Diabetes Knowledge Test (DKT), an inverse correlation was found between the number of correct answers their HbA1c ($r = -.33$; $p < .003$). This

finding implied that the more patients were educated concerning their condition, the more likely they were to take action in self-management.

The effect of structured education in diabetes management has been revealed in the professional literature. In one study, when patients were given a brief individualized self-management education, positive outcomes were observed. Compared to a control group, the percentage of calories from fat and serum cholesterol were significantly lower in the briefly-educated intervention group. Calories from fat decreased from 33.8% at baseline to 30.5% ($p = 0.023$) at 12-month follow-up; and calories from saturated fat dropped from 11.2% to 9.7% ($p = 0.003$). Serum cholesterol also decreased from 217 mg/dl to 208 mg/dl ($p = 0.002$) compared to the control group that showed increased serum cholesterol at the time of a 12-month follow-up session. The brief intervention included the use of a touch-screen dietary barriers assessment, encouragement of patient-centered goal setting, and problem-solving and dietary self-help materials (Glasgow et al., 1997).

Also, Ridgeway et al. (1999) showed a significant improvement in knowledge and metabolic control in patients with diabetes in a case-control study at a primary care setting, provided by a team consisting of a nurse and a dietitian. Intervention subjects were give instructions on diabetes treatment, and consequences with a high emphasis placed on individualized diets and exercise plans. At a six month follow-up, the mean knowledge score of the intervention group jumped to 85.7 compared to 74.2 at baseline. Metabolic control also significantly improved in the intervention group. At the six month follow-up the mean value for fasting blood glucose dropped from 215 mg/dl to 180 mg/dl ($p = 0.024$); the mean HbA1c dropped from 12.28 to 10.21% ($p = 0.003$); and the total

cholesterol decreased from 259 mg/dl to 221 mg/dl ($p = 0.012$); and LDL decreased from 133 mf/dl to 113 mg/dl ($p = 0.03$).

The relevance of diabetes educational programs to culture of the target audience is important for the education to have meaning and applicability among individuals (Brown, Duchin, & Villagomez, 1992; Wang & Chan, 2005). In a Chinese/American-specific diabetes education program, 33 individuals took part in a ten class program (one class/week) that provided counseling in diet, exercise, medication, and self-care, and they all expressed satisfaction with the tailored program. A large percentage of the participants (70 – 90%) demonstrated knowledge improvement concerning different aspects of diabetes management between the pre-test and post-test. Compared to baseline measures, the BMI was reduced in 42% of the subjects upon completion, and 24% of the participants had reached a BMI $\leq$23 kg/m^2 at the three month post-education follow-up. Also, the mean HbA1c decreased from 7.11% ± 1.1 at baseline to 6.12% ± 2.4 at 3-month follow-up (Wang & Chan, 2005).

In an African-American population with Type 2 diabetes, an experimental group was guided and supported to lose weight and to improve their metabolic profile. Participants were given dietary instructions based on the concepts of the DFP. Six months post intervention, two significant outcomes were observed. First, the experimental group had lost four pounds while the control group had gained 4.2 lb which was a significant difference. Second, the experimental group had significantly decreased their high-fat dietary habits to moderate-fat habits while the control group continued to maintain high-fat habits (Anderson-Loftin & Moneyham, 2000).

In a group of Mexican-American patients with Type 2 diabetes, a 15-minute culturally-appropriate video tape was pilot tested. The results of its effectiveness were shown to be positive on knowledge scores. The tape emphasized the possibility of controlling diabetes and was presented to an intervention group. Compared to a control group, the intervention group had higher scores on a knowledge test, which was hoped to motivate the group to better control diabetes (Brown et al., 1992).

Nutrition Education: Needs Assessment

Assessing the needs of the target population is an essential component that should take place if development of sound education materials and programs is desired. Needs assessment identifies weaknesses that a target audience might have which could include insufficient knowledge, misconceptions, beliefs, barriers, or low self-efficacy. Moreover, it provides grounds for planning, developing and evaluating educational efforts (Ward & Macfarlane, 1993).

Methods and approaches for evaluating educational needs vary depending on the area of concern and any matters relevant to research. Both quantitative and qualitative methods have been used to investigate the need for health education. Quantitative questionnaires have been successfully used to evaluate the needs of general physicians about their informational needs in educating patients about skin cancer. The assessment identified gaps in knowledge, differences in perception about skin surveillance, and the need for practical information, all of which were taken into account in planning for a one-day seminar for the general physicians (Ward & Macfarlane, 1993). Recently, a questionnaire was used to identify physicians' needs for information based on their

patients' nutrition inquiries. Doctors indicated the need for more information about obesity, lifestyle and disease-specific diets among others (Mihalynuk, Knopp, Scott, & Coombs, 2004).

Abdullah, Margolis, and Townsend (2001) assessed the needs for diabetes education by applying the Michigan DKT to assess knowledge among diabetic individuals (n = 300) in the United Arab Emirates (UAE). In addition, patients were given educational sources to rate based on their perceived usefulness of those sources. The study sample was reported to have a low mean knowledge score that was < 50%. Patients in this study responded to the survey by means of an interview due to the high prevalence of illiteracy (57%) among the subjects. Of all participants, only 38% reported to have had diabetes education in the past. Interestingly, the authors reported that 36%, 31%, and 28% of patients viewed written materials, nurses, and doctors, respectively, as the most effective and useful sources for diabetes education.

The need to use qualitative approaches in assessing nutrition education needs is strongly emphasized (Achterberg, 1988). Qualitative methods provide detailed insight in tailoring education or modifying any educational program or materials to the needs of the audience (Achterberg, 1988, 1994; Sims, 1987). Qualitative research focuses on gaining holistic understanding based on contextually detailed data (Mason, 1996) coming from numerous sources "consisting of detailed descriptions of situations, events, people, interactions and observed behaviors" (Patton, 1980). In addition to the advantage of qualitative research in creating programs and materials, there are many justifications for the need to use qualitative measurements. The absence of a valid and reliable quantitative

measure that is acceptable and appropriate for different situations is only one of the many reasons for selecting qualitative measures (Patton, 1980).

Qualitative research is flexible with no unified techniques, and there are no blueprints to follow in doing such research. Some might use focus group interviews while others might use one-on-one interviews that could be either face to face or via telephone (Mason, 1996). These methods are all useful either in designing new intervention programs or in reviewing and evaluating existing programs to capture the perspective of target groups and to develop strategies that are sensitive to their unique needs. In Los Angeles, focus groups with older African American and Latinos revealed cultural and age needs of the groups that were thought to be important in making cultural and age-specific changes to a self-care empowerment program (Sarkisian et al., 2005). When Arab and ex-Yugoslavian females in Sweden participated in focus group interviews, they indicated a need for information about diabetes management in a discussion format provided by medically skilled staff (Hjelm, Bard, Nyberg, & Apelqvist, 2003).

The one-on-one interview is another qualitative method used to identify needs in health practices (Stinson & Mueller, 1980). The aim of the interview is to gain insight into the interviewee's perspective of things that cannot be directly observed. There are three approaches to gathering data through interviews: informal conversations, general guided interviews, and standardized or structured open-ended interviews. With the first approach, questions are generated spontaneously with the flow of a conversation. Data collected with this approach varies for each interviewee. For the second approach involving a general interview guide, the interview is bound to a guiding framework used

in the process of interviewing people. The advantage of this approach is that it yields the same type of information from multiple persons. In the third approach, standardized written open-ended questions are pre set to guide the flow of the questions and the way the questions are to be asked during the interview. The last strategy is useful when time is limited and when the same information from each person interviewed is desired (Patton, 1980).

Interviews provide an opportunity for obtaining unbiased personal opinion by direct interaction between the interviewer and the interviewee. The person interviewed is protected from peer influence concerning his/her opinion or a change of position due to multiple persons' interactions as may be the case with focus groups. Furthermore, all participants are equally allowed to express their opinions and responses in one-on-one interviews (Krueger, 1988).

Interviews have been employed to determine the educational needs of target audiences in many ethnic groups and settings. In one study, the educational needs of women with Type 2 diabetes were effectively determined when 17 women were interviewed while shopping in supermarkets (Miller, Warland, & Achterberg, 1997). A different study interviewed 15 college students with Type 1 diabetes to explore their perceived barriers for successful diabetes management as a means to identify the perceived needs for educational programs. The study reported that students considered hypoglycemic reactions, time management, diet management, stress, and lack of money to be the major barriers in achieving diabetes management; and a diabetes education program was designed to meet a major portion of those barriers (Wdowik, Kendall, & Harris, 1997). Also, the educational needs of South African Blacks with Type 2 diabetes

were determined when 25 patients, from primary health care, were interviewed in-depth to identify barriers to dietary compliance. The interviews revealed that often patients have been provided with inaccurate diet-related advice such as the admonition to avoid all starchy foods or to avoid some starchy foods like maize meal, white rice, and white bread (Nthangeni et al., 2002).

Other researchers have held interviews with professionals for different purposes. Devine, Jastran, and Bisogni (2004) explored motivators and barriers of nutrition professionals in their work in developing professional development programs. Stinson and Mueller (1980) also investigated professional needs for continuous education in various areas by means of interviews. Brown and Hanis (1999) interviewed physicians individually to gain insight into the type of diabetes services provided in the community and the common types of health problems associated with diabetes. In these interviews, the authors also solicited suggestions from physicians concerning the desired characteristics of a future education intervention for the target population.

It is significant to include health professionals in needs assessment to take into account any professional-specific practices, attitudes and beliefs, or matters influencing educational programs, as doctors were reported to be optimistic concerning their ability to influence lifestyle aspects of the patients (Valente, Sobal, Muncie, Levine, & Antlitz, 1986). Furthermore, both patients and professionals are in different positions which will be reflected in their responses to needs inquiries. When Duchin and Brown (1990) surveyed patients (n=50) and nurses (n=50), they found that patients tended to respond with regard to what they needed based on their treatment plans while nurses tended to

respond based on a comprehensive perception of diabetes management (Duchin & Brown, 1990).

The Health Belief Model and Nutrition Education

Conducting theory-driven research in nutrition education is strongly recommended (Achterberg, Novak, & Gillespie, 1985). Principles, concepts, and theories help to answer questions and to explain and describe events (Novak & Gowan, 1984), and models draw concepts from several theories in an attempt to understand a problem in a given setting or context (National Cancer Institute, 2005). There is no specific theory that dominates the field of nutrition. Several theories or elements of theories from the social sciences in particular have been employed in nutrition education (Achterberg & Miller, 2004); and, the HBM is one among many models and theories that have been employed in nutrition studies.

The HBM was developed during the 1950s by a group of psychologists working for the U.S. public health services. The model adopts theory from the behavioral sciences in tackling and explaining the behavior of people in health matters. The group was trying to explain *why* people were not using preventative services such as x-rays and immunizations for screening for tuberculoses and preventing influenza, respectively, so as to promote these services using a better approach (Rosenstock, 1974). Since it first appeared, the application of the HBM has been expanded to include illness behaviors, sick-role behaviors, and preventive actions. The model has been used as a framework to guide health behavior interventions and to promote change and maintenance of health behaviors (Glanz, Lewis, & Rimer, 1997).

The model is based on six constructs that influence whether individuals will choose to take action to prevent, to screen for, and to control the health matter at hand (National Cancer Institute, 2005). The first component, *perceived susceptibility,* is the persons' belief or perceptions that they have the chance of getting an illness, health problem, or condition. *Perceived severity* is the individual's conviction that an ill-health problem could lead to undesired sequel. The construct concerning *perceived benefits* has to do with the patient's confidence that an action taken will actually reduce susceptibility to and/or severity of an ill-health condition. *Perceived barriers* is the opinion about potential negative aspects of a health action and these may impede taking up any recommended behaviors. *Cues to action* are stimulates to take action. *Self-efficacy* is how confident and able a person is in executing an action successfully (Glanz et al., 1997).

There is a wide spectrum of applicability of the HBM. Applying the model in developing persuasive educational messages for healthy behavior is widely supported. Such messages can be presented in printed materials, direct counseling, or through electronic media (National Cancer Institute, 2005). The HBM has been used as an explanatory tool and an intervention guide in dealing with many health-related issues, including cigarette smoking (Strecher, Kreuter, & Kobrin, 1995), behaviors associated with AIDS (Aspinwall, 1991), and adherence to diabetes treatment regimens (Chapman, Ham, Liesen, & Winter, 1995). The constructs of the HBM variables are recommended for use in program planning, including both needs assessments and program strategies, to increase the effectiveness of health promotion programs at the individual, group, or community level (Glanz et al., 1997).

Applying the Health Belief Model to Education of People with Diabetes

The HBM has been widely used to understand the attitudes and beliefs of people with Type 2 diabetes towards aspects of diabetes management in several ethnic groups: African Americans, Caucasians, Hispanics and many others (Brown, Becker, Garcia, Barton, & Hanis, 2002; Daniel & Messer, 2002; Swift, Armstrong, Beerman, Campbell, & Pond-Smith, 1995). Numerous studies have applied the HBM to unveil health-belief aspects about diabetes and their relationship to compliance with management plans reflected in glycemic control by individuals with Type 2 diabetes (Brown & Hanis, 1999; Daniel & Messer, 2002; Pham, Fortin, & Thibaudeau, 1996).

Theory and models are frequently used by health professionals in understanding patient behavior relevant to following diabetes-specific behaviors. In Canadian Aborigines, Daniel and Messer (2002) determined the health beliefs of 32 individuals with Type 2 diabetes based on four constructs of the HBM. Individuals had higher perceived severity (10.4 ± 1.9) and perceived benefits (9.0 ± 1.4) scores compared to the mean scores of perceived susceptibility (8.4 ± 1.6) and perceived barriers (6.9 ± 2.6). All constructs were measured based on a 20- point Likert-scale; high scores indicate the intensity of the beliefs and perceptions. Perceived barriers and perceived severity both correlated with glycemic control and predicted reeducation in HbA1c.

A different study showed that perceived severity of diabetes was significantly correlated with glycemic control (r = .21; p = 0.03) among 102 individuals with type 2 diabetes. This suggests that the more patients perceived diabetes to have serious consequences, the better their glycemic control. On the other hand, perceived barriers to treatment had a negative significant correlation (r = -.24; p = .02) with self-reported

adherence to diabetes regimen. This finding indicates that adherence decreases with increased perceived barriers (Polly, 1992). These findings are in line with the assumption of two constructs of the HBM: perceived barriers and perceived severity. When individuals have increased perception of barriers, they are less likely to take action, while they are more likely to take action when they have an increased perception of the severity of their health status.

In a cross-sectional correlation study, the HBM was employed to investigate barriers to implementation of good diet and exercise behaviors based on a self-reported questionnaire. The analyses showed that perceived barriers of self-care were highly correlated with undesired diets and exercise behaviors of individuals with Type 2 diabetes (Aljasem, Peyrot, Wissow, & Rubin, 2001).

The HBM has been used to identify factors influencing diabetes self-management behaviors among people with Type 2 diabetes. Such application of the HBM is very crucial in determining areas of emphasis and practical aspects in order to overcome barriers and misconceptions in creating effective nutrition education (Chapman et al., 1995).

In a study of the health and illness beliefs of diabetic Swede (n = 15), Arab (n = 13) and ex-Yugoslavian (n = 13) females living in Sweden, the HBM and locus of control were the theoretical framework of the study. Their beliefs were explored in focus groups. All three groups agreed on three factors as causes of their diabetes. They believed that supernatural factors, such as fate and evil eye/spirits, inheritance or the "genetic factor", and matters of social life, such as "disturbed relations to others", were causes for diabetes. Non-Swede female-perceived factors related to the individual such as

emotional discomfort and pressure like worries and agony to be causes for diabetes. On the other hand, Swede females reported obesity and drugs (cortisone) as having caused their diabetes. Arab respondents also pointed to fatty foods, an abundance of food, and anemia as causes for diabetes. Arab and ex-Yugoslavian patients revealed a lack of knowledge of the effect of insulin and the consequences of diabetes. Only unspecific symptoms such as pain, weakness, polydipsia, and ill health were mentioned. Further, only Arab respondents considered the seriousness of diabetes in their responses but did not know how long it would last. In general, Arabs showed that they took action to adapt to diabetes and pointed out many things that they thought they must do related to diet and seeking information on how to manage diabetes despite the fact that they mostly perceived its cause as "the will of Allah/God". Clearly, culture and religion are significant factors in self-care management behaviors (Hjelm et al., 2003).

The HBM has also been used to understand patient adherence and barriers to exercise in 83 persons with Type 2 diabetes based on a Likert-scale. Only 52% of the persons were reported to be exercising when surveyed. Walking was the most common type of physical activity followed by cycling. Perceived barriers to exercising were determined to be "physical discomfort", "fear of reactions from low blood glucose", "too overweight to exercise", and "lack of family support for exercise" (Swift et al., 1995). Pham et al. (1996) also found that increased perceived barriers have a significant negative influence on commitment to exercising; on the other hand, social support had a significant positive influence on adherence to exercise and diet recommendations.

The Need for Continuing Nutrition Education for Health Professionals

All health care professionals are able to encourage and support people with diabetes to strive for normal or near-normal metabolic control (Gehling, 2001). Increasing access to nutrition education for different groups of people with different physiological conditions is a priority of health care systems. One of the many avenues for effective nutrition education is through health professionals within health care systems. Hence, investigations to determine the nutrition education needs of the health professionals are repeatedly carried out in search for ways to empower the professionals with sound nutritional knowledge so they will then be in a better position to apply knowledge and maximize the delivery of sound nutrition education for targeted audiences. If effective health promotion is sought after, nutrition basic training, continuing education, and educational materials have been suggested as needing to be made available to primary care workers (Hjelm et al., 2003).

Continuous education was chosen by 94% of physicians (n= 255) as a source for professional nutrition information. When doctors were asked to rank the usefulness of services, 42% ranked continuing education as most useful to them, and only 39% stated that reimbursement for dietitians' services was the most useful. In addition, 70% of the general practitioners ranked patient pamphlets as the most useful patient-oriented service that they could be provided with (A. Kelly & M. R. Joffres, 1990).

Physicians have been identified as a major source of nutrition information along with media, schools, and friends (Price, Galli, & Slenker, 1985). Repeatedly, health professionals have been reported to provide diet/nutrition counseling (Frank, Wright, Serdula, Elon, & Baldwin, 2002; Murray, Narayan, Mitchell, & Witte, 1993; Olivarius et

al., 2005). For example, in a group of 4,501 female doctors, 43% and 50% reported providing counseling on nutrition and weight, respectively. When doctors have high-self-confidence in their ability to counsel, they are more likely to apply counseling (Frank et al., 2002). When practitioners were empowered in nutrition counseling, they were found to be more likely to ask patients about diet or nutrition (Lazarus, 1997). Ninety percent of Scottish health professionals, doctors and nurses (n= 58), in primary health care said they provided dietary advice whenever it was appropriate (Murray et al., 1993).

However, professionals are faced with many obstacles in their practice to provide nutrition counseling. In one study, Canadian family physicians perceived the lack of physician reimbursement, lack of time, and inadequate access to patient information to be barriers to nutrition education in their setting (S. A. Kelly & M. R. Joffres, 1990). A majority of American family physicians believed that nutrition was important but claimed that lack of time was their greatest barrier in including nutrition in patient care. To overcome the time barrier, an easy approach is to provide practical nutrition information quickly which may then positively alter practitioners' beliefs and practices to incorporate more emphasis on nutrition in patient care (Lazarus, 1997).

Besides time barrier, it is not uncommon for patients to be given inaccurate, inappropriate, or conflicting nutrition advice by health professionals. For example, black South African patients with Type 2 diabetes were reported to have received conflicting advice frequently about foods they were not allowed to eat without sound reasoning from health professionals in primary health services (Nthangeni et al., 2002). Dietary advice was mostly given by doctors (56 - 72%), followed by nurses (12 - 27%), and then dietitians (4 - 16%) among both urban and rural patients, the majority of whom had poor

metabolic control. Some professionals recommended the consumption of bananas, oranges, green apples, whole milk, white rice, and whiskey while others told patients to avoid them. Moreover, patients indicated having been confused about how much they should eat of various foods, and they generally had poor knowledge and understanding of the state of their health condition and treatment. Nthangeni et al. (2002) recommended that in addition to developing culturally appropriate dietary intervention programs, health professionals need to be retrained with respect to diabetes nutrition management (Nthangeni et al., 2002).

In a British study of nutrition knowledge among Scottish primary health care professionals, doctors, community nurses, and practice nurses (n= 58), participants were found to be aware of general nutrition issues, but only 33% knew that dietary cholesterol was not the most significant factor in controlling blood lipids. More than half of the respondents (57%) incorrectly responded that carbohydrates must be strictly reduced in a weight reducing diet. When given a case history of hypercholesterolemia, 24% of the participants failed to list six dietary pieces of advice that were correct, but they all were able to list one; 40% of the participants listed one or more pieces of advice that were inaccurate or misleading. Also, the group was indicated to have difficulty translating knowledge into a practical dietary recommendation (Murray et al., 1993).

In a different British study, nurses (n = 5) were shown to have low nutritional knowledge on a nutrition questionnaire. Before training, nurses had a low average-knowledge score (47.8%). When nurses were interviewed, they mentioned that they provided nutrition education to patients because they were expected to do so by doctors since the doctors lacked experience and knowledge about nutrition: the nurses

commented: "they don't know much about it; they offload it on to us; they see that as part of the practice nurses' job". All nurses but one spent about 20 – 50% of the time at the clinics providing dietary counseling. Four of them reported that they did not have past experience in nutrition training, and all five expressed interest in such training. With respect to the training they had received, the nurses reported that it made them more confident with the subject, and it taught them new approaches to diabetes nutrition education (Cadman & Wiles, 1996).

In Denmark, physicians in a primary care setting are also expected to provide diet counseling due to the lack of public access to dietitians. Doctors were found to have poor self-assessed knowledge about nutrition which in turn created a barrier in their skills and ability to counsel patients about diet. What's more, the proportion of diabetic patients treated with diet alone tended to decrease when doctors had decreased skills in counseling with respect to proper diabetes diets in a primary health care setting (Olivarius et al., 2005).

The British NICE published a report evaluating diabetes education models. It was reported that several diabetes education programs were in place, but they varied in style, content, and length, and some were not structured; only a few had been evaluated formally. Furthermore, NICE indicated that the majority of health professionals who conduct the education programs have not been trained to use those programs (National Institute for Clinical Excellence, 2003).

A study by Reed et al. (2001) reported on professional education programs about diabetes care but without any specifics as to the content of the program. The authors reported that primary care professionals (physicians and nurses) in Al-Ain, UAE, were

only trained to follow diabetes care guidelines as measured by the number of clinical tests, blood pressure, fasting blood glucose, urine protein, and total cholesterol, recorded in medical charts of patients. The group was not reported to have been trained in diabetes nutrition therapy.

It is common for physicians to be given simple information about diabetes dietary guidelines. PHC doctors in Abha, Saudi Arabia, are also left to cover health education for people with diabetes. Practitioners are provided with a sixteen-topic check list, including an explanation of diabetes, diet plan, use of medication, food care, skin infection, benefits of exercise, diabetes complications, and care during stress to use for their patients' education. Based on their perception of patient needs, physicians are left to develop the details of educational topics (Abdelmoneim & Al-Homrany, 2002).

Continuing Nutrition Education of Health Professionals

Primary care professionals play a pivotal role in health education. Doctors, nurses, pharmacists and dietitians all have been noted as partners in diabetes care in PHC. Some PHC settings have them all as a team while other settings lack some of the processionals named. The objective of the team is to function in unison to provide medical care and diabetes education to empower patients for better self-management and better metabolic control to prevent and/or to delay the onset of diabetes complications (Haase & Russell, 2006).

As it is commonly known that nutrition education is limited in physician training programs, experiences in continuing nutrition education for health professionals are diverse. The major focus with all such programs is to improve knowledge about and

counseling skills in nutrition since numerous physicians in primary care are expected to counsel their patients concerning diet as a result of a lack of access to dietitians or due to other reasons. The Danish "Diabetes care in general practice" study includes a diabetes nutrition education section for health care professionals. In this study, 113 physicians attended a continuing education seminar where they were given instruction on simple diet rules and the use of a food frequency questionnaire to help them make proper suggestions to change the amount and content of their patients' diets. Simple diet guidelines included the advice to "increase complex carbohydrates to at least 50% of daily energy needs, reduce fat to a maximum of 30%, eat five to six meals a day and increase physical activity" as examples. Doctors were given the food frequency questionnaire to complete as a self-test of the instrument to boost their learning experience that would help them overcome their lack of knowledge and skills pertinent to the approach (Olivarius et al., 2005).

In the USA, a six-month nutrition education program was implemented in a family-practice residency program with the aim of determining the effect of the education program. The study included a sample of five faculty members and nine resident doctors who completed pre-intervention and post-intervention assessments. The report indicated that there was a small but statistically significant increase in the mean total knowledge scores for all subjects ($73.1 \pm 1.5 - 75.7 \pm 1.5\%$; $P < 0.01$) and for the nine residents ($70.6 \pm 1.6 - 73.0 \pm 1.2\%$; $P < 0.05$) between pre and post intervention. Also, as a result of the intervention, a higher incidence of chart documentation of nutrition discussions (11.4% vs. 13.8%) and a higher incidence of abnormal cholesterol discussions (33.3% vs. 44.4%) were reported at post-intervention follow-up (Lazarus, Weinsier, & Boker, 1993).

To insure consistent recommendations are given to patients, all professionals in primary care should be provided with similar professional development opportunities through continuing education. Continuing education in diet and nutrition enhances professionals' knowledge in the area and empowers them in their practice. In three one-hour sessions of a nutrition education program led by a dietitian, nurses were given information related to nutrition on obesity, diabetes, and the prevention and treatment of heart diseases. Before training, nurses had an average knowledge score of 47.8%, which increased to 58% after nutritional training. This translated to a 10% increase in their knowledge. Post intervention interviews with nurses revealed that nurses tended to give more advice on diet and that they felt more confident and were able to use different approaches with their patients. Participants stated that they were interested in training programs in nutrition, and they suggested that other professionals might also be interested in nutrition education but they did not predict whether doctors would be so inclined (Cadman & Wiles, 1996).

The Status of Health Education in Developing Countries

The need for heath education has been investigated in some developing countries. In UAE, people with diabetes have been reported to have low knowledge with respect to their condition and diabetes education was indicated as a priority. In a sample of patients in this country, 20% were reported as not knowing what is diabetes, 15% not knowing any symptoms of diabetes, and 20 % not knowing about any diabetes complications (Mpofu, 1995). In a more recent study in the same country, patients (n = 300) were reported to have low knowledge about diabetes with a mean score < 50% based on a

survey adopted from the Michigan DKT. Furthermore, only 62% of participants indicated that they had ever received diabetes education (Abdullah et al., 2001).

In a case-control study in UAE, a diabetes educational program was led by nurses, physicians and nutritionists. However, the content of the educational program was not outlined. Data was only collected at post intervention using a 19-item survey. Overall, only 43.9% of the survey items were correctly answered. Both groups, case (n= 109) and control (n= 110) were found to have low mean knowledge scores. The case group had a mean of 7.13 and the control group had a mean of 6.94, based on the total score. Based on the survey subscales, the mean scores for diabetes complications (6-items) were 2.29 and 2.23 for the case and the control groups, respectively. The mean scores for diet knowledge (7-items) were 2.78 for the case group verse 2.75 for the control group. Management knowledge scores (6-items) were even lower, 2.06 for the case group and 1.92 for the control group. Despite the education program, there were no significant differences between the two groups in knowledge (Reed et al., 2001).

In a PHC center in Abha, Saudi Arabia, patient education on aspects of diabetes management including diet was led by physicians. Doctors were provided with a check list of education topics that they elaborated on based on their perception of patient needs. Saudi male patients were shown to have a higher mean number of education sessions (4.2 ± 1.9) than Saudi female patients (1.8 ± 1.3) in a 12 month period despite the fact that all patients had monthly follow-ups. Glycemic control of female subjects was significantly associated with the number of education sessions attended and dietary complacence was significantly poor in females and males. While only 15% of male patients had poor diet

compliance, 36.1% of female patients were classified with poor diet compliance based on a self-reported questionnaire (Abdelmoneim & Al-Homrany, 2002).

In Trinidad, diabetes health education is provided by nurses. Patients were found to have a high level of awareness about diabetes risk factors and a high level of knowledge on the importance of exercise, weight control and healthy diet in diabetes management. When patients were asked to rate sources of diabetes information, they rated printed and electronic media as the most common, followed by doctors and nurses which were placed third on the list (Ezenwaka & Offiah, 2003). However, the knowledge questions in this study were based on yes, no, and don't know responses that might not accurately reflect practical knowledge.

Summary

Research documents the need for enhanced diabetes education among many nations. The case in Oman is also pushing for the need of diabetes education. With increased prevalence of diabetes in Oman, it is important that a systematic approach is taken to develop a diabetes education program. Such a program would need to take into account the perspectives and concerns of both the target population and the diabetes heath care team. Each of these groups manages diabetes from a different position and their views would be of great importance in the pursuit of planning the educational program. Training educators and/or the health care professional team involved in the care of patients with diabetes should be the most logical step before implementing the programs to educate patients. This action would increase and update professionals'

knowledge and skills and also ensures that patients would be provided with current and consistent advice from different team members.

ASSESSMENT OF DIABETES EDUCATION NEEDS IN PRIMARY HEALTH CARE IN MUSCAT, OMAN

Introduction

Diabetes education is an important component in diabetes prevention and management (IDF, 2005). Self-care is the patients' responsibility and accounts for the long term control of diabetes. To achieve desired glycemic outcomes and to prevent or delay diabetes complications, individuals with diabetes need to be educated about all aspects of diabetes management (Anthony et al., 2004). The significance of long term metabolic control as measured by HbA1c has been strongly supported as a result of the UKPDS which showed that the chances of developing diabetes complications were largely decreased with low HbA1c (Stratton et al., 2000).

The benefits of education in diabetes self-care have been indicated by many studies. In one study, significant dietary behavior improvement was observed in subjects who were given a brief intervention compared to those who were not. Individuals who were given education significantly decreased their percentage of calories from fat; and in return, their serum cholesterol decreased significantly (Glasgow et al., 1997). Total cholesterol, glycosylated hemoglobin (HbA1c), and LDL-C were also significantly decreased among patients with Type 2 diabetes who were given diabetes education and dietary instructions in primary care clinics (Goddijn et al., 1999; Ridgeway et al., 1999).

However, educational programs need to be relevant to the target audience culture for the education to have meaning and applicability among individuals (Brown et al., 1992; Wang & Chan, 2005). Issues such as culture and dietary preferences and economic constraints should all be investigated to maximize the benefits of education (Dyson, 2002); and, theory-driven research in nutrition education is strongly recommended (Achterberg et al., 1985). The variables of the HBM are recommended to be used in program planning, including both needs assessments and program strategies, to enhance program effectiveness (Glanz et al., 1997). The HBM has been used to identify factors influencing diabetes self-management behaviors among people with Type 2 diabetes and their educational needs within a target group (Hjelm, Nyberg, Isacsson, & Apelqvist, 1999). Such application of the HBM is very crucial in narrowing down areas of emphasis and practical aspects in order to overcome barriers and misconceptions in creating effective nutrition education (Chapman et al., 1995). Also, understanding the drives behind certain actions or the lack of actions is valuable in determining the needs to be addressed in educational programs (National Cancer Institute, 2005).

In addition to exploring the needs of the target audience for health education, it is important to include health professionals in needs assessments in order to account for their opinions and suggestions (Duchin & Brown, 1990). Professionals can provide insight into the type of educational services available to target groups, identify problems associated with educating patients with diabetes, and suggest characteristics of future education programs (Brown & Hanis, 1999). Also, including professionals in the planning phase allows researchers to understand professionals' needs for continuous education in various areas (Stinson & Mueller, 1980).

Therefore, assessing the needs of the target population is an essential step in developing sound educational programs and materials. Needs assessments identify the weaknesses that a target audience might have which could include insufficient knowledge, misconceptions, beliefs, barriers, or low self-efficacy. Moreover, it provides grounds for planning, developing and evaluating educational efforts (Ward & Macfarlane, 1993).

There are several approaches used to investigate and evaluate educational needs of target populations. In situations where there is no valid and reliable quantitative measure that is acceptable and appropriate for the target group, qualitative measures are recommended (Patton, 1980). Qualitative research focuses on gaining a holistic understanding of the issues based on contextually detailed data (Mason, 1996). Qualitative methods such as focus groups and interviews are emphasized in nutrition education research (Achterberg, 1988). Such methods provide detailed insight in tailoring educational approaches or modifying any educational program or materials to the needs of the target audience (Achterberg, 1988, 1994; Sims, 1987). Structured open-ended interview is one interview method that has been used to investigate educational needs. In this method, the progress of data collection is limited to predetermined topic areas, wording, and sequencing of questions to conserve time (Patton, 1980). One-on-one interviews are one approach in collecting qualitative data. This method assures that participants' opinions are not swayed by interactions with others, as may be the case with group interviews (Krueger, 1988).

Qualitative interviews have been successfully applied in evaluating needs for nutrition education of people with Type 2 diabetes (Miller et al., 1997). In one study, this method was applied to reveal confusing messages related to diet provided to South African Black patients with Type 2 diabetes (Nthangeni et al., 2002). Among professionals, this method has been used during the planning phases of educational programs. In yet another study, such use of one-on-one interviews allowed researchers to gain insight into professionals' needs for nutrition education (Stinson & Mueller, 1980). In a different setting, interviews gave researchers insight into type of services provided to people with diabetes; and they were used to elicit suggestions from physicians concerning the desired characteristics of a future educational intervention for the target population (Brown & Hanis, 1999).

The current study was designed to use one-on-one interviews, based on the tenets of the HBM, and includes interviews with patients with Type 2 diabetes conducted in order to reveal certain factors related to their diabetes self-management. Of particular interest was the desire to gain a deep insight into and understanding of the patients' beliefs, motivators, and barriers associated with their diabetes self-management. The study was also designed to employ one-on-one interviews with health professionals in PHC to document current practices in diabetes education in PHC and to identify health professionals' perspectives and suggestions on the diabetes educational needs within PHC.

Methods

This research employed a qualitative approach, one-on-one interviews, to achieve the objectives of the study. For interviewing patients, one-on-one interviews were selected over other approaches. It has been found that the focus-group technique is not well received by most people in the Omani culture due to the lack of privacy as the researcher was advised by some health professionals. To experiment with the technique, two focus group sessions were scheduled with the target population during the summer of 2004. In this preliminary test, permission was obtained from the Ministry of Health, in Oman, to experiment with focus groups. Accordingly, people with Type 2 diabetes were approached in two PHC clinics and were invited to participate in focus group sessions at a given time and location. At one location, of the twelve people who consented to participate, only two showed up for discussion. At another location, six patients were scheduled to participate in a focus-group discussion, and none showed up. As a result, a decision was made to gather information by one-on-one interviews only for the present study.

With the patients with Type 2 diabetes, qualitative data regarding various factors associated with diabetes management was compiled using structured, open-ended interviews. Initially, structured, open-ended questions for interviewing patients were developed based on a review of the professional literature concerning diabetes studies (Hjelm et al., 2003; Wdowik, 1998; Wdowik et al., 1997). Then, the questions were modified and refined to address the constructs of HBM (Glanz et al., 1997). Constructs included were *perceived susceptibility*, *perceived severity*, *perceived benefits*, *perceived barriers*, *self efficacy*, and *cues to action*. Probe questions were added to each section to

form the interview guide. Additional questions were included to capture the demographic factors of patients. These questions were pertinent to gender, age, level of education, employment status, duration of diabetes, and status of former experience with diabetes nutrition counseling. The interview guide was then reviewed by a small panel of experts in the field of diabetes. One faculty member and one graduate student from the department of Food Science and Human Nutrition (FSHN) at Colorado State University (CSU) reviewed the script for clarity and flow of questions. See Appendix A for the interview script for people with Type 2 diabetes.

Qualitative data on current practices in diabetes education and professional perspectives and suggestions for future diabetes education programs were also collected via structured open-ended interview questions. One-on-one interviews were used due to time constraints and the busy work schedules of professionals. Questions for professionals were specifically developed to capture the essence of their current practices in diabetes education and to elicit suggestions and preferences concerning the type of educational materials/programs they believed would be beneficial in addressing their clients' needs. Probe questions were included to form the interview guide. Again, the guide was reviewed by a small panel of experts in the field, one faculty member and one graduate student from FSHN at CSU. See Appendix A for a copy of the interview guide for health professionals.

Approval for the needs assessment was obtained from the Colorado State University (CSU) Human Research Committee and from the Directorate General of Health Services, Ministry of Health Oman. Subjects from both groups, patients and professionals, signed informed consent forms as per the CSU Human Research

Committee regulations. An Arabic version of the consent form was provided for patients. See Appendix B for copies of approvals and informed consent forms.

Individuals with Type 2 diabetes were recruited from patients attending PHC centers in Muscat, Oman for their periodical follow-ups. Patients with diabetes in PHC represent the bulk of people with diabetes in the nation compared to those attending any other level of health care. Patients included adult ($\geq$20 years) male and female Omani nationals with Type 2 diabetes who were willing to participate. Targeted health professional interviewees included willing doctors, nurses, dietitians and diet technicians who work with diabetes patients in PHC centers. These professionals are the most knowledgeable about the type of health care provided to the diabetics within the system and the type of education they would be interested in, should it be made available to assist them in their work.

All data collection was done in Muscat, Oman, between December 26, 2004 and January 20, 2005. Of the 23 PHC centers in the region, seven centers were randomly and conveniently selected for recruiting the target individuals given the short time frame for data collection and the few and overlapping days of operation of the diabetes clinics. At most, each center has two or three days per five working days of the week designated for diabetes clinics.

During the hours of the diabetic clinics, patients showing up for their scheduled appointments were approached in the waiting room. The objectives of the project were verbally explained to them, and they were invited to participate. Upon agreement, subjects were invited to a meeting room for privacy during the interview. All volunteers signed consent forms and were interviewed for about 30 - 40 minutes independently. All

interviews were audio taped, and additional notes were taken in the process. Diabetes clinics operate during normal working hours only, from 7:30 a.m. to 2:30 p.m. Thus, data collection with patients was done during that time. All patient interviews were conducted in Arabic.

Health professionals were also approached in much the same manner. The project was verbally explained to them, and they were invited to participate. All interested professional volunteers signed up for a time to complete the interview. Arranging time to interview the professionals was essential and difficult due to their busy working schedules. Participants were mostly interviewed right after the morning shift or during an evening shift, between 3:00 and 9:00 p.m., since all centers run from 7:30 a.m. to 9:00 p.m. on the week days, divided into two shifts. The objectives and the process of the interview were explained to the participants, and they were asked to sign consent forms. Sample educational materials were gathered during the process of the interviews. The professional interview sessions lasted 20 - 30 minutes, and all sessions were audio taped as were the patient interviews.

Analysis of the interviews with patients proceeded as follows:

1.) Descriptive data was analyzed in Microsoft Excel to determine frequencies and means.

2.) All audio tapes were simultaneously translated and transcribed, and additional relevant notes taken during the interviews were added.

3.) Then, transcripts were read and common themes were highlighted.

4.) Summaries of total findings were then written for each question to identify common themes (Krueger, 1988). Themes were determined based on the frequency of statements relevant to the same idea.

Primary findings included those themes that were mentioned by ≥50% of the participants. In addition, secondary findings included those issues that were mentioned by < 50% of the participants. Because the interviews were based on the constructs of the HBM, these elements of the HBM were explored in particular: *perceived susceptibility, perceived severity, perceived benefits, perceived barriers, self efficacy,* and *cues to action.*

Analysis of the interviews with health care professionals proceeded as follows.

1.) Descriptive data was analyzed in Microsoft Excel for frequencies.

2.) All audio tapes were transcribed, and additional relevant notes taken during the interviews were added.

3.) Transcripts were then read, and common themes were highlighted.

4.) Summaries were then written for each question as per Kruger's (1988) recommendation.

5.) Again, themes were determined based on the frequency of statements relevant to the same idea as stated above.

Results

Interviews with Patients with Type 2 Diabetes

By the end of time frame, 29 patients from seven health centers (13 males and 16 females) had been interviewed. Patients ranged in age from 23 to 67 years with an average age of 45.7 years. The duration of diabetes ranged from one month to 19 years (mean 6.4 years). Among the participants, 22 had less than a high school education, of whom eight were illiterate, seven of which were female. Only seven patients had completed high school or a higher level of education; of these only two had a Bachelor degree. The majority, 19 subjects were not employed, as they were either retirees or home-makers and were mostly females. Overall, 17/29 participants reported having seen a dietitian/diet technician in the year just prior to the date of the interview. Twelve of the 29 patients had never met with a dietitian/diet technician. Of those who had had nutrition counseling, three times was the average number of counseling sessions they had received. Overall, the study sample had an average BMI of 31 ± 5.3 kg/m^2. Table 1 presented below, shows the demographic information for the patient participants.

Table 1: Demographic Information of Patient Participants

Clinic	Participant	Gender	Age	Duration of diabetes	Employment	Counseling (sessions)
WadiKabir	1	F	44	14m	No	Yes (1)
	2	F	60	19y	No	Yes (1)
	3	F	29	9y	No	Yes (2)
	4	M	38	4y	Yes	Yes (5)
	5	M	47	2m	Yes	No
SehAldhbi	1	F	50	4y	No	No
	2	F	44	4y	No	Yes (4)
	3	M	67	12y	No	Yes (5)
	4	M	61	8y	No	No
Adhaiba	1	M	46	4y	Yes	Yes (2)
	2	M	50	2y	Yes	Yes (1)
	3	M	42	1m	Yes	Yes (1)
	4	F	63	12y	No	Yes (1)
	5	F	40	5y	No	Yes (4)
Gubra	1	F	46	10y	No	No
	2	F	--	5y	No	Yes (1)
	3	M	50	8y	No	Yes (1)
Wataya	1	M	55	8y	Yes	No
	2	F	35	2y	Yes	No
Ashadi	1	M	23	3y	No	No
	2	F	38	2y	Yes	Yes (1)
	3	F	61	10y	No	No
	4	F	42	5y	Yes	Yes (1)
	5	F	--	15y	No	No
Ruwi	1	F	36	14m	No	No
	2	F	35	5y	No	No
	3	M	34	1y	Yes	Yes (1)
	4	M	54	3m	No	No
	5	M	64	12y	No	Yes (1)

y = years; m = months

Susceptibility

The majority of subjects (16/29) expressed that they felt susceptible to diabetes complications. Some responses included: "I feel in danger of getting other diseases" or "I'm scared, but I have to fight back and never give up." This majority (16/29) also associated these complications with elevated blood glucose.

The remaining subjects (13/29) indirectly indicated that they did not believe that they had a great chance of developing diabetes complications saying, "God gave me the disease, and he shall take care of me", "God knows if I'm susceptible", "No one in my family has any complications", or "I take the medications." These were their statements.

Kidney and eye diseases were the only two complications that were largely recognized as possible risks. Only 12/29 of the patients knew that heart diseases were related to diabetes. Repeatedly, patients referred to symptoms of hyperglycemia such as dizziness, sluggishness and weak body, and increased urination as diabetes complications.

Severity

With respect to severity, all subjects believed that complications could have serious consequences in their lives. Employed subjects mentioned that they might not be able to work which, would affect their source of income due to the increased number of visits to hospitals. Others associated severity with inability to perform duties and chores, physical and emotional discomfort, and negative impact on personal relations with spouses. Some saw that complications would cause them to be persistently weak, which would, in turn, affect their mobility and ability to eat.

Of all patients interviewed, only 7/29 patients had been hospitalized in the past due to reasons related to diabetes. Most of them revealed that the condition they were in was not comfortable, and this increased their worries: "I felt worried, and it made me think a lot." On the other hand, some mentioned that having been hospitalized did not affect them: "I had no choice; what can I do?" And "I depend on God," were the kind of comments these patients made.

Benefits

When asked about the benefits they believed they would gain from good diabetes management, these patients largely (20/29) supported the notion that good diabetes management would help them maintain their heath, feel healthy, be energized and free of symptoms: "Blood sugar level will be good and I will feel good, strong and healthy" or "Prevent body ache and repeated urination." Protection from disease complications was mentioned second most frequently (8/29): "I will be able to see and walk around, some people lost their vision," and "I will have fewer diseases." However, an element of uncertainty associated with the benefit of managing diabetes was revealed: "Maybe it will protect; everything is in God's hands." "It could protect against complications, but this is in God hands also." Again, this element is associated with religious belief. In other words, they were saying that control would protect a person from developing complications if it were not the person's fate to contract such ill health.

Barriers

The majority of the group did not test blood glucose (21/29) and relied on the tests that they received from health services during their periodical follow-ups. Finance was indicated as a barrier to blood self-monitoring by 15/21 of these people. This barrier is clearly seen in the following comments: "I don't have a meter and can't afford it," and "I would like to get one but it might be a financial burden." Of those who did test their blood glucose (8/29), all but one did it only once a week, and finance, again, was the major reason for the infrequent testing: "I only do it once a week because the strips are expensive," and "I would like to test every day, but I can't afford the cost of the strips."

Social interactions were also seen as another major factor affecting their dietary management (16/29). On social occasions and in gatherings, people socialize with food. Subjects with diabetes who refrained from different foods or who ate minimal amounts heard hosts telling them, "Maybe you didn't like our food"; thus, subjects were forced to eat more food. This factor is evident in the following statements made by patients: "I have to eat out of etiquette; the hostess will even serve me more food which is extremely difficult to refuse in our culture," or "Eat and Allah will take care of you." Only two participants indicated family interference with their eating behaviors: "I have to eat more rice so my family does not get affected psychologically; when I cut down on rice, I felt they didn't eat and enjoy food as they used to because I wasn't joining them." To top it off, most patients (24/29) appeared to experience the emotional struggle of wanting to be like others who do not have diabetes, particularly when they were around people in social settings.

Finance (23/29) and time (21/29) were not viewed as troublesome costs in managing diabetes. This is partly related to the fact that many patients did not test their blood glucose in the first place, and they largely did not engage in any eating patterns that differed from the rest of the family: "I eat the same food as my family members but in less volume"; or they got used to their situation (15/29): "It's my fate." "I'm used to my situation and don't sit with others when they eat what I'm trying to avoid." However, the feeling of being denied (13/29) was the highest cost of diabetes as per their perceptions, as reflected in the following quotes of patients: "I wish to eat meat to a point where I feel satisfied"; "I feel like an orphan child denied things"; "During mango season I don't get to eat them in addition to other things."

Overall, patients considered the benefits of controlling diabetes as outweighing the costs (23/29). They either placed short-term or long-term health benefits as more important. This philosophy of patients may be seen in the responses: "Remain healthy." "I have to do it if I want to be healthy and be able to move around."

Cues to Action

The major cue to action for diabetes self-management in this group was their fear of complications and their desire to feel better (21/29). This factor is seen in the following statements made by patients: "Nobody is unafraid of diseases"; "I control my condition to feel better and not for anything else"; and "I have to protect myself from getting more problems (complications)." Patients did not remark on any other reasons that they considered to be strong enough to trigger them to control their diabetes.

Efficacy Expectations

In examining patients' confidence in following recommendations and controlling their diabetes, most patients did not test their blood glucose at home largely due to financial reasons. A look at some of the recommendations that were provided to the patients showed that walking was the main physical activity suggested (20/29). This showed up in statements like this one: "The doctor told me to walk every day, even for half an hour." However, they mostly (18/29) did not comply with this suggestion for reasons such as "I don't feel like it", "I have backache", "I have a busy schedule", "My knees hurt", and "It's hot; I can't walk." Dietary recommendations were perceived as difficulty to follow: "It is not practical to tell someone don't eat such and such but eat such and such."

The majority of the subjects (17/29) perceived themselves as having good knowledge and skills with respect to diabetes management, and they did not feel that they needed anything else from the health centers other than medication. On the other hand, some of the subjects (11/29) perceived the situation to the contrary: "Can you tell me about what I need to do?", "All the materials I received from the heath center are introductory and don't provide solutions in dealing with diabetes", "I don't know what to eat or not to eat", "I might go without food from morning until lunch or dinner time", and "I was given a one-day diet plan which was hard to follow, particularly in Ramadan." These comments suggest a desire for better educational materials concerning diabetes management.

Traditional Medications

Traditional medicine is supported by a large number of families in Oman. In this study group, 20/29 mentioned that their families have recommended the use of such traditional remedies. These include some unknown, pre-mixed bitter herbal drinks that are obtained from traditional healers. Other examples included some homemade mixes of different blends such as fresh turmeric, thyme, and fenugreek. Some mentioned the use of bitter Indian gourd, from the vegetable family, (locally known as "Karela" in Oman, which is an Indian term), in which the vegetable is sliced and boiled. People either ate the cooked chunks of the vegetable, or they drank the broth resulting from boiling the vegetable for a period of time. The main reason behind the use of such medicines is that patients believe that the bitterness balances the sugar in the body. Nevertheless, participants said they had used them for a while and then stopped (10/20) or they had never tried them in the first place despite their families' recommendations (2/20). The major reasons behind discontinuing the use of these traditional medicines included such statements as "I used them but didn't see a difference", "My liver didn't tolerate them", and "They might affect the kidneys and the pancreas."

Educational Needs

Concerning the questions about educational support, patients were divided in their views. On one hand, 15/29 patients perceived themselves to be equipped with the necessary information to control their diabetes: "The nurse gave me booklets and papers to take home", "She, the doctor, talked to me about avoiding certain foods." On the other hand, 14/29 individuals perceived themselves as not having been empowered with the

necessary knowledge to take appropriate action: "There is no good education support", "All what they do is telling you that your sugar level is high and be careful", "I was given a paper about diabetes and no more", "I was told to walk only", and "They don't have much time to talk much, very few times when that happened (advice was given)."

The data from the interviews also revealed that patients did not actively seek information about diabetes (19/29). They relied on what was provided to them at the health services: "If information is provided, I listen." Of those who mentioned that they were actively seeking information away from the PHC (7/29), they mostly relied on radio and television programs about diet and depended on sharing experiences with other people who have diabetes.

Only 10/29 persons perceived education to be important for them as part of the support they could get in PHC: "I want to know what to eat" and "Give me meal plans and suggestions that will not be tedious." A number of patients (12/29) perceived the services that they get from the PHC to be sufficient and did not think they needed anything else to help them feel supported. They did not see education as being very important.

Dietary recommendations mentioned by patients were largely (22/29) about cutting down and avoiding carbohydrates and fats. Foods mentioned under such recommendations included rice/white bread (11/22), desserts (15/22), and fruits (7/22). This generalization is reflected in the following specific responses: "Avoid mangoes and mango juice, and dates", "Avoid sweets and a lot of meat," and "Don't eat rice; eat brown bread."

Avoiding and reducing sugary and starchy foods was a major recommendation of family members as well. Nearly half, 15/29 persons, were told to avoid these foods by their families: "Blood sugar is like a fuel gauge: the more you pump gas into your tank, the more it rises." Table 2 summarizes primary findings of patient interviews.

Table 2 Summary of the Interview Findings of Patients with Type 2 Diabetes

Theme	Frequency	Participants' Responses
Susceptibility	16/29	Felt susceptible to diabetes complications
Severity	29	Complications have serious consequences
Benefits	20/29	Maintain heath, feel healthy, be energized and free of symptoms (short term benefits)
Barriers	21/29	Lack of finance for self blood glucose testing
	16/29	Social interactions for dietary control
	24/29	Emotional struggle
Cues to Action	21-29	Fear of complications and the desire to feel better
Efficacy expectations	17/29	Perceived having good knowledge and skills
	11/29	Perceived NOT having good knowledge and skills
Traditional medications	20/29	Have been recommended to use traditional remedies
Educational Needs	15/29	Perceived to have been equipped with the necessary information
	14/29	Perceived to have NOT been empowered
	19/29	Did not actively seek information about diabetes
	22/29	Recommended to cut down and avoid carbohydrates and fats

Discussion

The health beliefs of people with diabetes in Oman and the Arab world have not been given adequate attention in the past. The findings of these interviews provide some understanding of the common health beliefs, motivators, and barriers of people with Type 2 diabetes concerning self-management of diabetes. The findings are significant, as they enhance our understanding of the important areas of focus to target in planning future educational programs and materials.

Some of the patients did not think they were susceptible to complications. Similarly, another study of Muslim populations in the United Kingdom (UK) found that 37% of the patients questioned did not perceive themselves to be at risk of developing complications (Vyas et al., 2003). Our study revealed that those individuals who did not think they were prone to developing complications were in a state of denial for different reasons. Trusting in Allah/God's power to protect them was the main source of their position of denial. With this low perceived risk of developing complications, it is more likely that adherence to self-management behaviors will be low, based on the HBM (Glanz et al., 1997).

On the other hand, all patients believed that complications, should they develop, would have adverse effects on their lives. Immobility and physical weakness were the prominent perceived consequences. Thus they placed a high value on the long-term health benefits of controlling diabetes and viewed complications as having serious consequences. Comparable perceptions of the effect of diabetes were reported among Pakistani Muslim patients with diabetes in Manchester, UK, (Vyas et al., 2003). The HBM speculates that metabolic control will be related to *perceived severity* (Glanz et al.,

1997). Research indicates that high *perceived severity* is related to better metabolic control among individuals with Type 2 diabetes (Daniel & Messer, 2002; Polly, 1992) Thus, it is interesting, and perhaps reasonable, to speculate that Omani patients would have reasonable adherence to self-care behaviors, provided they were well-informed about diabetes management skills.

Most of those interviewed in the group only acknowledged the short-term benefits of diabetes management, as was reflected in their responses about having low blood glucose, less body aches, and less polyuria. Only a few subjects pointed out the long-term benefits of self-care; these related good control to the outcomes of maintaining their vision and having fewer diseases. These findings give rise to a concern about incorrect knowledge and misconceptions about the complications of diabetes held by those within this group of patients. Patients referred to symptoms of hyperglycemia as diabetes complications; they mentioned liver diseases and overweight as complications as well. Arab diabetic females in Sweden were reported to have similar misconceptions, referring to diabetes symptoms as consequences of diabetes (Hjelm et al., 2003). With these inaccurate perceptions of the benefits of diabetes management, subjects would be less likely to be fully involved in managing their condition.

Four barriers to diabetes self-care were evident as affecting this group. First, finance was a major issue for all participants with respect to blood glucose self-monitoring. Most admitted that they did not monitor their blood glucose at home. Only a few did test their blood glucose but only once a week, and this was for financial reasons as well. Lack of self-monitoring of blood glucose has been reported as a barrier to diabetes self-care by other researchers as well (Brown, Upchurch, Garcia, Barton, &

Hanis, 1998; Greenhalgh, Helman, & Chowdhury, 1998). Further, patients did not view self blood glucose testing to be important in managing their diabetes. From these interviews it seemed that patients had not been advised to test their blood glucose at home. Doctors did not emphasize this aspect, which could explain the widespread lack of testing among patients and why they viewed self blood glucose testing as unimportant. Patients depended on their symptoms only to monitor their diabetes, which is not a good approach. Recommending self blood glucose monitoring could teach individuals how their blood glucose reacts in relation to diet, medication, and exercise. They could also learn to distinguish between the symptoms of hypo- and hyper- glycemia with regular home blood glucose testing (Brown et al., 1998).

Second, social commitment was a barrier in maintaining sensible eating behaviors. When patients do not receive good social support, they are more likely not to adhere to a meal plan that is good for their diabetes control. The Omani culture is characterized by strong social network; family, relatives, and friends have a great influence on an individual's life. Despite the fact that most volunteers mentioned that families did not interfere with their eating behaviors or intentions, we can conclude that family influence was there as patients directly said that they ate just like their families. In social gatherings, patients stated that they were forced to eat more food out of social obligation. Therefore, social support is a significant factor to be taken into account in counseling Omani patients. A relevant finding on social obligation was reported by Greenhalgh et al (1998) in a study on Bangladeshi Muslims living in the UK. The authors reported that it was a common act among Bangladeshi patients with Type 2 diabetes to give up their diabetes meal planning due to social obligations.

Third, lack of knowledge and certain misconceptions can play as barriers to self-management. Low knowledge about diabetes and aspects of self-care is common among persons with diabetes and has been reported in several studies (Abdullah et al., 2001; Latalski, Skórzynska, & Pacian, 2002). On the other hand, studies of nutrition education for people with Type 2 diabetes reported positive relationships between knowledge and metabolic control; as patients knowledge increased they were more likely to have better metabolic control (Panja et al., 2005; Ridgeway et al., 1999). The confusion in identifying symptoms and complications seen among the Omani patients has been reported elsewhere (Hjelm et al., 2003).

Furthermore, patients lacked knowledge on appropriate eating behaviors because they were widely being advised, by health professionals and family members, to abstain from a variety of foods. As a result, they did not know how to balance diet in controlling diabetes. Lack of knowledge on appropriate eating patterns created emotional struggles among these patients. They mentioned feeling denial and wanting to be like others. Such feelings may put people in a position where they might frequently avoid or give up trying to control diabetes in their daily lives. Living with such restrictions is troubling to the person especially when the social life is communal and the people around them are not educated about the disease or sensitive enough to it. Initially, therefore, patients need to be educated concerning and empowered with approaches to controlling diabetes that fit with the customs and norms of their cultural and social lives.

When patients were asked if they were empowered with knowledge and skills for self-care, a considerable number of them perceived the educational services provided to them as not being good, being hard to follow, and insufficient. In addition, many patients

did not perceive diabetes education as an important element associated with diabetes self-care. Medication was perceived as more important than education and lifestyle factors. Similar views of the significance of medication over lifestyle factors have been seen in other groups in the Arabian Gulf region (Abdelmoneim & Al-Homrany, 2002). For the Omani patients, the low perception of the significance of diabetes self-care education could be attributed to the fact that most of the people interviewed had low levels of education; 22/29 subjects had completed less than 12 years of education. Also, lack of practicality and cultural sensitivity, of materials and advices they have received, could be other factors related to their perception of the significance of diabetes education. On the other hand, some viewed education as an important aspect of diabetes care. This latter group of patients emphasized that the education should be pragmatic and not tedious to follow. Participants in this study seem to need practical knowledge that is helpful in dealing with diabetes in their daily lives.

Generally, it appeared that patients were given very limited advice throughout the process of being examined and treated by physicians. The type of advice provided to patients only included *do*s and *don't*s. Patients were then given informational leaflets or booklets that were general and impractical. Most subjects in this study did not actively seek information about diabetes; only a few mentioned that they sought information about the disease. Audio-visual media and peer information exchange were the main sources of information concerning diabetes self-management for these people. These types of sources of information have been reported to be used by other groups of people with Type 2 diabetes (Ezenwaka & Offiah, 2003; Nthangeni et al., 2002). Due to the lack of an organized educational program in the PHC services, it would be beneficial to

patients to introduce a well-thought-out and properly planned educational curriculum that is culturally appropriate for Omanis in order to provide good education for people with diabetes.

Fourth, the responses from this group of patients lead to the conclusion that low or lack of self-efficacy was a barrier among these patients. Self-efficacy is a major player in self-care behaviors including exercise, blood glucose monitoring, and adherence to diet plan. Based on this construct, patients might believe that an action could benefit them, but they might not act accordingly to achieve the desired outcomes due to low or lack of confidence in executing the necessary actions (Bandura, 1977). Although a large number of participants in this study perceived positive benefits to having good diabetes control, many admitted failing to adhere to recommendations. Most patients admitted that they did not commit to exercise due to personal perceptions of wellbeing, lack of time, or lack of motivation. Additionally, they did not follow diet recommendations mainly because the recommendations were not practical, did not fit into their culture, and promoted abstinence from foods. Non-adherence to exercise and diet found among adult patients in Oman is similar to that reported among different groups of people with Type 2 diabetes (Abdelmoneim & Al-Homrany, 2002; D. V. Ary, 1986). High self-efficacy score has been reported to be significantly and positively correlated with desired diabetes self-management behaviors. When patients with diabetes had higher self-efficacy scores based on a self reported survey, they were more likely to test their blood glucose, not to skip medications, not to engage in binge eating, and to adhere to good diet. Further, it has been shown that there was a negative relationship between barriers and self-efficacy. When patients perceived fewer barriers, they were more confident in diabetes self-care

behaviors (Aljasem et al., 2001). Thus, to increase self-efficacy in diabetes self-care behaviors, other barriers, such as lack of knowledge and skills, should be alleviated; and this could be achieved by appropriately supporting patients with necessary knowledge and skills.

In this study, an internal factor seemed to trigger patients' actions. Participants feared feeling poorly due to having high blood glucose levels, having kidney diseases, and losing their vision. They were motivated to control their diabetes so as to feel good. This factor is supported by the HBM concerning the potential effect of cues to trigger action (Glanz et al., 1997).

The study group in this research project had strong beliefs in traditional remedies which demonstrated that patients are seeking solutions for their health condition. Using traditional remedies has been reported among other groups of patients with Type 2 diabetes in the literature (Brown et al., 1998; Hjelm et al., 2003; Nthangeni et al., 2002). This leads us to conclude that Omani patients with Type 2 diabetes were not well-informed of the fact that diabetes is a life-long condition, that once a person has it, s/he has to learn to live with it. Research is needed to understand the effects of the popularly used traditional medications on the health of patients as well as the effect of the interaction of these medicines with modern drugs.

Passive behavior in taking charge of diabetes was revealed in this group of patients due to religious beliefs, low levels of education, and a strong trust in the role of modern medications. This could probably be linked to lack of awareness of the fact that diabetes management is actually in the patients' own hands and that it is a manageable disease. Similar beliefs of not being able to control diabetes were reported among

Mexican Americans (Brown et al., 1992). Fatalism and trust in God to take care of one's health imply dependency which can negatively reflect on the self-efficacy component of proper diabetes self-management. Findings with similar conclusions were found among Arab women with Type 2 diabetes in Sweden (Hjelm et al., 2003). The Omani patients need to be educated on the possibility and means of controlling diabetes. Such education includes empowering patients with both knowledge and skills. It is very likely that patients often lack the means to take appropriate action in managing their diabetes.

To our knowledge, this research is the first to study the health beliefs of people with diabetes in Oman and the Arabian region. It is also the first study to use qualitative one-on-one interviews with patients with Type 2 diabetes to evaluate their needs for diabetes education in Oman as well as in the neighboring countries. Individual interviews were the most appropriate method to use with the target audience since focus groups were not well received by the target population. This method provided individualized, in-depth insight concerning the patients' beliefs and perspectives about diabetes and its complications. Interviewed subjects did not influence one another's responses.

Perspective of Health Professionals about Diabetes Education Needs in Primary Health Care

Fifteen professionals were interviewed by the end of the data collection period. Of these, eight were general physicians; four were nurses; and three were diet technicians. The group had an average of 4.5 years of experience working in diabetes clinics ranging from 2 months to 17 years. However, only one person had seventeen years of experience. Of the seven clinics visited in the Governorate of Muscat, none had

a dietitian and some PHC centers did not have a stationed diet technician or a health educator. The situation was eased by having one diet technician or a health educator rotate between two or among three centers. Table 3 shows the demographic information of the professional participants.

Table 3: Demographic Information of Professional Participants

Clinic	Participant	Gender	Position	Experience in diabetes clinic
SehAldhbi	1	F	Diet Technician	2 years
	2	F	Nurse	2 years
	3	M	Physician	4 years
Adhaiba	1	F	Diet Technician	3 moths
	2	F	Nurse	2 years
	3	F	Physician	3 years
	4	F	Physician	10 months
Gubra	1	F	Nurse	1 years
	2	F	Physician	17 years
	3	F	Physician	5 years
	4	F	Physician	2 years
Wataya	1	F	Diet Technician	3 years
	2	F	Nurse	2 months
	3	M	Physician	4 years
Ashadi	1	F	Nurse	1 years

Based on an interview with the senior dialectologists in the Governorate of Muscat, Dr. Hani Najib, who oversees PHC in the health region, explained that the setting for diabetes clinics in primary care in Oman includes a team of a doctor, a nurse, a dietitian or a diet technician, and/or a health educator. The term *diet technician* refers to a professional with an associate degree in nutrition; *health educator* indicates a

professional with an associate degree in health promotion. He mentioned that the largest number of patients with diabetes is seen in the PHC centers. In the clinics, patients are seen by doctors; and they lead the course of work. Nurses play a supporting role in the clinics. They help doctors in the process of examining patients by documenting blood test results and other parameters in the diabetes registry and in the patients' diabetes/hypertension booklets. Nurses in all PHC clinics are responsible for keeping the diabetes registry. The role of dietitians and/or diet technicians is fairly new in the PHC setting. Availability of dietitians or diet technicians in PHC centers was limited at the time of the interviews.

Interviews with health professionals in PHC provided insight into their daily practices pertinent to nutrition education of patients with diabetes. In the process of examining patients, cases are handled by two members of the clinic: doctors and nurses. When asked about the feasibility of educating patients, doctors (6/8) and nurses (2/4) indicated that they did not always educate patients but they did when patient turn out in the clinics was not high: "I educate when the clinic is not crowded" and "I don't educate very often depending on how crowded the clinic is." In addition to time barriers, professionals mentioned that patients did not want to spend enough time in the clinics to receive education; this feeling was indicated in the following statements made by health professionals: "Patients must agree to spend more time in the clinic" and "Patients want to take medications and leave." On the other hand, all of the diet technicians (3/3) mentioned that they only got to see patients for counseling when they were referred to them: "I have time but I don't get to see many patients." Only 3/8 doctors mentioned referring patients to diet technicians. When counseled, patients are educated on

individual basis between the patients and the educators, regardless of profession. Educating patients in groups had not been approached in the PHC centers included in this study.

Some doctors, however, pointed to the lack of a stationed dietitian/diet technician in their clinic as a barrier to educating their patients. They noted that they would like to have such a professional available full time in the clinics.

All professionals provided supporting educational materials to patients. However, most of the materials available were mainly concerned with diabetes symptoms and complications. Only diet technicians provided educational materials pertinent to nutrition. Preset one-day and three-day meal plans were the only nutritional materials found among the diet technicians. Most professionals (13/15) perceived the educational materials available to them as either needing to be improved or not being so good, stating, "They need to be revised", "They are not good because they contain a lot of writing, and they don't have pictures; people do not have the patience to read long text; ...materials with visuals will be better in getting the attention of the subjects", "I rate them as 50%", and "They provide general recommendations." In addition, all participants expressed that they needed more patient-oriented educational materials or programs in their settings.

Concerning the characteristics of diabetes education materials and programs which they thought would be of benefit to their patients, professionals noted that they wanted materials that are more specific and that elaborate on diet and exercise. They wanted materials "To be detailed in terms of caloric intake and activity level"; "People need specific information about how much to eat of specific foods", and "Nutrition and

diabetes... all we have is on general awareness about the disease." Furthermore, they emphasized that the materials should be culturally sensitive: "They need to take into account that lunch is the main meal in our culture", "Patients ask how much rice they should eat at lunch and dinner"; "Give me information about foods from our culture not the Saudi culture."

Booklets, pamphlets, and posters, were named as the most desired format for educational materials/programs. Professionals also expressed the need for a comprehensive audiovisual program that covers all aspects of diabetes management which could be displayed for patients while they wait to meet with doctors. They also suggested that printed materials have minimal text and be easy for patients to understand without having to read long text.

With respect to patients' understanding of the role of dietitians/diet technicians, both doctors and nurses mentioned that they explained their role to the patients. However, doctors (4/8) indicated that some patients did not welcome the idea of meeting with such professionals to discuss diet while others refused to meet with them because they viewed the diet technician's role as unnecessary and a waste of time: "Once I say that I'm referring them to the dietitian (diet technician), they say there is no need for it", "Some say that they don't have the time to listen to so much talk that they will not follow", and "The majority don't think diet will make a difference...medicine comes in the first place." Only one nurse mentioned that "they think of them as docs who prohibit them from what they like." Diet technicians, also, mentioned that many patients did not accept their role and did not show interest in meeting with them: "We are new in the

system.....they think we should give them papers on nutrition only and that we don't need to communicate."

When asked whom patients tended to trust most for nutritional information, the majority (11/15) strongly expressed that patients, particularly with low levels of education, tend to trust doctors most concerning diet-related topics. This attitude was reflected in the following statements: "They trust doctors more because they think doctors should know about everything", "They trust us (doctors) even if we give them wrong information about diet", "It's the biggest problem that I (diet technician) face many times ...doctors give incorrect information sometimes.....they (patients) say how come you are saying otherwise", and "It is hard to correct diet information after doctors."

When professionals were asked about what they thought of their patients' understanding of the multiple aspects of diabetes management, they (8/15) indicated that not all patients understand the role of diet and exercise. But they (7/15) thought that most patients understand the role of stress in elevating blood glucose as patients explain it to them fairly well. Most professionals pointed out that patients see medication as the key player in controlling diabetes.

When asked about what they needed to help facilitate their role in educating patients, professionals said they wanted informational materials that are comprehensive, and they also wanted classes for their patients. More information about nutrition, stress, the food pyramid, the plate model, and glycemic index were mentioned by several participants as being desirable: "Give me information about foods from our culture not the Saudi." Also, some wanted to learn about different methods of exchanging

information between professionals and patients: professional-patient communication skills. Table 4 summarizes primary findings of interviews with health care professionals.

Table 4 Summary Findings of Professional Interviews

Theme	Responses
Barriers to patient education	Lack of time – patient turn out (doctors & nurses) Lack of referral (diet technicians)
Quality of available educational materials	Perceived as either needing to be improved or not being so good
Patients' understanding of the role of dietitians/diet technicians	Patients did not welcome meeting w/dietitians/diet technicians Patients did not show interest in meeting with them
Whom patients trust most for nutritional information	Patients trusted doctors
Professionals' needs in educating patients	Comprehensive informational materials (nutrition, stress, the food pyramid, the plate model, and glycemic index) Classes for patients

Discussion

The professional interviews showed that diet technicians play a minimal role in counseling patients. From the perspective of diet technicians, lack of referral was the main barrier in educating patients. From the doctors' perspective, lack of time, hassling patients, and lack of in-house dietitian/diet technicians were the main barriers to educating patients. Lack of time was the main barrier for nurses as well. With reference to the Diabetes Mellitus Management Guidelines (DMMG), dietitian/diet technicians and health educators should have the main role in educating patients with diabetes (Ministry of Health, 2003). Based on this study, it appears that the role of diet technicians needs to

be asserted in the facilities to make use of any related manpower available to benefit the patients.

The time barrier facing doctors and nurses due to high turnout of patients could be overcome with a proper use of dietitians/diet technicians/health educators in the clinics. All diabetes clinics are conducted during regular working hours in the country. Hassling and unwillingness of patients to stay for diabetes education could be attributed to time issues. In the case of employed patients, usually they are in hurry to get back to work. In the case of patients who are homemakers or parents, they are restricted by the time constraints on those who take them to the clinics; often, these are spouses or children that are required to get back to work as well. As a result, patients are often in a hurry, and education becomes inconvenient. Different approaches to diabetes education could be tested with these patients. For example, group diabetes education sessions held after regular working hours could be tested. To provide a comprehensive diabetes self-management education, multiple sessions are required, which could be provided over time. Another alternative would be to give patients appointments at times other than their follow-up appointments for diabetes and diet education.

There is no formal comprehensive diabetes education program in the country. With regard to available educational materials, professionals rated them as being, mostly, poor. Some materials were reviewed, and they were found to have long, dull text and to lack pragmatism. Professionals rely on foreign sources to counsel patients. As a result, dietary advice is provided without adjustment for the culture in which it is applied. Preset diet plans, one-day or three-day, and a list of recommendations were found to be the most common dietary education strategy and type of materials given to patients.

Preset diet plans are difficult to follow; and, rigidness is an inherent characteristic of this strategy. This was reflected in the negative views of patients concerning the educational materials they had received.

Professionals expressed their desire to have materials that provide pragmatic advices, that are easy to read and to understand, and that are culturally sensitive. Suggested topic areas included nutrition in diabetes education, general awareness information about diabetes, and notification about the significance of follow-up visits. Leaflets, booklets, posters, and audiovisuals were suggested. For their professional development, participants named comprehensive information about the food pyramid, plate model, and glycemic index as the topics about which they wanted to learn more. With these methods of meal planning, professionals wanted to learn how to apply Omani foods, particularly mixed dishes.

Limitations of the Study

The findings reported in this study should be interpreted with caution due to limitations in the selection of the study sample. A convenience sample of clinics was approached based on the distance between the clinics and the residence of the interviewer. Only clinics that were not more than a 45 minute drive (on the highway) were approached. A time constraint was another factor limiting clinic selection based on traveling distance. Data was collected from Muscat, Oman, and there was just 26 days to collect data. Within clinics, there was no systematic approach used in selecting volunteers from both groups of patients and professionals. All people who were randomly approached and agreed to participate were included. Also, interpretation bias

of qualitative data analysis is a potential characteristic impacting this type of study. Data for this study was only collected from one region in Oman; thus results could not be generalized to people in other regions. Finally, interviews with patients were conducted in Arabic and then translated into English. To increase the value and accuracy of the data, an independent bilingual colleague (dietitian) reviewed the transcripts against the original audio tapes, but language could be a small factor affecting this study.

Conclusion

In this study, one-on-one qualitative interviews have been successfully applied in evaluating needs for nutrition education of people with Type 2 diabetes in Muscat, Oman. For the study sample, the method assisted the researcher in gaining insight into and understanding of the health beliefs and barriers of patients relevant to diabetes self-care that in turn revealed educational needs. These findings were valuable in planning a diabetes education program and accompanying materials.

Barriers to optimal diabetes self-care were identified as having to do with inadequate finances, social commitments, lack of practical and cultural knowledge of diet and exercise management skills, and issues of self-efficacy. Also, the study identified other matters applicable to diabetes self-management. These included the feeling of being denied in the process of diet control due to widespread use of the recommendation to avoid a variety of foods and the lack of practical advice and educational programs and materials for people with diabetes in Oman.

About 51.7% (15/29) of the patients perceived they were equipped with the essential knowledge and skills needed for diabetes self-care. However, this perception is

open to concerns for several reasons. First, a large number (22/29; 75.9%) of the participants had less than 12 years of education. Second, about 48% (14/29) of the patients claimed not to have received good support from the clinics. Third, many people did not consider education in diabetes self-care to be a significant element. Fourth, a large number of the study sample did not independently seek information about diabetes. Fifth, educational materials found in the clinic are not pragmatic, and dietary advice was based on short lists of *do*s and *don't*s in the doctor's office. Sixth, diet counseling was based on pre set meal plans that are difficult to follow and to apply on daily basis, especially for people with low levels of education. Seventh, all professionals but two perceived the quality of the educational materials to be poor and in need of more pragmatic resources. Eighth, patients are not provided with alternative strategies to increase physical activities given the hot climate of the country; they are only advised walking. Ninth, overall, patients acknowledged not adhering to recommendations which implies their lack of skills to act and probably low self-efficacy in taking action. Tenth, there is the element of a very passive attitude towards taking action and protecting one's self due to trust in Allah/God. Eleventh, professionals acknowledged barriers in educating patients that include lack of time on their part and lack of time and patience on the part of patients in staying in the clinics long enough to receive comprehensive care. Twelfth, professionals cited patient refusal to meet with diet technicians as a barrier to proper education and diabetes management. Thirteenth, only a few doctors mentioned having referred patients to diet counseling.

This study helped to understand the perspective of professionals concerning diabetes patients' educational needs, the characteristics of future educational programs

and materials, and the needs of professionals for continuing education. Professionals felt that patients mostly valued the effect of medications. Lifestyle factors in managing diabetes were not seen as important. Such beliefs influence patients behaviors and are related to the many barriers identified in the interviews with patients and described above.

Furthermore, the PHC settings lack a formal comprehensive diabetes education program. The role of dietitian/diet technicians is new in the system; this group of professionals was sometimes seen as being not as credible as doctors when it comes to education. Available educational materials do not provide daily life practical skills. The materials were seen as poor by both patients and professionals; they were not pragmatic, were difficult to apply, and were not culturally sensitive. Dietary recommendations provided to patients concentrated on avoiding foods. All of these factors could be behind patients' refusal to interact with diet technicians. Cultural insensitivity of dietary recommendations stems from the fact that health professionals lack access to practical advice in these areas due to a gap in availability of appropriate education programs and materials. With no exception, these professionals expressed the need for culturally appropriate and easily comprehendible educational materials for successful diabetes education. Specificity and applicability of educational materials were seen as desirable. Professionals were interested in learning about lifestyle diabetes self-care matters. Clearly, training professionals is a principle element in implementing an effective program geared toward patients and their specific needs.

Custom, culture, and religion need to be accounted for in planning educational activities. It would also be beneficial for patients to learn assertive but culturally

appropriate skills in controlling food intake at social gatherings. It would also be of great significance to educate the public at large in Oman on their obligation to cater to the needs of persons with diabetes at social gatherings by not pressuring them to adhere to customs that may be detrimental to their health.

Additional qualitative studies of people with diabetes and PHC professionals should be conducted locally in different regions in Oman to understand the health beliefs of this population at large, and to gain insight into their needs for diabetes education. This study could be seminal for further studies about diabetes education in the area.

DEVELOPING AND PILOTING A CULTURALLY SENSITIVE DIABETES EDUCATION PROGRAM

Introduction

Diabetes is a life-long condition that can lead to acute debilitating complications affecting the quality of life of those who have the disease and that of their families (IDF, 2005). Such effects include disability, work loss, and premature mortality which may also be counted as indirect costs of diabetes (Hogan et al., 2003). Furthermore, the effects of diabetes can also be seen in the estimated direct medical costs associated with diabetes medical care. This direct cost of diabetes affects entire nations and societies (Hogan et al., 2003; WHO, 2003). There are several types of diabetes and Type 2 is the most prevalent form of diabetes mellitus in the world (IDF, 2007). It is characterized by relative, and not absolute, insulin deficiency (WHO, 1999).

Globally, unhealthy diets and lack of physical activity are the leading causes of non-communicable diseases including Type 2 diabetes (WHO, 2004). Most people with this form of diabetes can usually manage the disease through good self-management of lifestyle factors (diet, physical activity, alcohol intake, and smoking). The goal for disease self-management is to maintain good metabolic control (near normal blood glucose levels, lipids, blood pressure, and desirable body weight) which helps to prevent or delay future complications and ill-health (WHO, 2004).

The significance of lifestyle factors (diet and physical activity) in diabetes control has been proven in several studies concerning diabetes education (Gary et al., 2003; Sadur et al., 1999; United Kingdom Prospective Diabetes Study Group, 1990). Because day-to-day control of diabetes is the responsibility of patients, persons affected with diabetes need to learn effective skills for self-care (Carey & Daly, 2004). Therefore, diabetes education programs should involve discussion of comprehensive plans and should be an integral component of diabetes management empowering people with diabetes to strive for better quality of life (IDF, 2005). Education concerning such life-long health conditions needs not only to convey knowledge but also to provide practical skills that are easy to comprehend and to follow as part of an individualized care plan (ADA, 2003).

The International Diabetes Federation (2007) commented that the evidence shows that the number of people with diabetes is increasing, yet the awareness of the public about effects and treatment of diabetes remains low. As previously mentioned, the national health statistics in Oman indicate that the nation is being faced with the challenge of the increasing prevalence of diabetes. From 2001 to 2005 there was a 78.5 percent increase in the number of people with diabetes (Ministry of Health, 2002, 2006a).

As a logical and systematical approach to devising educational programs for the target population, assessment of needs was perused as reported in the previous chapter. Based on that assessment of educational needs in Muscat, Oman, no formal comprehensive diabetes education program was found to be in place. The available educational materials were perceived to be mostly poor and lacking pragmatism. They merely provide general recommendations while patients and professionals expressed their

need for guiding information that would help people take proper action in lifestyle behaviors. Only one approach to nutrition counseling was found to be in practice: one-day or three-day sample meal plans which people found hard to follow.

Further the assessment helped to identify both patient barriers to good lifestyle behaviors and professional barriers to educating patients. The most significant patient-specific barriers to optimal diabetes self-care in Oman were identified as inadequate finances, social commitments, lack of practical and cultural knowledge of diet and exercise management skills, inaccurate knowledge, and issues of self-efficacy. Furthermore, the study showed that there is a widespread practice of recommending food avoidance, but there is a general lack of practical advice, educational programs, and materials for the target population. In addition professionals working with the target population expressed a need for educational materials that are culturally appropriate, easily comprehendible and applicable. Also, professionally specific barriers were identified as lack of time by doctors and nurses, and lack of referrals by diet/technicians.

As previously mentioned, barriers identified among the target population could be attributed to inadequate and inaccurate counseling that they receive from the health professionals in PHC. It has been reported that patients in many cases have received inaccurate information from their health providers (Murray et al., 1993; Nthangeni et al., 2002). To overcome such barriers, health professionals have recommended that they be retrained with culturally appropriate nutrition counseling (Nthangeni et al., 2002). In its 2004 position statement, the American Diabetes Association asserted that health professionals be educated concerning new nutritional guidelines and that they be given access to simplified educational tools to provide to their patients (American Diabetes

Association [ADA], 2004a). Moreover, the IDF strongly recommends not only that *education* be an integral part of diabetes management but also that professionals be trained in various approaches to diabetes and the delivery of educational information to patients (IDF, 2005).

Training health professionals who provide diabetes education is an effective strategy to ensure that they gain a good understanding and mastering of the education program before they can effectively implement it. When the program "From the Pyramid to the Plate" was piloted with health professionals, participants (n=75) showed improved knowledge and skills, relevant to the program. However, the professional knowledge and skill were assessed based on a short questionnaire (15 items); and they improved on seven items only between pre and post test (Kunkel & Luccia, 2004).

In a study evaluating the effect of intensive patient and/or physician diabetes education, positive outcomes were observed in patient metabolic indices. Physicians (n= 45) and their patients (n=532) were randomly assigned to one of four groups, control, only patient education, only physician education, and both patient and physician education. Physicians were trained on a program that emphasized attitudes, beliefs, skills, clinical support, and clinical knowledge. The study also educated patients on diabetes self-management behaviors. When only patients were educated, there was a significant decreased in average Fasting Plasma Glucose (FPG) (27.5 mg/dL) and HbA1c (0.43%) compared to a control group which showed an average decreased of 2.7 mg/dL for FPG and an average increase of 0.35% in HbA1c. In the group in which only professionals were trained, patient glycemic indices also significantly decreased (26.1 mg/dL for FPG and 0.39% for HbA1c) compared to the control group (4.1 gm/dL and

0.31% HbA1c). When both patients and physicians were educated, patient metabolic indices were even lower than that of only patient and only physician education groups. FPG decreased by an average of 39 mg/dL and HbA1c decreased by an average of 0.92% while those of the control group increased by an average of 7.7 mg/dL for FPG and 0.56% for HbA1c (Vinicor et al., 1987).

To address the needs of people with diabetes, it is very crucial that members of the diabetes team (doctors, nurses, dietitians, diet technicians, and health educators) work in unison, combining their areas of expertise in order to educate people with diabetes in the most effective way. Based on the DMMG for Primary Health Care (Ministry of Health, 2003), all members of the diabetic team must share the responsibility of educating diabetic patients. As discussed, one important aspect of diabetes management is nutrition education. However, the guidelines provided in the DMMG are too broad and lack practicality in daily practice given the increase in number of people diagnosed with diabetes and the current workloads of health professionals in Oman. Therefore, it is important that a nutrition education program designed for people with diabetes be developed for Oman. Also, it is necessary that the program be implemented in the health care facilities and health professionals be trained to ensure consistency of advice and the promotion of sound diabetes self-management techniques.

The purposes of this study were: 1) to develop a culturally-sensitive diabetes education program and related printed materials for the Omani culture based on the Dining with Diabetes in Colorado program; 2) to develop a knowledge/attitudes questionnaire; 3) to pilot a culturally appropriate education program and materials with health professionals in order to train them by holding a one-day intervention; 4) to

evaluate the effectiveness of the program by examining any change of knowledge/attitudes using a quasi-experimental design (nonequivalent group time series); and, finally, 5) to collect professional evaluations of the quality of the program/materials for improvement and revision purposes.

Methods

Based on the findings of the first assessment of educational needs with the target population and its diabetes health care team in the PHC in Muscat, Oman, it was possible to identify the best approach in adapting a diabetes program from among the many existing ones that have been devised in different countries. Initially two programs were reviewed, the "Dining with Diabetes in Colorado" (Colorado State University Cooperative Extension & Colorado Department of Public Health and Prevention, 2004) and "From the Pyramid to the Plate" (Clemson University Department of Food Science & Human Nutrition, 2003). The programs were carefully reviewed, and the decision was made to adapt one over the other based on the comprehensiveness of the program. The comprehensiveness of the program was a concern when selecting the program due to the fact that the PHC system in Oman is lacking an educational program for the target population in the first place. The "Dining with Diabetes in Colorado" was favored over the second programs for the reasons explained below.

The program from Clemson University mainly concentrates on meal planning by combining the concepts of the United State Department of Agriculture Food Guide Pyramid (USDA-FGP) and timing of meals to put the "consistent- carbohydrate" meal planning approach in practice. The Dining with Diabetes in Colorado is an enhanced

version of two programs, the "Dining with Diabetes" program which was developed through West Virginia University's (WVU) Cooperative Extension and the "Diabetes in Idaho" program which was developed in the University of Idaho's Cooperative Extension System. The Colorado program is a four-class program with a one-month reunion. It emphasizes the plate method and provides information concerning desirable, advantageous self-management behaviors involving goals for metabolic control, complications, significance of blood monitoring, exercise, and food safety (Barker, 2003).

A major concern with the "From the Pyramid to the Plate" curriculum was the use of the USDA-FGP. It was deemed inappropriate because the grouping of foods in the DFP is based on the carbohydrate and protein content of foods while that of the USDA-FGP is based on classification of foods (ADA, 2005). Furthermore, the "From the Pyramid to the Plate" program lacked information concerning general knowledge about diabetes and its complications, food safety issues, components of physical activity, and blood monitoring. However, all of these points were addressed in the other program under investigation. Therefore, the decision was made to adapt the "Dining with Diabetes in Colorado" program to the needs of Omani diabetic patients.

Adaptation of the "Dining with Diabetes in Colorado" for Oman

After comparing the two programs mentioned above, a decision was made to adapt the "Dining with Diabetes in Colorado" for the reasons stated earlier. To start with the process of adapting the program, the components of "Dining with Diabetes in Colorado" were thoroughly studied further: lessons were systematically and critically

reviewed in relation to the Omani culture and society. Any elements or sections that were viewed as not fitting the Omani culture and society for which the program was to be adapted were marked and investigated before a final decision was made to eliminate or modify such sections. Food products available in four major supermarkets in the region were surveyed in the process of adapting the program. Thus, the following approaches were used in adapting the curriculum presented in this study.

The concept of nutritional facts and information (food labels) was the first topic from "Dining with Diabetes in Colorado" to be analyzed and eliminated. The main reason for its elimination was its dependence on American standards in reporting nutritional information while it was found that Oman lacks standards/strategies for reporting nutrition facts on processed products. That is to say, different types of food products were obtained from supermarkets in Muscat region, including ready-to-eat cereals, canned products, and refrigerated and frozen products to evaluate the consistency in reporting nutritional information. By studying the labels on the products, it was found that, while some products included nutrition information in the format similar to that reported in the USA, some either had a different format or did not have any nutritional facts reported at all. The section on food labels in the program teaches carbohydrate counting by using information that is readily available on food products. It was determined that it would be impossible and fruitless to teach this concept in Oman due to lack of standards in reporting nutrition information in the country. Therefore, this section was dropped in creating the adapted version of this study.

Information about foods that are not commonly used in the Omani culture was substituted with information regarding more common foods from the culture. For

example, enchiladas were substituted with hareess; and stir fry was substituted with thareed. All of these foods represent mixed dishes. Other foods, such as tofu, were totally removed because they were perceived as not fitting the cultural diet and practice at all. The aim of the program was not to introduce new foods to the culture but to familiarize participants on how they should view cultural foods within the context of diabetes management.

Because there is no comprehensive nutritional analysis of cultural foods in Oman, several approaches were taken to obtain estimates of portion sizes and nutrition information concerning ethnic foods. When dishes were similar, tables of nutrient analyses from two countries in the Arabian Peninsula: Bahrain (Musaiger & Al-Dallal, 1985) and Kuwait (Sawaya, Al-Awadi, Eid, & Dashti, 1998) were used to come up with estimates of portion sizes of cultural foods. In this case, ingredients and recipes of dishes from these two cultures were compared with those in a popular Omani cook book "Al-Azaf: Omani Dishes" (Al-Tai, 1994). When recipes were comparable, data from these sources was used. In cases when there were no comparable dishes from the two references mentioned above, the Genesis for Windows version 7.8.0 (ESHA Research Inc., 2005) software was used to create nutrition facts labels for the desired dishes based on the recipes from the Al-Azaf: Omani Dishes (Al-Tai, 1994). Serving sizes were determined based on carbohydrate content of foods since this is the accepted basis for determining diabetes serving sizes. Each serving of any food had no more than 15gm of carbohydrates based on the concept of the Exchange Lists (American Dietetic Association & ADA, 2003). Also, other sources were consulted to estimate the macronutrient content of some foods commonly consumed in Oman (Food and

Agriculture Organization of the United Nations, 1982; Wu Leung, Butrum, Chang, Rao, & Polacchi, 1972).

Also, an element of visual clues was added throughout the program where applicable. This addition was thought to be important because it provided practical reference points in estimating appropriate serving sizes (Rizor & Richards, 2000) and also because the use of visual messages was found to be effective for adult learners (Kicklighter, 1991). The visual clues referenced in classes were based on the use of the hand, common household measures, and other items that are commonly known by the public such as a tape cassette or a small match box. The use of these types of visuals was preferred over food models because the availability of resources is limited in the clinics; and these do not incur high costs. Also, these are resources that the typical Omani household contains making it easier and more practical for the diabetes patient to apply.

The availability and the form of artificial sweeteners referenced in the original program were compared to those available in the Omani market. Minor changes were made accordingly; the liquid form of artificial sweeteners was not found in the Omani market. Cooking examples were dropped for three reasons. One, the program was directed at health professionals. Two, there is the need to experiment with modifying cultural recipes before providing this type of hands-on activity as it is presented in the Colorado version of the program. Three, based on the current assessment, the settings in PHC centers do not allow for such practice when the program is applied to educate patients. Also, future investigation is required to learn the feasibility and acceptance of including this component in the adapted version of the program.

Also, the form of language was changed in order to help the health professionals empower their patients. The program emphasized that professionals clearly explain the link between high blood glucose and diabetes complications by explaining such link in very simple language. All graphics that did not seem to reflect the culture were changed to represent something from the culture.

The original "Dining with Diabetes in Colorado" program is a power-point slide show with accompanying printed materials. The same format was retained for the adapted version of the Omani program because it represented an audiovisual format for which professionals had expressed a desire in the needs assessment phase of the current study.

In the process of adapting the educational program, the decision was made to pilot the program by means of the internet as a long-distance training program. This decision was made due to time constraints, as it was not feasible for the researcher to travel to Oman at the time. This decision was also the result of a precautionary measure in avoiding unreliable videoconferences across the oceans if it were to be piloted by such means. Also, with regard to the future, establishing the program as a computer-based one will facilitate smoother implementation in other regions in the country given that appropriate changes have been made based on the pilot test.

The program content was revised four times before the final version was produced. It was also reviewed by an expert in the field. The program was called "Dining with Diabetes." Once the final version was reached, audio files were recorded and then packaged with the power point slides. Finally the presentation was loaded on the Colorado State University Food Science and Human Nutrition department website;

and a link was created and provided to workshop moderators in the Department of Food Science and Nutrition at Sultan Qaboos University, Oman.

The final version of "Dining with Diabetes" is divided into six modules. The first module presents the objectives of the program and background information about the types of diabetes, insulin action, diabetes symptoms and complications, and tests involved in monitoring patients with diabetes. The second module presents approaches in meal planning. These include the use of the DFP and the plate method in conjunction with visual clues to assist patients in estimating serving sizes. Also, this module provides practical examples of how to analyze cultural foods within the plate model. The third module provides a description of the relationship between carbohydrates and glycemic index and glycemic load. This module also expands on the concept of visual clues for determining the serving size of foods from the carbohydrate group. The fourth module elaborates on carbohydrates and provides useful information about the use of sugar substitutes. The fifth module covers dietary aspects relevant to the health of the heart. First it covers foods containing healthy fats; it then shows the importance of calcium for both the heart and bones; and then it provides tips for lowering salt intake. The sixth module covers guidelines for physical activity, blood glucose monitoring, and food-safety issues relevant to people with diabetes. Table 5 represents the content and the length of the Dining with Diabetes modules.

Table 5: the Dining with Diabetes Module Contents

Module	Focus	Length (minutes)
1	Background information about diabetes: insulin action, diabetes symptoms and complications, and tests involved in monitoring patients with diabetes	30
2	Meal planning approaches: plate method, DFP, and visual clues	40
3	Relationship between carbohydrates and glycemic index and glycemic load	15
4	Carbohydrates: sugar substitutes	26
5	Heart healthy eating	24
6	Physical activity, blood glucose monitoring, and food-safety	22

Development of Printed Educational Materials

Printed educational materials that go with the PowerPoint presentation were developed, and others were adapted from the original "Dining with Diabetes in Colorado" program. Three kinds of materials were developed: a plate model flyer, DFP and visual clue booklet, and an activity log booklet. All the printed materials were provided in Arabic and English as per the suggestions of the health professionals. The plate model flyer is similar to that of the Idaho plate method with the element of visual clues included. The DFP and visual clue booklet provides information concerning the different food groups and examples of appropriate serving sizes based on visual clues. The activity log is to be used by patients to record their activity levels and to share that information with their health professionals. All printed educational materials were reviewed by a bilingual dietitian from Oman.

Development of Knowledge and Attitude Quantitative Questionnaire

After developing the cultural educational program, the next step was to pilot the program with health professionals to determine its effect on professional knowledge with reference to the education program. Initially, a questionnaire was developed based on a review of the literature. The "knowledge" portion of the survey was based on the instrument used for "Dining with Diabetes in Colorado" which had previously been tested for reliability and validity (Barker, 2003; Colorado State University Cooperative Extension & Colorado Department of Public Health and Prevention, 2004). Any questions that did not seem to be appropriate for health professionals were changed or dropped. Also, additional questions were formulated and added based on the culturally adapted program. Then, sections on perceived self-efficacy, barriers, and education-importance were developed and added based on the findings of the needs assessment and on different studies relevant to the continuing education needs of health professionals in diabetes education (Cadman & Wiles, 1996; Crutcher, Then, Edwards, Taylor, & Norton, 2004; Nicholas, Pond, & Roberts, 2005; Nicholas, Roberts, & Pond, 2003). The first draft of the survey consisted of 87 questions, 70 multiple-choice questions and 17 Likert scale items. The survey was reviewed by a panel of experts as indicated below.

Assessment of Validity

Content validity is the degree to which a study instrument samples items from the desired content (Windsor, Baranowski, Clark, & Gutter, 1994). To ensure that the survey was sampling items from all contents of the program, it was reviewed by an expert faculty member in the field from the department of Food Science and Human Nutrition (FSHN) at Colorado State University (CSU).

Face validity is the degree to which an instrument appears to be measuring what it is intended to measure (Windsor et al., 1994). For this purpose, the questionnaire was reviewed in the USA by two faculty members from the department of FSHN, one statistician, and one registered dietitian expert in diabetes research, who also was an expert with the education program "Dining with Diabetes in Colorado". In Oman it was reviewed by two doctors from Khoula hospital. Based on the feedback received, changes were made; some questions were reworded for clarity, more transitional explanations were added before each section, and negatively worded questions were minimized.

Assessment of Reliability

Reliability is the extent to which an instrument can generate similar results over time. It can be established by two methods, by correlating a measure with another one that is parallel or by test-retest method (Parmenter & Wardle, 2000). A test-retest method was applied to evaluate the reliability of the survey in this study. The survey was given to 23 individuals, 11 in the USA and 12 in Oman. The survey participants in the USA included two graduate students and four research assistants from the FSHN department and five health professionals (three doctors and two nurses) from the CSU Hartshorne Health Center. Because the survey was designed for health professionals in Oman, 12 health professionals in Oman (five dietitians from Sultan Qaboos University (SQU) and six nurses and one diet technician from Khoula hospital) also participated in the test-retest. All individuals completed the two tests with one week gap between the test and the retest.

Data was entered into SPSS for Windows version 14.0 and analyzed by Pearson correlation coefficient and paired sample t-test statistics. Analyses were done on eleven

scales: general knowledge, plate method, DFP, carbohydrates, food safety, physical activity, heart healthy eating, behaviors, barriers, self-efficacy, and education importance. The first seven scales represented topics in the education program. The last four scales represented professional attitudes.

All scales but two were found to be significantly correlated on the test and retest ($p < 0.05$) with an r range between 0.57 - 0.95. The two scales that did not correlate significantly were questions related to heart healthy eating and education importance topics with an r of (0.24) and (0.45), respectively. The lack of correlation in these two scales could be attributed to the few numbers of questions in each scale. However, paired t-test analyses of all scales showed no significant differences ($p > 0.05$) between the means of the two test sets. Also, correlations and paired t-tests were done on each question individually to identify specific questions that were problematic. Minor changes were made based on all the steps followed in developing the questionnaire. The questionnaire was revised and a final version of the survey with 61 questions was reached (Appendix C: Dining with Diabetes Survey).

Assessment of the effect of the educational program was achieved using this instrument. The survey included assessment of demographic information (five items) which was obtained via fill-in-the-blank or multiple-choice items. General knowledge related to diabetes management, nutrition (including function of fiber, effects of nutrition on blood glucose, the concepts of glycemic index and glycemic load etc.), physical activity, and food safety issues were assessed with 20 multiple-choice items with 35 possible correct points; some questions had multiple corrects answers. Diet knowledge was evaluated through 19 multiple-choice questions which covered practical knowledge

about the plate model, DFP and visual clues. This section had a total of 37 correct possible points. In addition, two multiple-choice items inquired about whether or not participants had any former knowledge about the plate model and DFP.

Also, the survey assessed self-efficacy of health professionals in applying learned nutrition topics using a 10-item Likert scale, professional perception of the importance of patient education using 4-item Likert scale, and perceived barriers to educating patients using a 12-item Likert scale. All Likert scales ranged from 1 (strongly disagree) to 5 (strongly agree).

Development of the Qualitative Program Evaluation Instrument

The program evaluation instrument was designed based on an open-ended questionnaire consisting of eight questions (Appendix C: Dining with Diabetes Evaluation Form). Initially, the instrument was based on the "Dining with Diabetes in Colorado" program evaluation form. The original questions were modified to make them more appropriate for use with health professionals. Also, more questions were added related to the printed educational materials. The instrument was reviewed for clarity and wording by an expert faculty member in the field from the Department of Food Science and Human Nutrition, CSU.

Human Subject Approval

Once appropriate recruitment materials, consent forms, and the quantitative and qualitative evaluation instruments were developed, approval to pilot test the education program was obtained from the CSU Human Research Committee (Appendix D). An approval for the complete projects also was obtained from the Ministry of Health, Oman

(Appendix B). When the project was approved, a workshop schedule was planned (Appendix E).

Issues in Planning the Professional Training Workshop

The logistics of the workshop changed during the process of correspondence with the Director of Planning and Training (Directorate General of Health Services, Governorate of Muscat). Initially the program was planned as a two-day workshop. However, the director of training expressed concern about the number of working days that would be missed and the resulting staff shortage in clinics. Consequently, the workshop was presented as an eight-hour, one-day workshop. The same workshop was given twice in order to overcome the conflicting schedules of health professionals and to recruit as many as possible to participate in the study. The workshops were held on January 29 and January 30 of 2007.

The workshops were held in a conference room at SQU. The education program was launched from the internet to a group of participants in the conference room. It was not possible to get a computer lab where each participant could access the program independently. Also, it was not possible or practical to ask participants to access the education program from their homes because many of the professionals did not have access to the internet.

Previously, during December of 2006, five volunteers were trained to moderate the process of the workshop. Two were administrators and one was a technical support personnel in the college of Agricultural and Marine Sciences; and two were nutrition graduate students from the Department of Food Science and Nutrition of the same college at SQU. They went through a rehearsal workshop. The group set up the conference area,

arranged to obtain a laptop from the department, learned to set up and connect the computer to the LCD, downloaded a trial version of the educational program, and completed the survey and the evaluation forms. All their concerns were addressed, and any unclear matters were clarified.

Subject Recruitment

The study population consisted of health care professionals (doctors, nurses, dietitians, diet technicians, and health educators) from the diabetes clinics in the PHC centers in Muscat, Oman. As of December of 2006, there were 22 PHC centers. Workshop recruitment and sign-up materials were sent to all PHC clinics in the region (Appendix F). People who signed up provided their names, work locations, and contact information. This type of information was necessary for tracking participants for the follow-up survey.

Sign-up materials were collected from the clinics after having been posted in those locations for one month. All names were put in one workshop attendance form based on the date of the workshop. At that point, 45 people had registered for the workshop from 18 PHC centers in the region, 31 for the first day (January 29, 2007) and 17 for the second day (January 30, 2007). Two days before the workshop, all participating health centers (centers employing professionals who had signed up for the workshop) were given a reminder call concerning the workshop and its location.

Comparison participants were recruited from the PHC clinics that did not have people participating in the intervention workshop. Recruitment and sign-up materials pertinent to the comparison group were posted in clinics (Appendix G). All consenting participants signed consent forms (Appendix G) and provided their names and contact

information for follow-up purposes. There might have been recruitment bias in this process. Some professionals might have not participated because they did not want to give their names and contact information. Professionals might not have been allowed to participate in the education workshop due to shortage of staff; or because they did not want to drive a long time to the location of the workshop. The same quantitative questionnaire was completed by both the intervention group and the comparison subjects at three intervals, pre-test, post-test, and follow-up, but the comparison group was not given training. Upon completion of follow-up survey, comparison participants were offered access to the education program and materials for participation in the study.

Names of participants provided in the sign-up forms were not used for any other reason than to locate subjects for the follow-up tests. All sets of the survey employed a self-created six digit ID in order to match survey sets while maintaining the privacy and anonymity of the participants.

Piloting "Dining with Diabetes" with Healthcare Professionals in Oman

Registered participants attended the workshop on nutrition education for people with diabetes for a whole day from 7:30 a.m. to 3:00 p.m. (see Appendix E for workshop agenda). Previously trained moderators moderated the implementation of the program. The classes were presented as narrated power-point slide shows. Before launching the program, participants were given an explanation of the process of the project and were given consent forms (Appendix H). Then, they completed the pre-workshop survey, which took about 20 to 30 minutes to complete. The program was launched as six

modules with breaks in between each. Upon completion of all modules, a post-workshop survey was administered. Then, an open-ended questionnaire was administered to obtain professional input concerning the program. Finally, intervention subjects were sent the follow-up questionnaire one month after the workshop at their work places.

Data Analysis

All data was analyzed in SAS version 9.1 (2002-2003). Demographic information was assessed based on descriptive statistics using means and percentages. A repeated measures analysis (ANOVA) was performed to evaluate the change in knowledge, self-efficacy, education importance, and barriers of health professionals from pre-test to post-test to follow-up within each group and between the two groups (intervention and comparison).

Also, a Cronbach alpha analysis was performed to evaluate the internal consistency of the survey scales (general knowledge, nutrition knowledge, self-efficacy, education importance, and barriers to patient education).

Qualitative analysis of the evaluation of the quality of the program was performed based on majority of themes that appeared. The results of the analyses procedures are discussed in detail below.

Results

Internal Consistency of the Survey Scales

Cronbach's Alpha internal consistency was used to analyze the survey scales. This is a procedure to measure the consistency of the way in which items were answered within each group of questions. The survey used in this study included five subscales: one that reflected general knowledge (this section was related to nutritional aspects of diabetes, but the questions were not specifically related to practical skills in meal planning), one about dietary knowledge (this was concerned with the practical application of the concepts of the DFP, the plate method, and visual clues), one concerning the self-efficacy of professionals in educating people with diabetes, one pertaining to barriers to patient counseling, and a last one regarding the perceived importance of patient education. This statistical procedure was performed on the combined pre-tests of both groups and the combined post-tests of both groups, independently, (n= 63) as shown in Table 6 below.

Table 6: Cronbach Coefficient Alpha of the Survey Scales

	Alpha Scores (n= 63)	
Scale	Pre-test	Post-test
General Knowledge (n= 20)	0.73	0.72
Nutrition Knowledge (n= 19)	0.68	0.80
Self-Efficacy (n= 10)	0.85	0.89
Barriers (n= 12)	0.72	0.74
Education Importance (n= 4)	0.94	0.95

The analysis showed that all scales had acceptable Cronbach's coefficient alphas; alpha of 0.7 is recommended (Parmenter & Wardle, 2000). The highest alpha score was seen in the scale measuring professionals' perceptions of the importance of educating people with diabetes (0.94); this could be attributed to the fact that they were only four elements addressing this scale. The lowest score was found through analysis of the dietary knowledge scale at pre-test (0.68). This scale measured practical knowledge and skills in using the plate method, DFP, and visual clues. Looking at the post-test alpha value for this scale (0.80), there was a large improvement in dietary knowledge following the workshop. This led to the conclusion that the low alpha, at pre-test, was most likely to have been caused by lack of knowledge and guess work in answering the questions related to this section.

Participants Characteristics

The intervention program was a one-day workshop presented as narrated power point modules, downloaded from the internet. Of the 45 professionals who registered for the workshop, only 35 people showed up divided into two batches (January 29 and 30, 2007). Of the attendees, five subjects withdrew early in the day due to a language barrier. Thus, only 30 people from 14 PHC centers completed the workshop with a recruitment respond rate of 66.7%. All intervention participants completed the pre and post workshop surveys. At the follow-up stage of the study, 29 subjects returned the follow-up survey which presents a 96.7% retention rate.

For the comparison group, 34 subjects from seven PHC centers returned the pre-test survey. At post-test, 33 persons returned the survey. At follow-up, only 20 professionals submitted the survey, representing a 58.9% overall retention rate. All subjects who completed at least two sets of the survey were included in the analyses. Therefore, only one person from the comparison group was eliminated from the statistical analysis.

Demographic characteristics of the intervention group and the comparison group are shown in Tables 7 and 8. Thirty health professionals completed the intervention workshop. The group was young with a mean age of 27.83 ± 3.63 years (Mean ± Standard Deviation [SD]). Only 24 subjects provided information concerning the length of their experience in diabetes clinics. On average they had worked with people with diabetes for about 3 ± 2.54 years. A wide spectrum of health professionals participated in the workshop: the majority were nurses (26.7%) followed by health educators (20%). Only three doctors attended the workshop. The majority (79%) of the intervention

subjects reported not having received training in diabetes nutrition counseling. Most of the professionals (n= 25; 86%) reported having heard of the DFP. But, 50% reported not having heard of the plate method.

Table 7: Means of the Demographic Characteristics of the Study Groups

	Comparison	SD	Intervention	SD
Age (years)	36.46 (n=30)	8.40	27.83 (n=30)	3.63
Experience (years)	2.78 (n=31)	2.42	3.09 (n=24)	2.54

All data are based on pre surveys

The comparison subjects had a mean age of 36.5 ± 8.4 years and an average of 2.8 ± 2.4 years of experience in the diabetes clinics. The group was predominantly females. It consisted of doctors (*n*= 22; 66.7%) and nurses (*n*= 11; 33.3%) only. A large number of the comparison group (*n*= 18; 56%) reported having heard of the DFP and a large number (*n*= 21; 63.6%) reported not having heard of the plate method. Similar to the intervention group, the majority of the comparison group (*n*= 26; 81%) never received training in diabetes nutrition counseling.

Table 8: Frequency and Percentage of the Characteristics of the Study Groups

	Comparison	%	Intervention	%
Gender:				
Female	27	81.82	28	93.33
Male	6	18.18	2	6.67
Occupation:				
Doctor	22	66.67	3	10.00
Nurse	11	33.33	8	26.67
Diet technician	--	--	4	13.33
Health educator	--	--	6	20.00
Dietitian	--	--	5	16.67
Internship trainee	--	--	4	13.33
DFP Knowledge				
Yes	18	56.25	25	86.21
No	12	37.50	2	6.90
Not Sure	2	6.25	2	6.90
Plate Model Knowledge				
Yes	11	33.33	10	35.71
No	21	63.64	14	50.00
Not Sure	1	3.03	4	14.29
Diabetes Nutrition Training				
Yes	6	18.75	6	20.69
No	26	81.25	23	79.31

All data are based on pre surveys

Change of Percent Knowledge over Time

Participants in the intervention group completed a workshop in diabetes nutrition education, and they completed the same questionnaire at three different intervals, a pre-test prior to the workshop, a post-test upon completion of the workshop, and a follow-up test one month later. The comparison group was not given the educational workshop, but they completed the same questionnaire at three intervals at their work location: a pre-test during the first week of February 2007, a post-test two days after the completion of the

pre-test, and a follow-up one month after completion of the post-test. Results are presented as percentages of means ± Standard Error (SE) for the knowledge scales (Table 9).

General Knowledge

Interestingly, the mean percentages of the general knowledge of the intervention group increased from 50.27 % ± 2.51 at pre-test to 72.52 % ± 2.51 at post-test. The change in this knowledge scale as seen in the post-training score was statistically significant ($p < .0001$). At one-month follow-up, the average score (67.24 % ± 3.61) was still significantly different from that of the pre-test ($p = 0.0004$).

On the other hand, the comparison group's general knowledge score did not change significantly from pre-test (58.11% ± 2.71) to post-test (63.47 % ± 2.71). However, there was a significant decrease seen in this knowledge score at follow-up (40.45 % ± 3.78) as compared to both pre- and post-test scores ($p < .0001$). This decrease could be attributed to the smaller sample size for the third retake of the survey; or that the missing surveys were for high scoring individuals. At follow-up, only 20 professionals returned the survey, 12 doctors and nine nurses, compared to 33 at pre- and post-tests. To start with, the comparison group had a significantly ($p = 0.04$) higher general knowledge score (58.11% ± 2.71) compared to that of the intervention group (50.27 % ± 2.51); see Table 9 for the mean percentage scores of general knowledge for both groups.

Nutritional Knowledge

The mean percentage score of the nutritional knowledge of the intervention group significantly ($p < .0001$) increased from 47.82 % ± 2.87 on the pre-test to 69.91% ± 2.87 on the post-test. A small drop from post-test to follow-up was seen; however, it was not significant. Despite the drop, the group mean percentage concerning nutrition knowledge at follow-up (66.09 % ± 3.50) was yet significantly ($p = 0.0001$) higher than the group score at pre-test.

No significant change was seen in the mean percentage of the nutritional knowledge of the comparison group between pre- and post-test. Similar to what was seen concerning the general knowledge of the comparison group, the mean percentage of nutritional knowledge significantly decreased ($p = 0.001$) from 42.92 % ± 2.84 at pre-test ($p = 0.0005$) and from 42.02 % ± 2.84 at post-test to 27.83 % ± 3.58 at the time of the follow-up survey. Again, this large decrease concerning this knowledge scale was most likely due to the small number of people (n= 20) who completed the follow-up questionnaire. Table 9 shows the mean percentage scores of the nutritional knowledge component of the survey for both groups.

Table 9: Mean Percentages (± SE) for Knowledge Scores over Time

	COMPARISON GROUP			INTERVENTION GROUP		
	Pre (n= 33)	Post (n=33)	Follow-up (n= 20)	Pre (n= 30)	Post (n= 30)	Follow-up (n= 29)
General Knowledge	58.11 [c] (2.71)	63.47 [c] (2.71)	40.45 [a] (3.78)	50.27 [b] (2.51)	72.52 [d] (2.51)	67.24 [d] (3.61)
Diet Knowledge	42.92 [b] (2.84)	42.02 [b] (2.84)	27.83 [a] (3.58)	47.82 [b] (2.87)	69.91 [c] (2.87)	66.09 [c] (3.50)

[a-d] means with different superscripts within the same row are significantly different at $p < 0.05$

Change of Knowledge Scores among the Intervention Health Professionals

Table 10 shows the mean percent knowledge scores of the heath care teams in the intervention group. Diet technicians had the highest general knowledge score at pre-workshop survey (62.1 ± 6.2). Nurses on the other hand had the lowest general knowledge score (40.4% ± 4.4) on the pre-workshop survey. All professionals in this group had significant changes ($p < 0.01$) in their mean percent scores on general knowledge. Health care professionals had a mean percent change of general knowledge (from pre to post) ranging from 18.6 ± 4.4 to 26.4 ± 3.8. Health educators had the lowest change while nurses had the highest change.

For the dietary knowledge, diet technicians had the highest score (70.27% ± 5.5) on dietary knowledge at pre-workshop survey. Health educators had the lowest score (33.78% ± 5.3) on dietary knowledge at pre-workshop survey. The group had a mean percent change ranging from 5.41 ± 6.4 to 35.14 ± 6.4. All health professionals except diet technicians had significant changes in their dietary knowledge scores between pre and post workshop surveys. To start with, diet technicians had the highest score (70.27% ± 5.5) of dietary knowledge but they had the lowest change (5.4% ± 6.4) on this scale while doctors had the highest change (35.1% ± 6.4). Based on the pre-workshop survey scores, there were no ceiling effect seen in either the general knowledge or the dietary knowledge subscales.

Table 10: Mean Percent Change (± SE) of Knowledge among Intervention Groups (n= 30)

	General Knowledge				Dietary Knowledge			
	Pre%	Post%	Change%	*P*	Pre	Post	Change	*P*
Doctors (n= 3)	55.24^{abc} (7.2)	79.05^{c} (4.9)	23.81^{a} (6.2)	0.0010	34.23^{b} (6.4)	69.37^{bc} (4.5)	35.14^{b} (6.4)	<.0001
Nurses (n= 8)	40.3^{a} (4.4)	66.78^{ab} (3.0)	26.43^{a} (3.8)	<.0001	35.47^{b} (3.9)	63.51^{ab} (2.7)	28.04^{b} (3.9)	<.0001
Diet Technicians (n= 4)	62.14^{c} (6.2)	76.19^{bc} (4.9)	20.95^{a} (6.2)	0.0029	70.27^{a} (5.5)	78.38^{cd} (4.5)	5.41^{a} (6.4)	0.4081
Health Educators (n= 6)	43.80^{ab} (5.1)	62.38^{a} (3.5)	18.57^{a} (4.4)	0.0004	33.78^{b} (5.4)	55.86^{a} (3.2)	22.07^{b} (4.5)	<.0001
Dietitians (n= 5)	56.57^{bc} (5.7)	80.95^{c} (4.9)	22.86^{a} (6.2)	0.0014	62.70^{a} (4.9)	81.98^{d} (4.5)	18.01^{b} (6.4)	0.0106
Internship Trainees (n= 4)	56.43^{bc} (6.2)	82.86^{c} (4.9)	20.00^{a} (6.2)	0.0041	62.16^{a} (5.5)	82.88^{d} (4.5)	19.82^{b} (6.4)	0.0057

a-d means with different superscripts within the same column are significantly different ($p < 0.05$)
P values compare means within the same raw

Change of Knowledge Scores among the Health Professionals in the Comparison Group

As seen in Table 11 doctors had a significantly higher pre-survey mean percent scores in general knowledge (61.30 ± 2.54) compared to that of nurses (51.17 ± 3.6). Both, doctors and nurses had positive mean changes between pre- and post-survey on general knowledge but only doctors had significant changes (5.85% ± 2.0; $p = 0.007$). The increase in general knowledge of the comparison groups indicated a learning effect of the pre-survey. Doctors also had higher pre-survey dietary knowledge score (44.96 ± 2.9) compared to nurses (38.33 ± 4.15) but the difference was not significant. In contrast to percent change of general knowledge, the percent change of dietary knowledge was not significant for both professionals.

Table 11: Mean Percent Change (± SE) of Knowledge among Comparison Groups (n= 33)

	General Knowledge				Dietary Knowledge			
	Pre%	Post%	Change%	*P*	Pre	Post	Change	*P*
Doctors (n= 22)	61.30[a] (2.54)	66.53[a] (2.7)	5.85[a] (2.0)	0.0067	44.96[a] (2.9)	44.27[a] (3.4)	0.13[a] (2.3)	0.9553
Nurses (n= 11)	51.17[b] (3.6)	55.84[b] (3.8)	4.67[a] (2.8)	0.1025	38.33[a] (4.15)	34.64[a] (4.7)	-3.69[a] (3.1)	0.2508

a-b means with different superscripts within the same column are significantly different ($p < 0.05$)
P values compare means within the same raw

Change in Mean Attitude Scores Over Time

This study investigated three attitudes of health professionals based on Likert scales ranging from 1 to 5 with 1 being "strongly disagree" and 5 being "strongly agree"; 3 represented a neutral position. One scale was related to their perception of the importance of educating people with diabetes. Another scale was pertinent to their perceived confidence in counseling patients with respect to diabetes lifestyle self-management factors. The third scale assessed professionals' perceptions of the barriers affecting their ability to educate patients with diabetes. Table 12 presents the change in mean attitude scores ± SE over the three intervals for both the intervention and the comparison group.

Regarding the importance of diabetes education, the data showed a slight increase in the professionals' perception scores in the intervention group as a result of the workshop; however, the change was not significant. For the comparison group, there was no significant change in the professionals' perceptions of the importance of diabetes education over time as indicated by the data. It is interesting to note that the subjects in the comparison group had a higher mean score on this scale compared to that of the intervention group for all three tests. However, only mean scores from the pre-tests were significantly different. The comparison group had a mean score of 4.85 ± 0.25 on the pre-test while the intervention group had a mean score of 4.15 ± 0.19 on the pre-test with $p = 0.02$.

With respect to the self-efficacy component of the survey, the professionals' confidence in counseling patients significantly increased ($p = 0.005$) from a mean of 3.51 ± 0.14 prior to the workshop to a mean of 3.90 ± 0.14 on the post-workshop survey.

Furthermore, the professionals' confidence was retained at high levels as seen in the follow-up survey score of this element; there was no significant decrease in their confidence after one month. In comparison, the comparison group showed no change in its confidence level in counseling patients about nutrition-related topics.

The results of the evaluation of the barriers that affect professionals' ability to counsel patients concerning lifestyle matters were interesting. Answers or rankings of professionals from both groups tended to gravitate to the middle of the scale (5 being strongly agree; 3 being neutral; and 1 being strongly disagree) with a very slight shift towards agreement with the statements of barriers presented to them. Also, there was no significant change seen over time in the rankings of perceived barriers by either group.

Table 12: Mean (± SE) Attitude Scores over Time

	COMPARISON GROUP			INTERVENTION GROUP		
	Pre (n= 33)	Post (n= 33)	Follow-up (n= 20)	Pre (n= 30)	Post (n= 30)	Follow-up (n= 29)
Education Importance	4.85 [b] (0.25)	4.79 [b] (0.25)	4.77 [b] (0.25)	4.15 [a] (0.19)	4.31 [ab] (0.19)	4.25 [ab] (0.19)
Self-Efficacy	3.77 [ab] (0.18)	3.72 [ab] (0.18)	3.69 [ab] (0.19)	3.51 [a] (0.14)	3.90 [b] (0.14)	3.85 [b] (0.14)
Barriers	3.25 [a] (0.14)	3.37 [a] (0.14)	3.16 [a] (0.15)	3.17 [a] (0.11)	3.06 [a] (0.11)	3.15 [a] (0.11)

[a-b] means with different superscripts within the same row are significantly different at $p < 0.05$

Likert scale: 1 strongly disagree; 2 disagree; 3 neutral; 4 agree; 5 strongly agree

Attitude Characteristics of the Study Groups

Tables 13 provides an overview of the pre-workshop attitude characteristics of the professionals within the intervention group. Diet technicians seemed more confident in educating patients with diabetes compared to other professionals. Their mean level of self-efficacy was more than "agree" but less than "strongly agreed" (4.28 ± 0.3). Doctors, diet technicians, dietitians, and internship trainees perceived diabetes education to be important with a mean score of > 4.5 on the Likert scale (5 being strongly agree). In all professional groups, the mean scores for perceptions of barriers to educating patients with diabetes were in the "neutral" range.

Table 13: Attitude Characteristics (Mean ± SE) of the Intervention Professionals (n= 30)

	Self-efficacy Pre	Education Importance Pre	Barriers Pre
Doctor (n= 3)	3.07 (0.3)	4.78 (0.5)	3.42 (0.3)
Nurse (n= 8)	3.29 (0.2)	3.73 (0.3)	3.01 (0.2)
Diet Technician (n= 4)	4.28 (0.3)	4.63 (0.5)	3.17 (0.3)
Health Educator (n= 6)	3.10 (0.2)	3.64 (0.4)	2.91 (0.3)
Dietitian (n= 5)	3.74 (0.3)	4.55 (0.4)	3.24 (0.3)
Internship Trainee (n= 4)	3.95 (0.3)	4.75 (0.5)	3.65 (0.3)

Likert scale: 1 strongly disagree; 2 disagree; 3 neutral; 4 agree; 5 strongly agree

Tables 14 provides an overview of the pre-survey attitude characteristics of the professionals within the comparison group. Both doctors and nurses in the comparison group perceived diabetes education as important with means > 4.5 of the scale (5 being strongly agree).

Table 14: Attitude Characteristics (Mean ± SE) of the Comparison Professionals (n= 33)

	Self-efficacy	Education Importance	Barriers
	Pre	Pre	Pre
Doctor (n= 22)	3.61 (0.1)	4.89 (0.1)	3.19 (0.1)
Nurse (n= 11)	3.80 (0.2)	4.67 (0.1)	3.38 (0.2)

Likert scale: 1 strongly disagree; 2 disagree; 3 neutral; 4 agree; 5 strongly agree

Table 15 provides detailed pre-workshop barrier characteristics of the intervention group. Most overall mean barriers tended to gravitate around neutral position on the Likert scale. Only three overall mean barriers were between "disagree" (2 on the Likert scale) and "neutral" (3 on the Likert scale). Two of those barriers were about difficulties in organizing and presenting diabetes, and one was about professional motivation. Only the barrier of not enough time differed ($p < 0.05$) among the health professionals. Doctors were more likely to agree (4.33 ± 0.5; $p < 0.05$) that time was a barrier in educating patients. On the other hand, health educators were the least likely (2.2 ± 0.4; $p < 0.05$) to perceive time as a barrier to them in educating patients. Though differences were not significant, doctors and internship trainees appeared more likely to agree (means ≥4.0) that lack of staff training and lack of skills were barriers. Doctors, diet technicians and internship trainees were more likely to agree (means ≥4.0) that lack of teaching and

illustrative materials was a barrier. Diet technicians, dietitians, and internship trainees were more likely to agree (means $\geq$4.0) that patient refusal to stay for education was a barrier.

Table 15: Pre-workshop Barrier Characteristic of the Intervention Participants

Barriers	Overall mean	Occupation Group Mean (± SE)						
		D (n= 3)	N (n= 8)	DT (n= 4)	HE (n= 6)	Dn (n= 5)	IT (n= 4)	*P*
a. Not enough time	3.38 (0.16)	4.33 (0.5)	3.50 (0.3)	3.50 (0.4)	2.20 (0.4)	3.60 (0.4)	3.50 (0.4)	0.04
b. Teaching materials are expensive	3.07 (0.21)	3.33 (0.6)	2.76 (0.4)	3.25 (0.6)	2.60 (0.5)	3.80 (0.5)	3.75 (0.6)	0.20
c. Subject is too confusing	2.71 (0.14)	2.33 (0.4)	2.75 (0.3)	2.50 (0.4)	2.50 (0.4)	2.60 (0.3)	3.50 (0.4)	0.35
d. Lack of patient motivation	3.28 (0.20)	3.67 (0.6)	3.13 (0.4)	3.00 (0.5)	2.80 (0.5)	3.40 (0.5)	4.00 (0.5)	0.62
e. I'm not motivated to educate patients	2.14 (0.15)	2.67 (0.5)	2.43 (0.3)	1.75 (0.4)	2.40 (0.4)	1.80 (0.4)	1.75 (0.4)	0.38
f. Lack of patient referral for nutrition education	3.40 (0.24)	3.67 (0.7)	3.17 (0.5)	3.50 (0.6)	3.25 (0.6)	3.20 (0.5)	4.00 (0.7)	0.93
g. Lack of nutrition education and training for staff	3.56 (0.21)	4.00 (0.6)	3.25 (0.4)	3.25 (0.5)	3.75 (0.5)	3.25 (0.5)	4.25 (0.5)	0.62
h. Lack of skills to teach diabetes meal planning	3.63 (0.23)	4.00 (0.7)	3.29 (0.4)	3.50 (0.6)	3.40 (0.5)	3.75 (0.6)	4.25 (0.6)	0.80
i. Lack of teaching/ illustrative materials	3.68 (0.18)	4.00 (0.6)	3.00 (0.3)	4.25 (0.5)	3.75 (0.5)	3.80 (0.4)	4.00 (0.5)	0.32
j. Patient refusal to stay longer in clinic	3.72 (0.23)	3.00 (0.7)	3.75 (0.4)	4.00 (0.6)	3.00 (0.6)	4.20 (0.6)	4.25 (0.6)	0.50
k. Lack of support staff	3.32 (0.15)	3.67 (0.5)	3.00 (0.3)	3.50 (0.4)	3.20 (0.4)	3.25 (0.4)	3.75 (0.4)	0.65
l. I don't know how to organize the subjects	2.54 (0.20)	2.33 (0.6)	2.57 (0.4)	2.00 (0.5)	3.25 (0.5)	2.25 (0.5)	2.75 (0.5)	0.60

D- Doctors; N- Nurses; DT- Diet Technicians; HE- Health Educators; Dn- Dietitians; IT- Internship Trainees
Likert scale: 1 strongly disagree; 2 disagree; 3 neutral; 4 agree; 5 strongly agree

The Qualitative Program Evaluation

Upon program completion, the intervention group was asked to respond to an open-ended questionnaire that attempted to account for any advantages and disadvantages of the piloted diabetes education program. In addition, the evaluation attempted to obtain suggestions from health professionals for any improvements or changes that might have seemed necessary to them throughout the course of the workshop.

In response to a question about what they liked the most about the program, participants (18/30) indicated that they liked the sections in the program covering the use of the DFP, the plate method and visual clues. When asked what they had learned that they had not known before or that had surprised them were, it was interesting that 18/30 participants provided responses regarding the DFP, the plate method, and visuals as topics that they had not known about prior to the workshop. In answering the question asking them what it was that they still wanted to learn more about, 16/30 participants indicated that they wanted to learn more about the meal planning approaches presented in the workshop, in greater detail and more in-depth. Specifically, they wanted more hands-on activities in learning the concepts used in estimating total calories. They also pointed out that they would prefer that the workshop be extended beyond one day so they could have a more detailed presentation.

When asked what they liked the least about the workshop, 14 of the 30 participants answered with "none" or something to that effect. Others provided varied responses with no one response being represented more than four times. Such responses included lack of time for application of concepts (3/30), and the sections on physical activity and food safety (4/30).

Participants provided useful suggestions for improving the program. Many suggested presenting the workshop over more than one day in order to be able to present the material in more detail with respect to diabetes meal-planning and to provide various hands-on examples. Only three participants disliked the long distance approach and would have preferred to have had a speaker communicating with them face-to-face. Additionally, some suggested that it would be preferable to implement the program with a larger group of participants in all regions and to provide the program in English and Arabic to the PHC centers where they can use it with patients.

With regard to the printed educational materials, over 50% of the professionals rated the materials as either being good or excellent and useful, mostly because, as they expressed, these materials were simple and easy to understand. They also indicated that all the materials presented seemed usable for their setting in dealing with diabetes patients.

Discussion

The participants in the intervention program represented a diverse group of health professionals consisting of nurses, health educators, dietitians, diet technicians, internship trainees, and doctors, in descending order. Only three doctors participated in the pilot program. The low rate of participation by doctors has been commonly observed in other studies where doctors were less likely to participate in nutrition training programs. Because doctors are credible sources of information, they can reinforce the advice provided by other members of the team. Thus, it would be beneficial to encourage more doctors to attend nutrition training programs (Cadman & Findlay, 1997).

It is important to note that a substantial percentage of the professionals from the intervention (79%) and the comparison (81%) groups reported not having received training in diabetes nutrition education. This finding should raise a red flag in the system. If guidelines recommend that patient education be an integral part of diabetes management (IDF, 2005), the professionals working with those patients should be well-informed concerning all aspects of diabetes education to insure that they are capable of empowering their patients in the most effective ways. Professional agencies like the IDF and the American Diabetes Association recommend that health professional teams be trained in educating patients (ADA, 2004a; IDF, 2005). When a new program was developed in the UK, professionals were trained in order to equip them with the appropriate skills needed to use the program effectively with their patients (Carey & Daly, 2004).

As an effect of the education program offered in this study, knowledge scores of professionals were improved significantly among the intervention group as compared to those of the comparison group concerning both general and nutrition knowledge. Participants in the comparison group had a significantly higher mean percent score on general knowledge at the beginning of the study as compared to the subjects in intervention the group. The two groups were different at pre-test on this scale of knowledge. This could be rationalized by the fact that the comparison group only consisted of doctors (66.7%) and nurses (33.3%) while the intervention group consisted of a diverse group of health professionals with only 10% being doctors and 26.7% being nurses. Nevertheless, the effect of the intervention was very obvious. As a result of the

workshop, the intervention group scored significantly higher than the comparison group in general knowledge, both in post and follow-up surveys.

On the other hand, the two groups obtained similar scores on the pre-test with respect to nutrition knowledge despite differences in their fields of expertise. The effect of the pilot program was clearly seen in the intervention group concerning this scale as well. The mean percentage of the nutrition knowledge scores of the intervention group significantly increased on the post-test while that of the comparison group remained near constant at all intervals.

At follow-up, it was clear that the intervention group had retained knowledge after one month as seen from both the general and nutritional knowledge scales. There was no significant difference in the drop of either knowledge scales one month after the group had completed the workshop.

Although the comparison group did not show any significant knowledge change or improvement between pre- and post-tests on either of the two knowledge scales, its mean percentage scores (on both knowledge scales) decreased significantly on the follow-up test. Most likely, this finding was due to the fact that the sample size of this group decreased; only 20 subjects returned the follow-up survey compared to 33 subjects at the pre and post intervals of data collection. Looking into the demographics of those who returned the follow-up compared to pre- and pot-test, it appeared that ten doctors did not respond at that time.

Professionals in both groups were from the diabetes clinics in PHC. Presumably, they are all concerned with educating patients in order to promote effective diabetes self-management by providing patients with the knowledge, skills, and support needed to

promote the delay and/or prevention of diabetes complications. In assessing the pre-test knowledge scores, it was clear that participants from both groups had low mean percentage scores. Both groups achieved scores of < 60% concerning general knowledge and < 50% concerning nutritional knowledge on the pre-test. These low knowledge scores of the two groups could have been related to the finding that 81% of the comparison group and 79% of the subjects in the intervention group had never received training in diabetes nutrition training.

What's more, the intervention group had a sizable number of dietitians, diet technicians, health educators, and dietician trainees (all together forming about 63% of the participants), yet the group achieved a score < 50% concerning nutrition knowledge on the pre-test. This could be associated with the fact that 50% of the participants reported not having heard of the plate method, although only about 7% reported not having heard of the DFP.

Overall, this indicated that professionals from PHC have a gap in their knowledge and practical skills which, again, is of concern because they are in positions to empower patients. How can they be expected to do a good job when they do not have the knowledge and the skills their patients need? This lack of knowledge and skills could lead to providing inaccurate and misleading information to patients. Low nutritional knowledge was common in other groups examined in the literature as well. Nurses in a British study only achieved a score of 47.8% on a nutrition survey (Cadman & Wiles, 1996). A different study revealed that 57% of professionals in primary care (n= 58) provided incorrect responses in a weight-loss case study (Murray et al., 1993).

In general, professionals considered diabetes education to be an important factor with a pre-test mean of 4.15 ± 0.19 for the intervention group and 4.85 ± 0.25 for the comparison group (with 5 meaning "strongly agree"). The perceptions of the importance of education of both groups remained high throughout the series of tests which indicates that, indeed, they do value educating patients. Likewise, professionals in other studies have been found to value diabetes education. In a study by Kelly and Joffres (1990), 70% of doctors (n= 255) ranked patients pamphlets as the most useful services that could be provided to them. Also, Valente et al. (1986) reported that out of 1,487 physicians, 97% reported perceiving health promotion as an important factor in diabetes management in their practices (Valente et al., 1986).

All groups had somewhat moderate perceived levels of confidence concerning their ability to educate people with diabetes about lifestyle, self-management factors. On the pre-test, the intervention group obtained a mean score of 3.51 ± 0.14 (with 3 representing "neutral" and 5 representing "strongly agree") and the comparison group obtained a mean score of 3.77 ±0.18 on the pre-test. This difference between the two groups was not significant. The mean perceived self-efficacy scores of the comparison group remained constant throughout the test series. In comparison, the mean self-efficacy score of the intervention group significantly increased from 3.51 ± 0.14 before the training to 3.90 ± 0.14 ($p = 0.005$) after the training. This led to the conclusion that the education program did increase the participants' confidence in their ability to educate patients about lifestyle factors because they were empowered with knowledge and skills themselves through the program. This finding is in line with findings reported by others. In one study, the self-efficacy of a group of nurses increased significantly after

educational training in nutrition. At a post-training, 88% (n= 59) of nurses reported having good or excellent confidence compared to 27% at pre-training (Cadman & Findlay, 1998). In another study, when professionals had high-self confidence in their ability to educate patients, they were more likely to educate than not (Frank et al., 2002). Similarly, in yet another study, when professionals were provided with nutrition education they were found to be more involved in educating patients about diet (Lazarus, 1997).

Nevertheless, the mean self-efficacy scores of the intervention group of this study were somehow low, between neutral and agree (3-4 on the Likert scale) at all intervals. This response is similar to those of subjects in a study by Nicholas et al. (2005) in which a larger number of participants tended to express their confidence level as being somewhere between the "neutral" and "agree" points of a Likert scale. For our study, it seems to indicate that professionals did not totally "agree" that they were confident in providing practical advice about diabetes lifestyle factors; they were reserved in expressing their confidence. This led to the logical conclusion that this group of professionals needs further training in practical skills that address diabetes lifestyle factors. The low perceptions of confidence could have negative impacts on the success of professionals in promoting health behaviors and skills for patients. Valente et al. (1986) reported that physicians were more successful in health promotion when they were supported with appropriate training concerning specific topics, educational materials, and training in behavior modification.

With respect to perceived barriers, the comparison group showed somewhat higher mean perceived-barriers scores at all test intervals when compared with the

intervention group. However, there was no statistically significant difference observed between the two groups. At pre-test, both intervention and comparison participants had near neutral views of the barriers presented to them, with a slight tendency towards agreeing with barrier statements (between neutral and agree which correspond to 3 and 4 on the Likert scale). Over time, the groups did not show significant shifts with regard to their perceived barriers. Other studies have also reported barriers in nutrition education for professionals. Among 633 general physicians, lack of good nutrition knowledge was selected by 59%, lack of time was selected by 57%, and lack of patient motivation was chosen by 51% of the participants as barriers they perceived or dealt with in nutrition education (Hiddink, Hautvast, van Woerkum, Fieren, & van 't Hof, 1995). In the case of this study, it would be insightful to recalculate pre-test barrier scores based on percentage of participants on the Likert scale to determine the weight of each barrier enlisted on the survey. This analysis would distinguish the most common barriers in the group if quantified by frequency of appearance or percentage of occurrence as shown in the above study.

With regard to the qualitative feedback from the intervention group, participants expressed positive attitudes towards the workshop as a whole. The mode of delivering the program was also well received and accepted (only three participants of the workshop expressed dislike of the delivery mode). Professionals elsewhere have provided positive feedback on the use of computers in nutrition training. A total of 44% of primary care physicians (n= 1,103) rated computer nutrition learning program as very effective or effective on a 5-point ordinal scale; and 38% perceived themselves to be very interested or interested in this mode of education among primary care physicians to improve their

skills in nutrition counseling (Kushner, 1995). The mode of delivery in our study was not an issue, workshop participant even suggested that the program be made available to a larger number of professionals and that it be provided in Arabic for their use in clinics with patients. With reference to what they still wanted to learn, a large number emphasized their interest in learning more practical concepts in meal planning. They also expressed their desire to get more hands-on application opportunities in training sessions.

Limitations of the Current Study

The findings reported in this study should be interpreted with care due to limitations in the selection of the study sample. All data was collected abroad in Muscat, Oman with a convenience sample of health professionals given access and time constraints. The number of health professionals associated with diabetes clinics in PHC is small. To maximize participation in the pilot test of the education program, professionals from all diabetes clinics in Muscat were invited to participate in the education program. Based on the response, clinics that had participants in the workshop were designated as intervention; clinics that did not have staff participating in the workshop were designated as comparison. In other words, the intervention group was self-selected and the comparison group was a default. It was not feasible to randomize clinics as participation was voluntary and some clinics had shortage of staff. The education program was presented in English only; professionals with a language barrier were naturally eliminated from participation. Also, only self-motivated persons participated which could be a potential bias.

Conclusion

The pilot of the adapted program "Dining with Diabetes" was a successful experience providing continuing education for professionals in the PHC system in Oman. This is the first known study of this nature conducted in Oman. The study showed that health professionals in the PHC system had a gap in knowledge and skills in dealing with lifestyle and nutritional aspects of patient education concerning diabetes. The program was successful in the sense that it increased the participating professionals' knowledge and skills: this was also reflected in their increased self-efficacy levels. The use of a comparison group provided additional support for the positive effect of the education program ensuring that statistical significant changes were not observed as a result of chance. Within the intervention group, there was a significant increase in knowledge scores while the same was not observed in the knowledge scores of the comparison group. Increasing professionals' knowledge and skills about lifestyle factors will have a positive effect on their practices; this is an assumption that has been observed and verified in the literature. When health professionals were provided with continuing education, they were successful guiding patients to achieve improved metabolic control. Patients had significantly lower Fasting Plasma Glucose (FPG), HbA1c, and BW (Vinicor et al., 1987).

The "Dining with Diabetes" program was successfully adapted to the Omani culture. Intervention participants highly valued the program and suggested expanding its application with larger numbers of professionals and providing it as a standard educational program to patients given that it be provided in Arabic.

Professionals in the intervention group expressed the desire and need to learn practical hands-on diabetes meal planning approaches. This indicates that they have a gap in their knowledge and skills in dealing with patient education concerning diabetes. In fact, this need was quantified by the survey, as professionals scored low on knowledge scales.

GENERAL DISCUSSION AND RECOMMENDATIONS

The rapid change in the socio-economic status and food supply in Oman has caused formerly uncommon, diet-related, non-communicable diseases to surface in the nation. Studies on the prevalence of diabetes show an increasing burden of the disease in Oman. The increase in the prevalence of diabetes, Type 2 specifically, has been largely attributed to lifestyle factors (IDF, 2003). With the economic changes that the nation is going through, it is anticipated that diabetes will continue to increase. Thus, a need has arisen to address lifestyle, self-care factors in order to support those who have the disease in learning to control their condition so as to prevent or delay diabetes complications.

Supporting and empowering patients can be achieved through appropriate self-management education. Given that the health care system is relatively new in Oman, there is a need to establish appropriate, effective procedures concerning numerous aspects of public health. Therefore, a systematic approach to developing a culturally appropriate diabetes education program was deemed necessary. As a starting point, it was imperative that the needs of both patients and health professionals be assessed. This assessment was accomplished through one-on-one, structured, open-ended interviews conducted with members from both groups. Obtaining information from both groups was deemed essential in designing a diabetes education program since the perspectives of each group are distinct and complement one another. Further it was decided that it was appropriate to apply the HBM in order to gain a deeper insight and understanding of patients' beliefs,

motivators, and barriers associated with diabetes self-management in the process of developing a program that fits the culture and society setting.

It was quite evident that the structured open-ended interviews were a valuable component in the design of this study. They allowed the target population to express opinions and feelings in a confidential environment. It was clear that patients (a large number had had less than 12 years of education) thought that if diabetes complications were to develop, they would have adverse effects on their lives. Nevertheless, there were a sizable number of patients who did not seem to believe that they were at a risk of developing complications. This state of denial was attributed to their religious beliefs. They believed that complications would not develop if it were not their fate to develop such complications. On the other hand, this logic implied that they believed that no matter what they did, if they were destined to develop diabetes complications, then, the complications would indeed develop.

I would speculate that the passive attitude of the subjects in the study sample originated from a lack of knowledge and their illiteracy. Being from the same faith, I can argue that the predominant religion of the region, Islam, does not promote passiveness at any point with regard to human health. In fact, seeking remedy is encouraged and preferred over passiveness when therapy would likely be successful and harm most unlikely (Abudawud, 1995; Al-Tirmidhi, 1995).

The target population was found to have inaccurate knowledge concerning diabetes complications and symptoms. Symptoms were referred to as complications, and only two complications were recognized amongst patients interviewed during the course of the study. Most of the patients interviewed only indicated a perception of the short-

term benefits resulting from diabetes management. Patients largely did not see the long-term benefits of diabetes management which is the main purpose for implementing diabetes management plans; when patients have good metabolic control, it is a given that symptoms will be alleviated. This tendency or way of thinking of patients seems to imply that there is a lack of understanding and an underlying lack of knowledge concerning the connection between diabetes and its complications as well as the important role of diabetes management.

It was found that the patient group, as a whole, was not engaged in effective blood glucose self-monitoring; and, of great concern, they were not being encouraged to do so by their health professionals. Two barriers were found to be related to the lack of self blood glucose monitoring: lack of financial resources and lack of recommendations and emphasis on the importance of self-monitoring of blood glucose on the part of health professionals.

Because Oman has a national health care policy, patients are more likely to perceive self blood-glucose testing to be a financial burden because it is not subsidized by the government. People are used to receiving health services at no cost. Patients may hold the belief that, if self blood-glucose monitoring were important, it would be provided to them by the government.

On this score, it seems appropriate to recommend that heath authorities subsidize the cost of self blood-glucose monitoring for the economically disadvantaged patients. Also, it is clear that professionals should encourage patients to engage in blood-glucose self-monitoring, and they should educate patients so that they know that blood-testing allows patients to understand how their bodies act with different blood-glucose levels,

which in turn will help them take the appropriate steps needed to manage the situation effectively.

Social commitments were seen as barriers to the good intentions of people with diabetes to watch their diet. It is expected that these barriers will continue to exist for a long time in the community because of the nature of the social culture. Also, it was found that the patients interviewed had been suffering emotionally, wanting to be like others, particularly when around people and when experiencing the feeling of being denied a variety of foods. Thus, in addition to educating patients with diabetes about self-care behaviors, there is a need to raise community awareness of the dangers of diabetes and the ways to help or accept those who suffer from it in social situations.

Both patients and professionals revealed that, in current practice, patients were given very limited advice and counseling, and what they got emphasized abstinence from a variety of foods. Advice and counseling of this nature explains the emotional struggle those patients expressed having suffered; they felt a sense of self-denial and wanted to be like others who do not have diabetes. Patients also admitted to not following recommendations about diet or physical activity. And, many perceived diabetes education to be an unimportant matter in helping them achieve good diabetes self-management. Patients were not compliant in meeting with diet technicians. This was largely related to the finding that the recommendations given were not practical to follow and were not culturally appropriate. The provision of sample one-day or three-day meal plans was the only approach used to educate patients about proper eating habits. The recommendations were seen by patients as too restrictive, banning them from foods which they did not want to avoid, so they did not follow them very well.

In relation to lack of knowledge, self-efficacy issues are more likely to arise because patients do not have the knowledge and skills needed for appropriate self-care behaviors. The more patients lacked knowledge, the more they perceived barriers to self-care behaviors and the more likely they were not to be engaged in desirable diabetes self-care behaviors.

Patients should be informed of the fact that they do not need to avoid any sort of foods but that they need to eat wisely and healthily. Applying the consistent-carbohydrate approach in diabetes meal planning would benefit patients in overcoming their feelings of being denied. This method allows for the freedom of food selection, suiting preferences, eating habits, and customs (ADA, 2000). The method is also flexible in that different cultural aspects of diet can be applied. The plate model, the DFP, and visual clues all are flexible meal planning methods that can be applied in different cultures in teaching patients to eat consistent amount of carbohydrates.

Interviews with professionals revealed that there was no formal comprehensive program for educating people with diabetes in existence within the system. With no exception, professionals expressed the need for culturally appropriate and easily comprehendible educational materials for effective diabetes education. Specificity and practicality (applicability) of educational materials were designated as desirable aspects of a successful program. Two barriers were identified by the sample of doctors and nurses with regard to patient education: lack of time and patients refusal to stay for education. Diet technicians expressed a lack of patient referrals to them. As indicated by some physicians, when some patients were given referrals to meet with a dietitian/diet technician, they refused to stay longer in the clinic as they had already spent about two

hours waiting to see a doctor and getting periodic routine tests done. In these cases, in order to overcome time barriers and patient refusal of education, dietitians/diet technicians might need to arrange a different time to see patients; patients might be given appointments to see them on a different day.

Overall, patients seemed not to understand the important role of lifestyle self-care behaviors; and, they did not value diabetes self-management education. Many factors could have affected this situation:

- illiteracy, lack of knowledge, and misconceptions
- lack of appropriate diabetes education program
- large belief and trust in modern medication in treating diabetes
- misconceptions about the nature of diabetes (some think it will go away)
- search for traditional remedies to treat the condition
- the relatively new roles of dietitians, diet technicians, and health educators within the health care system, and lack of value placed on these positions by patients and doctors.

For patients to value the role of diet and physical activity in diabetes management, doctors and nurses need to change the way in which patient education is approached. Diet education should be included as an integral part of diabetes management. Group education sessions could be considered as an option and should be held at times that are different from doctors' appointments.

The "Dining with Diabetes" program in this study was adapted from the "Dining with Diabetes in Colorado" program. It is a comprehensive education program educating people with diabetes in lifestyle self-care factors (diet and physical activity). Also, it

covers essential and necessary background information about diabetes and the role of insulin. The link between elevated blood glucose levels and the development of diabetes complications was emphasized in the program so as to stress the importance of maintaining near-normal blood-glucose levels. The adapted program offers liberal, culturally appropriate, meal planning approaches. Foods are not restricted; and eating well and sensibly is a key emphasis. Cultural preferences and lifestyle differences are not overlooked.

Because diabetes can affect all aspects of life, people with diabetes should be educated in a comprehensive manner with respect to their condition. Patients are the ones who have to deal with the situation on a daily basis. Thus, empowering patients to take desired actions toward modifying aspects of lifestyle should be the objective of diabetes education to prevent or delay any complications (Anthony et al., 2004). However, we should not expect that patients are going to be supported as recommended if the health professionals working with these people are not well trained. Also, it is vital that patients receive consistent messages from the health professional team in the diabetes clinics. Thus, it is important that all team professionals be trained and empowered with the same knowledge and information relevant to counseling patients in diabetes self-management behavior. When patients receive similar and non-conflicting information from multiple professional within a practice, messages are reinforced, and patient confusion is overcome (ADA, 2004a; Nthangeni et al., 2002). Therefore the purpose of the second phase of the current project was to develop a culturally appropriate diabetes education program and pilot the education program with health professionals in order to train them in its use and the use of the accompanying printed educational materials.

Piloting the program with a group of health professionals was a successful experience. The program had a positive effect on the knowledge of health professionals concerning diabetes lifestyle factors. Knowledge among the intervention group increased significantly as a result of participation in pilot testing of the "Dining with Diabetes" program. Moreover, those who attended the training program retained the knowledge at a level that was significantly different from their knowledge level before completion of the workshop. Furthermore, the intervention group exhibited improved self-efficacy after completing the training session.

The fact that a large number of participants reported not having been trained in diabetes lifestyle management raises concern about the quality of the counseling provided to patients in their clinics. The findings of the needs assessment indicate that patients seemed to lack good knowledge about diet. This could be related to the fact of that the health professional teams are not well-trained and were found to have low knowledge scores and low self-efficacy as well in counseling patients about diabetes lifestyle factors.

There have been reputable efforts to fight and prevent infectious diseases in Oman. It appeared that emphasis on training health care staff is mainly placed on the medical aspect. There is little emphasis put on training health professionals concerning lifestyle aspects of diabetes management. Therefore, it seems appropriate to recommend that health professionals in the PHC in Oman be trained in lifestyle diabetes self-management factors.

The mode (power point presentation) used to pilot the educational program with health professionals did not seem to be an issue. This approach could be further employed to train professionals in remote regions with minimal cost. In general, the

program and accompanying printed educational materials were well received by health professionals. Two additions are seen as important with the piloted version of the "Dining with Diabetes" program to account for professional needs in training. One, there is a need to provide more hands-on applications during the workshop. Two, the participants recommended including case studies on diabetes counseling in the training program.

Recommendations

With regard to the needs assessment of patients with Type 2 diabetes, it is evident that more research is needed to understand the health beliefs of patients with Type 2 diabetes in other regions of the country before this program could be piloted in different regions. There is a need to understand gender differences in health beliefs of patients with Type 2 diabetes with respect to self-management. Studies are also needed to design a quantitative survey based on the HBM that would allow determination of the health beliefs of people with diabetes and to better understand the predictors of diabetes self-care in the population. Studies are needed to reveal the importance and cost effectiveness of self blood glucose monitoring in order to influence the national health policy to subsidize glucose self-monitoring.

With reference to the pilot test, follow-up studies are necessary with the intervention group if the long-term effects of the program on professional knowledge, self-efficacy, and barriers are to be identified. Also, this type of follow-up would provide insights into program improvement and update. Studies are needed to evaluate the educational program with patients and to test the comprehensibility and acceptance of the

printed educational materials. Consultations with the authorities are needed in order to understand the feasibility of implementing "Dinning with Diabetes" in the primary health care system and to determine the most appropriate approaches to use in doing so. There is a need to create an Arabic version of the program that is appropriate for use with patients. Also, there is a need to design evaluative scales of patient-knowledge and attitude concerning the educational program "Dining with Diabetes" before the program could be successfully implemented with patients.

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APPENDICIES

Appendix A: Needs Assessment:

Interview Script for People with Type 2 Diabetes

Interview Guide for Health Professionals

Interview Script for People with Type 2 Diabetes

Thank you for participating in the study interview. The interview will take about 30-40 minutes. Please be as thorough as possible with your answers so we can get a good overview. I would like to audiotape the interview so that no responses will be missed. The tapes will be kept in locked storage and used only by the research team. Tapes will be destroyed once all the data has been assembled. Do you have any questions? Let us start.

I. Demographic:

1. Gender: ____Male ____Female
2. How old are you (years)? _____
3. What is the last level of education did you finish?
    a. Illiterate
    b. Less than high school
    c. High school
    d. Bachelor degree
    e. Graduate degree
4. Do you work? ____Yes ____No
5. How long have you had diabetes? _____
6. Have you ever had nutrition counseling related to your diabetes?
    ____Yes ____No

If Yes, How many times have you seen a dietitian during the lat year? _____

II. Perceived threat:

Perceived Susceptibility:

We want to know what you think about diabetes complications:

Probe: What complications do you think could result from diabetes?
Probe: Why would diabetes result in complications?
Probe: Do you think you are susceptible to getting any type of diabetes complications?

Perceived Severity:

Probe: Do you think these diabetes complications might affect your daily life?
Probe: How?
Probe: How does that make you feel?
Probe: How often were you hospitalized for a reason related to diabetes?
Probe: How does that make you feel?

III. Outcome expectations:

Perceived Benefits:

1. What are the benefits of controlling your diabetes?
    Probe: Do you think you will benefit if you control your diabetes?
    Probe: Can you explain the type of benefits you will gain?

Probe: Do you control your diabetes because you fear the risks associated with the disease, you want to please someone or you feel better when you control your diabetes?
Probe: Do you feel that good diabetes management will protect you from the disease complications?
Probe: Do you feel you could benefit from diabetes education you could get either by instructions or written materials.
Probe: Do you think you will live longer and have a better quality of life if you controlled you diabetes?
Probe: What does your family recommend for diabetes care?
Probe: Do your friends/ collogues know about your diabetes?
Probe: How often do you feel pressure to be like others around you?
Probe: Is it worth to bear the costs to control your diabetes?
Probe: Do you feel you are getting good support (equipped with information necessary to empower you to take action) from the center?
Probe: Do you look for more information about diabetes management outside the health center?
Probe: What do you think will make you feel more supported?

Perceived Barriers:

2. What makes you not take actions to manage your diabetes?
   Probe: Is it inconvenient to test your blood glucose as often as you should?
   Probe: Does your work get in the way of planning for exercise?
   Probe: Does your family and social commitments get in the way of planning for exercise?
   Probe: How often do family members or friends interfere with your good eating intentions?
   Probe: How often is lack of money or time inhibiting your objective to monitor your blood glucose?
   Probe: Do you think life style is a relevant aspect of diabetes management?
   Probe: What are the costs for controlling your diabetes? (money, time, denial, emotion)
   Probe: Does it worth to manage diabetes? Why?

IV. Efficacy expectations:

1. What aspects of diabetes management do you feel you are good at?
   Probe: Do you think you have good knowledge and skills to manage your diabetes?
   Probe: Are you proficient in planning and preparing appropriate or selecting meals and snacks?
   Probe: Are you committed to exercise?
   Probe: How well do you take care of yourself when you are sick?
   Probe: Tell me some recommendation you have received from a health care professional about diabetes management.

Probe: Do you think compliance to recommendations is going to affects your blood glucose?
Probe: Do you think your blood glucose will be the same regardless of whether you do or do not follow recommendations?
Probe: How often do you get recommendations on how to manage your diabetes?
Probe: Are there recommendations that you can ignore and still have near normal blood glucose levels?

Interview Guide for Health Professionals
Primary Health Care Clinics

Thank you for participating in the study interview. The interview will take about 30-40 minutes. Please be as thorough as possible with your answers so we can get a good overview. I would like to audiotape the interview so that no responses will be missed. The tapes will be kept in locked storage and used only by the research team. Tapes will be destroyed once all the data has been assembled. Do you have any questions? Let us start.

1. Introduction:
    a. What is job title? _____
    b. How long have you been working with diabetic patients? _____
    c. Approximately, how much time do spend with one patient? _____

2. How often do you find time to educate your patients to manage their diabetes?
3. Do you hand out any support materials to the subjects?
4. Can I have a sample of the materials you provide?
5. Do all diabetics get nutrition education?
    Probe: Approximately, how many times in a year one patient will get counseling?
    Probe: What is the setting for the counseling session; individual, group?
6. What do you think about the nutrition education materials that you have for diabetics?
    Probe: Do you think you need more education materials for diabetics?
    Probe: What type of materials would you like?
    Probe: What would you like to see in those materials?
7. Is it easy for you to communicate with the diabetics?
    Probe: Do you think your patients understand what you are telling them?
    Probe: Do think your diabetics comply with the recommendations?
8. What do you think the diabetics think about dietitians?
    Probe: Whom the diabetics trust more, dietitians or doctors?
    Probe: Do they understand the multiple aspects of diabetes management?
9. What could I provide for you to assist you in your position?
10. Is there anything else you would like to say?

Appendix B: Needs Assessment

CSU Human Subject Approval

Study Approval Letter from Oman

Patient Consent Form

Arabic Version of the Patient Consent From

Professional Consent Form

Colorado State University

Office of Regulatory Compliance
Office of Vice President for Research
and Information Technology
Fort Collins, CO 80523-2011
(970) 491-1553
FAX: (970) 491-2293

MEMORANDUM

TO: Pat Kendall, FSHN, 1571

FROM: Janell A. Meldrem, Administrator
Human Research Committee

SUBJECT: **PROJECT APPROVAL**
Title: Diabetes Educational Needs in Oman
Protocol No.: 04-341H
Funding Agency: N/A

DATE: January 25, 2005

The above-referenced project was approved by the Human Research Committee on December 22, 2004 for the period December 22, 2004 to December 13, 2005 with the condition that the attached consent form is signed by the subjects and each subject is given a copy of the form. It is the investigator's responsibility to obtain this consent form from all subjects. *NO changes may be made to this document without first obtaining the approval of the Committee.*

Approval is for 25 health professional interviews and 40 patient interviews with the condition that the final translated consent forms in Arabic are submitted.

A status report of this project will be required within a 12-month period from the date of approval. Renewal is the Principal Investigator's responsibility, but as a courtesy, you will be sent a reminder approximately two months before the protocol expires. The Principal Investigator will report on the numbers of subjects who have participated this year and project-to-date, about problems encountered, and provide a verifying copy of the consent form or cover letter used. The necessary form (H-101) is available from the Regulatory Compliance web page (see below). Should the protocol not be renewed before expiration, all activities must cease until the protocol has been re-reviewed.

It is the responsibility of the investigator to immediately inform the Committee of any serious complications, unexpected risks, or injuries resulting from this research. It is also the investigator's responsibility to notify the Committee of any changes in experimental design, participant population, or consent procedures or documents. This can be done with a memo which completely describes the changes and their consequences (new consent form or cover letter, or altered survey instrument, for example). Students serving as Co-Principal Investigators may not alter projects without first obtaining PI approval. The PI is ultimately responsible for the conduct of the project. Upon completion of the project, an H-101 should be submitted as a close-out report.

This approval is issued under Colorado State University's OHRP Federal Wide Assurance 00000647. If approval did not accompany a proposal when it was submitted to a sponsor, it is the researcher's responsibility to provide the sponsor with the approval notice.

Please direct any questions about the Committee's action on this project to me for routing to the Committee.

Attachment

cc: Lyutha Al Subhi w/attachment

Sultanate of Oman
MINISTRY OF HEALTH
Directorate General of Health Services
GOVERNORATE OF MUSCAT
Director General Office

سلطنة عمان
وزارة الصحة
المديرية العامة للخدمات الصحية
لمحافظة مسقط
مكتب المدير العام

عاجل جداً
MOST URGENT

Ref: MH/DGHS/MCT/2004/ 263
Date: 10 / July / 2004

المرجع : وص/م ع خ ص/م م/ ٢٠٠٤ / ٢٦٣
التاريخ ١٠ يوليو /٢٠٠٤

Director of Health Services (Seeb, Bausher, Muttrah , Al-Amerat), MOIC's (Muscat , Quriyat).

الأفاضل / مدراء الخدمات الصحية بالولايات المحترمين
الأفاضل/ مشرفي الخدمات الصحية بولايتي (مسقط / قريات) المحترمين

After Complements,

تحية طيبة وبعد،،،

Sub: Leutha Bint Khalfan Al-Subhi

الموضوع : الفاضلة / ليوثة بنت خلفان الصبحي

This is to inform you Ms. Leutha Bint Khalfan Al-Subhi who is working as a teacher in College of Agricultural & Marine Sciences at Nutrition Department has a study of Nutrition and Food Sciences, for that she will make a rotation to some of the Health Centers to collect data for her study subject.

نود الإفادة بأن الفاضلة/ ليوثة بنت خلفان الصبحي والتي تعمل مدرساً بكلية العلوم الزراعية والبحرية بقسم علوم الأغذية والتغذية مبتعثه لدراسة الدكتوراه في مجال التغذية وعلوم الأطعمة .. ولكون المذكورة بصدد جمع البيانات الخاصة بموضوع رسالة الدكتوراه فيتطلب منها القيام بتقييم إحتياجات المراكز الصحية الأولية ومقابلة الأطباء والمرضى لأخذ بعض المعلومات البيانات المتعلة بخدمات مرضى السكري.

You are kindly requested to inform all the concerned Health Center to extend all assistance to enable her to finish her study successfully.

عليه فنرجو إبلاغ جميع المؤسسات الواقعة تحت إدارتكم وتقديم التسهيلات الممكنه لإنجاح مهمتها ..

Thanking You ,

وتفضلوا بقبول فائق الإحترام ،،،

Adil Bin Sakhi Al-Balushi
عادل بن سكي البلوشي
Director of Planning & Training
مدير التخطيط والتدريب

COLORADO STATE UNIVERSITY
INFORMED CONSENT TO PARTICIPATE IN A RESEARCH PROJECT
For Diabetic Patients

TITLE OF THE PROJECT: **Diabetes Educational Needs in Oman**

NAME OF PRINCIPAL INVESTIGATOR: Pat Kendall, PhD, RD

NAME OF CO-INVESTIGATOR: Lyutha Al-Subhi

CONTACT NAME AND PHONE NUMBER FOR QUESTIONS/PROBLEM: Lyutha Al-Subhi, Oman, 24494470

PURPOSE OF THE RESEARCH:
The purpose of this study is to understand your feelings about diabetes, exercise, and monitoring of blood glucose and to identify factors that affect your ability to manage your diabetes. The information you provide will help up the researchers develop educational materials that better meet the needs of Omanis with diabetes.

PROCEDURES/METHODS TO BE USED:
A one-to-one interview will be conducted between you and the co-researcher in a private meeting room in the clinic or in another agreed upon place. The session will be audio taped so that no information will be missed. Names will not be mentioned in, nor attached to; the tapes and the tapes will be kept in locked storage for the duration of the study. The tapes will be destroyed following the completion of the study.

TIME INVOLVED: The personal interview will last for 30-40 minutes.

RISKS INHERENT IN THE PROCEDURES:
It is not possible to identify all potential risks in a research project, but the researchers have taken reasonable safeguards to minimize any known and potential but unknown risks. Due to the emotional nature of working closely with individuals having a certain medical condition, it is possible that some unforeseen emotional distress could occur. If you are uncomfortable for any reason, you may discontinue the interview at any time.

BENEFITS:
No research has been done on the needs of Omani diabetics. The interviews will identify factors that will enhance diabetes control for yourself and other people with diabetes, and will be useful in the development of educational programs for persons with diabetes.

CONFIDENTIALITY:
A number will be assigned to each interview to protect the identity of the interviewee. The information gathered will be kept confidential and reviewed only by the co-researcher for the purposes of the study. Audiotapes of the interviews will be stored in a locked storage and destroyed upon completion of the study (about January, 2008). Your name will not be used in any written reports that are produced as a result of the information given.

LIABILITY:
The Colorado Governmental Immunity Act determines and may limit Colorado State University's legal responsibility if an injury happens because of this study. Claims against the University must be filed within 180 days of the injury.

Questions about participants' rights may be directed to Celia S. Walker at (970) 491-1563.

PARTICIPATION:
Your participation in this study is voluntary. If you decide to participate in the study, you may withdraw your consent and stop participating at any time without any penalty. Your withdrawal will not affect your ability to receive medical and benefits to which you are otherwise entitled.

Your signature indicates that you have read this consent form and have decided to participate in the study. You will be provided with a copy of this consent form containing 2 pages.

_____
Participant name (printed)

_____ _____
Participant signature Date

_____ _____
Witness to signature (project staff) Date

جامعة كولوراده ستيت

عنوان الدراسة: الاحتياجات التعليمية للسكريين في عمان
الباحث الأولى: د. بتريشا كندل
الباحث الثانوي: ليوثه الصبحي
اسم ورقم الهاتف للرد على الاستفسارات: ليوثه الصبحي (24494470)

هدف الدراسة: تهدف هذه الدراسة إلى فهم اتجاهاتك ومشاعرك إزاء مرض السكري والنشاط الرياضي وأساليب ضبط السكري من اجل معرفة أو استنباط العوامل المؤثرة على قدرتك في التحكم في السكري. سوف تساعدك المعلومات التي تدلين بها إلى تصميم مواد تعليمية تهدف لمساعدة العمانيين المصابين بالسكري.

أساليب البحث: سوف تعقد مقابلة شخصية مع الباحثة في غرفة لضمان سرية المعلومات أو في مكان أخر يتم الاتفاق عليه. المقابلة سوف تسجل في شريط لضمان الحصول على جميع المعلومات. لن تذكر أسماء في التسجيل للحفاظ على سرية شخصية الفرد. لن يطلع على المعلومات سوى الباحث فقط وذلك لأغراض الدراسة سوف يتم التخلص من جميع الشرائط المسجلة بعد تمام الدراسة.

مدة المقابلة : 30 – 40 دقيقة .

مخاطر مرتبطة بالدراسة: لا توجد مخاطر مرتبطة بالدراسة ولكنه في حالة عدم شعورك بالارتياح النفسي لك عامل الحرية في الانسحاب وعدم المقابلة وعدم إكمالها.

فوائد البحث: في الوقت الحالي لا توجد دراسة تم إجرائها عن الاحتياجات التعليمية لمرضى السكري في عمان. سوف تساعد هذه المقابلة في التعرف على العوامل المرتبطة في التحكم بالسكري لدى العمانيين ومن ثم ذلك سوف تستخدم هذه المعلومات في تقييم برنامج تعليمي للسكريين بهدف مساعدتهم في ضبط السكري لديهم.

سرية المعلومات: جميع المقابلات سوف يتم تمييزها بأرقام ولن تذكر وتكتب أسماء معها أو مع الشرائط المسجلة. سوف تخزن جميع الأوراق والشرائط في خزان مغلق

ويتخلص منها بعد الانتهاء من البحث وذلك قرابة 2008م. سوف لن يذكر اسمك في أي تقرير مكتوب نتيجة تحليل المعلومات.

الاشتراك في البحث:

مساهمتك في البحث مسألة اختيارية وبإمكانك الانسحاب في أي وقت ما شئت دون ما يؤثر ذلك على أهليتك في الرعاية الصحيحة المستحقة.

التوقيع أدناه يثبت بأنه تم شرح البحث ومضمونة لك وبأنك قرأت ما ورد أعلاه وبأنك موافق في الاشتراك في هذا البحث.

تتكون استمارة الموافقة من ورقتين وسوف يعطى لك نسخة من هذه الاستمارة.

اسم المشترك:.....

توقيع المشترك:..... التاريخ:.....

شاهد التوقيع(الباحث):..... التاريخ:.....

COLORADO STATE UNIVERSITY
INFORMED CONSENT TO PARTICIPATE IN A RESEARCH PROJECT
For Health Care Professionals

TITLE OF THE PROJECT: **Diabetes Educational Needs in Oman**

NAME OF PRINCIPAL INVESTIGATOR: Pat Kendall, PhD, RD

NAME OF CO-INVESTIGATOR: Lyutha Al-Subhi

CONTACT NAME AND PHONE NUMBER FOR QUESTIONS/PROBLEM: Lyutha Al-Subhi, Oman, 24494470

PURPOSE OF THE RESEARCH:
The purposes of this study are to investigate the current practices in diabetes education and to obtain your insight regarding the needs for education materials for diabetics. The information you will provide will assist in developing and evaluating diabetes educational materials for use in Oman.

PROCEDURES/METHODS TO BE USED:
A one-to-one interview will be conducted between you and the co-researcher in a private meeting room in the clinic or in an agreed upon place to discuss the current practices you follow in diabetes education and to obtain your insight on the educational needs of persons in Oman with Type 2 diabetes. The session will be audio taped so that no information will be missed. Names will not be mentioned in, nor attached to, the tapes and the tapes will be kept in locked storage for the duration of the study. The tapes will be destroyed following the completion of the study.

TIME INVOLVED: The personal interview will last for 30-40 minutes.

RISKS INHERENT IN THE PROCEDURES:
It is not possible to identify all potential risks in a research project, but the researchers have taken reasonable safeguards to minimize any known and potential but unknown risks. Due to the emotional nature of working closely with individuals having a certain medical condition, it is possible that some unforeseen emotional distress could occur. If you are uncomfortable for any reason, you may discontinue the interview at any time.

BENEFITS:
No research has been done on the needs of Omani diabetics. You will have the opportunity to assist the researcher document the practices followed in the primary health care clinic for educating subjects with Type 2 diabetes. Also, you will have the chance to express your opinions and ideas about diabetes management education needs. The interview will assist in determining the needs for programs in the future.

CONFIDENTIALITY:
A number will be assigned to each interview to protect the identity of the interviewee. The information gathered will be kept confidential and reviewed only by the co-researcher for the purposes of the study. Audiotapes of the interviews will be stored in a locked storage and destroyed upon completion of the study (about January, 2008). Your name will not be used in any written reports that are produced as a result of the information given.

LIABILITY:
The Colorado Governmental Immunity Act determines and may limit Colorado State University's legal responsibility if an injury happens because of this study. Claims against the University must be filed within 180 days of the injury.

Questions about participants' rights may be directed to Celia S. Walker at (970) 491-1563.

PARTICIPATION:
Your participation in this study is voluntary. You may withdraw your consent and stop participating at any time without any penalty. Your withdrawal will not affect your ability to receive medical and benefits to which you are other wise entitled.

Your signature indicates that you have read this consent form and have decided to participate in the study. You will be provided with a copy of this consent form containing 2 pages.

_____
Participant name (printed)

_____ _____
Participant signature Date

_____ _____
Witness to signature (project staff) Date

Appendix C: Diabetes Education Program

Dining With Diabetes Survey

Program Evaluation Form

Dining With Diabetes Survey

Date_____

ID: Dear participant, in the following space please create an ID for your self using Latin alphabets and Arabic numbers by following the criteria and the example provided. Starting from left to right, write the first two letters of your MOTHER'S first NAME using capital letters (A-Z), then write the DAY of the month in which you were borne (01-31) then write the MONTH in which you were born (01-12). The final ID should have the following format (XX-DD-MM). For example; Fatma's mother is called Jokha. Fatma was borne on November 30. Her ID will be as (JO – 30 – 11).

Your ID is: _____ (__ - __ - __)
Follow this format: (XX – DD - MM)

The following section asks questions related to general information about diabetes. Some questions require one answer only and others require more than one answer. All questions that require more than one answer are marked "*Circle all that apply*". Please CIRCLE the appropriate answers below:

1. A sugar free food item is ALWAYS calorie free as well:
   a. True
   b. False
   c. Not sure

2. What is the BEST way to wash your hands?
   a. Wash with warm water and soap for ten seconds (count to 10)
   b. Wash with warm water and soap for twenty seconds (count to 20)
   c. Not sure

3. A person should NOT start exercising when he/she experiences symptoms of: *(Circle all that apply)*
   a. Low blood glucose
   b. High blood glucose
   c. Shortness of breath
   d. Very dry mouth

4. Which of the follow are good substitutes for milk for people with lactose intolerance? *(Circle all that apply)*
   a. Low fat milk
   b. Soy milk
   c. Yogurt
   d. Skimmed milk

5. Damage to small blood vessels may lead to:
    a. Loss of liver function
    b. Arthritis
    c. Loss of kidney function
    d. None of the above

6. Potassium chloride (KCl) salt is a good salt substitute for diabetics who have kidney complications:
    a. True
    b. False
    c. Not sure

7. People with diabetes have a high risk for food-borne illness because they have :*(Circle all that apply)*
    a. Increased movement of the gut
    b. Short transient time in the gastrointestinal (GI) tract
    c. Compromised immune function
    d. Decreased acid production in the stomach

8. Where is the BEST place to store RAW meat in your refrigerator (not freezer)?
    a. Bottom shelf
    b. Top shelf
    c. Not sure

9. Physical activity helps us feel better because it causes the body to send _____ to the brain.
    a. Insulin
    b. Lactase
    c. Serotonin
    d. Not sure

10. Insulin functions to:
    a. Mediate the conversion of glucose into energy
    b. Facilitate sugar breakdown into glucose
    c. Facilitate glucose movement from blood into cells
    d. None of the above

11. Glycemic load and glycemic index are synonyms (mean the same thing):
    a. True
    b. False
    c. Not sure

12. Three sessions of 10-minute walks per day are _____ one 30-minute walk session per day:
    a. as beneficial as
    b. more beneficial than
    c. less beneficial than
    d. not comparable to

Rank order the following energy nutrient groups according to how much they increase blood glucose, with 4 being the highest, 3 being the high, 2 being the low and 1 being the lowest:

a. _____Fats b. _____Carbohydrates
c. _____Proteins d. _____Proteins+fats+carbohydrates

13. People with diabetes should not eat sweets and desserts:
    a. True
    b. False
    c. Not sure
14. Glycemic index and glycemic load are influenced by many factors such as: *(Circle all that apply)*
    a. Form of food
    b. Fiber
    c. Preceding meal
    d. Fat

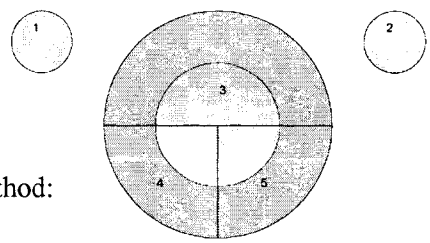
15. Consuming alcohol on empty stomach will lead to _____
    a. High blood glucose
    b. Low blood glucose
    c. Weight loss
    d. No effect

16. What are the benefits of exercise for people with diabetes? *(Circle all that apply)*
    a. Better blood glucose control
    b. Helps in weight management
    c. Improves body's use of insulin
    d. Helps cure diabetes

This section contains questions about the Plate Method. Some questions require one answer only and others require more than one answer. All questions that require more than one answer are marked "*Circle all that apply*". Please CIRCLE the appropriate answers below:

17. Have you heard about the Plate Method in the past?
    a. Yes
    b. No
    a. Not sure

18. Match each section of the Plate Method diagram seen with the corresponding food group it represents. *Write the corresponding number of the section in the space provided.*
    a. Meat/Protein: _____
    b. Fruits: _____
    c. Grains/Beans/Starchy vegetables: _____
    d. Vegetables-non starchy: _____
    e. Milk/Yogurt: _____



19. Measuring foods is an essential part in using the Plate Method:
    a. True
    b. False
    c. Not sure

20. Which part of the plate model contains 0 grams of carbohydrates?
    a. Vegetables
    b. Meat
    c. Starches/Grains
    d. Fruits

21. A good visual clue for the size of a cup is:
    a. Light bulb
    b. Medium sized female fist
    c. Male fist
    d. Female palm

22. The type of carbohydrates (CHO) eaten is the more important than the total amount of CHO eaten:
    a. True
    b. False
    c. Not sure

23. A deck of cards and cassette tape are good visual clues for:
    a. 2-3 oz meat/protein
    b. 2-3 oz grains
    c. 2-3 oz vegetables
    d. None of the above

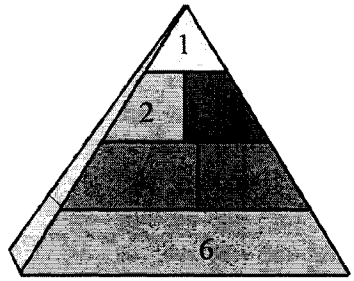
24. Circle each item below that is a good visual clue for 1 serving of a fruit: ***(Circle all that apply)***
    a. Light bulb
    b. Deck of cards
    c. Tennis ball
    d. Female palm

25. Each serving of starches, fruits, and dairy products contains about _____ of carbohydrates and will rise blood about the same level.
    a. 10 gm
    b. 15 gm
    c. 20 gm
    d. 25 gm

This section includes questions about the Diabetes Food Pyramid. Some questions require one answer only and others require more than one answer. All questions that require more than one answer are marked "***Circle all that apply***". Please CIRCLE the appropriate answers below:

26. Have you heard about the Diabetes Food Guide Pyramid in the past?
    c. Yes
    d. No
    a. Not sure

27. Match each food item below with the corresponding section based on the Diabetes Food Pyramid groupings: *Write the corresponding number of the section in the space provided.*



a. Eggs: _____
b. Apple: _____
c. Butter: _____
d. Burger bun: _____
e. Lentils (Adas): _____
f. Lettuce (khass): _____
g. Yoghurt: _____
h. Almonds: _____
i. Honey: _____
j. Yams or sweet potatoes (findal): _____

28. When using the Diabetes Food Pyramid, a serving of fruit juice is about:
    a. ¾ cup
    b. 2/3 cup
    c. ½ cup
    d. 1/3 cup

29. The reference size of the cup used in the Diabetes Food Pyramid is about:
    a. 340 ml
    b. 320 m
    c. 240 ml
    d. 220 ml

30. Fiber content is higher in _____ than in _____
    a. Fruit juice, whole fruit
    b. Whole fruit, fruit juice
    c. Not Sure

31. Fiber functions to: *(Circle all that apply)*
    a. Provide bulk in the intestines
    b. May help decrease blood cholesterol
    c. May slow the rate at which glucose is absorbed into the blood
    d. May slow blood coagulation

32. The caloric content of ½ cup of yams (findal) is less than that of ½ cup of spinach:
    a. True
    b. False
    c. Not sure

33. Circle each food below that is a good source of fiber. *(Circle all that apply)*
    a. Quaker Oats
    b. Chicken
    c. Kidney beans
    d. White bread
    e. Figs

34. 1 tablespoon of heart healthy fats:
    a. Contains the same amount of calories as in 1 tablespoon of ghee
    b. Contains less calories compared to 1 tablespoon ghee
    c. Contains more calories compared to 1 tablespoon ghee
    d. None of the above

35. Circle each food below that is a good source of carbohydrate. *(Circle all that apply)*
    a. Potato
    b. Butter
    c. Milk
    d. Orange juice

36. In the Diabetes Food Pyramid, cheese is part of the _____ group:
    a. Milk
    b. Fats and oils
    c. Meats
    d. Breads, grains and starches group

37. 2 cups of uncooked leafy vegetables is counted as:
    a. 1 serving of vegetables
    b. 1.5 servings of vegetables
    c. 2 servings of vegetables
    d. 2.5 servings of vegetables

38. An ounce (1oz) of meat is about:
    a. 59 grams
    b. 49 grams
    c. 39 grams
    d. 29 grams

39. The daily recommended amount of meat and meat substitute servings for people with diabetes is:
    a. 1-3 oz/day
    b. 4-6 oz/day
    c. 7-9 oz/day
    d. None of the above

40. Removing fat from diary products removes calcium:
    a. True
    b. False
    c. Not sure

In the following section, read each statement carefully and indicated to what extend you agree or disagree with the statement based on a 5 point scale from **S**trongly **D**isagree (**SD**) as being 1, **D**isagree (**D**) as being 2, **N**eutral (**N**) as being 3, **A**gree (**A**) as being 4, and **S**trongly **A**gree (**SA**) as being 5. Please **CIRCLE** your response below:

	SD	D	N	A	S A
41. I know good resources where I can get diabetes nutrition information	1	2	3	4	5
42. I'm confident I can teach patients the diabetes food groups correctly	1	2	3	4	5
43. I can use the plate method to describe diabetes meal planning easily	1	2	3	4	5
44. I can easily give patients examples (visual cues) of serving sizes from high carbohydrate groups	1	2	3	4	5
45. Educating patients about diet is essential for diabetes control	1	2	3	4	5
46. I'm confident I can give patients practical advice about exercise	1	2	3	4	5
47. I can easily rationalize the important of fiber in diabetes control	1	2	3	4	5
48. Explaining diabetes complications to patients is important	1	2	3	4	5
49. I'm positive I can explain to patients the link between uncontrolled blood glucose and eyes diseases	1	2	3	4	5
50. Educating patients about the importance of exercise is necessary	1	2	3	4	5
51. I'm confident I can translate the meaning of serving into practical measurable amounts and visual clues	1	2	3	4	5
52. I feel confident advising patients with diabetes about diet	1	2	3	4	5
53. I easily use a different approach to provide nutrition education when patients seem not to understand the meal plan that I'm explaining	1	2	3	4	5
54. Educational materials are important for patient education	1	2	3	4	5

55. What problems do you typically have or expect to have with teaching diabetes meal plan?

		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
a.	Not enough time	1	2	3	4	5
b.	Teaching materials are expensive	1	2	3	4	5
c.	Subject is too confusing	1	2	3	4	5
d.	Lack of patient motivation	1	2	3	4	5
e.	I'm not motivated to educate patients	1	2	3	4	5
f.	Lack of patient referral for nutrition education	1	2	3	4	5
g.	Lack of nutrition education and training for staff	1	2	3	4	5
h.	Lack of skills to teach diabetes meal planning	1	2	3	4	5
i.	Lack of teaching/ illustrative materials	1	2	3	4	5
j.	Patient refusal to stay longer in clinic	1	2	3	4	5
k.	Lack of support staff	1	2	3	4	5
l.	I Dot know how to organize the subjects	1	2	3	4	5

The next set of questions is related to your self. Please select or write the appropriate responses as they relate to you:

56. What is your age? _____ years *(Please write)*

57. Are you:
    a. Male
    b. Female

58. Are you a:
    a. Doctor
    b. Nurse
    c. Diet technician
    d. Health educator
    e. Dietitian
    f. Other _____ *(Please write)*

59. How many years have you been working in the diabetic clinic?
    _____years_____months. *(Please write)*

60. Have you received special training in diabetes nutrition?
    a. Yes
    b. No

Program Evaluation

Dining with Diabetes

1. What did you like most about Dining with Diabetes?

2. What are some of the things you learned that you did not know or that surprised you?

3. What things do you still want or need to learn about meal planning?

4. What did you like least about Dining with Diabetes?

5. Do you have any suggestions about how we could change Dining with Diabetes to make it better? *Please use back of page if needed.*

6. What is your impression about the education materials provided with the program?

7. Do you think you can use the education materials provided with the program?

8. Are there any materials that you do not see any use for with your patients?

Appendix D: Diabetes Education Program

CSU Human Subject Approval

Colorado State University

Office of Regulatory Compliance
Office of Vice President for Research
Fort Collins, CO 80523-2011
(970) 491-1553
FAX: 491-2293

Notice of Human Research Amendment Approval

Principal Investigator: Pat Kendall, FSHN, 1571
Co-Principal Investigator: Lyutha Al-Subhi, FSHN, 1571
Title: Diabetes Educational Needs in Oman
Protocol #: 04-341H
Committee Action: **Amendment Approved:** December 19, 2006

HRC Administrator: Janell Meldrem

The Human Research Committee reviewed and approved your request to amend the above-referenced project. The approved amendments are below.

Amendment(s):

- to pilot test nutrition education program with health professionals
- to evaluate the effectiveness of the nutrition education program
- to add 200 participants; half in a test group & half in a control group
- to use the revised consent forms for each group, the revised flyers, survey & evaluation form

Investigator Responsibilities:

- It is the responsibility of the PI to immediately inform the Committee of any serious complications, unexpected risks, or injuries resulting from this research.
- It is also the PI's responsibility to notify the Committee of any changes in experimental design, participant population, consent procedures or documents. This can be done with a memo describing the changes and submitting any altered documents.
- Students serving as Co-Principal Investigators may not alter projects without first obtaining PI approval. The PI is ultimately responsible for the conduct of the project.

This approval is issued under Colorado State University's OHRP Federal Wide Assurance 00000647.

If you have questions, please contact me at 1-1655 or janell.meldrem@colostate.edu.

attachment Date of Correspondence: 1/8/07

Colorado State University

Office of Regulatory Compliance
Office of Vice President for Research
Fort Collins, CO 80523-2011
(970) 491-1553
FAX: (970) 491-2293

Notice of Approval for Human Research

Principal Investigator: Pat Kendall, FSHN, 1571
Co-Principal Investigator: Lyutha Al-Subhi, FSHN, 1571
Title: Diabetes Educational Needs in Oman
Protocol #: 04-341H **Funding Source:** N/A

Number of Participants/Records: 200 participants; 100 control/100 test group
Committee Action: **Approved on:** December 14, 2006 **Expires:** December 14, 2007

HRC Administrator: Janell Meldrem

Consent Process:
The above-referenced project was approved by the Human Research Committee with the condition that the attached consent form is signed by the subjects and each subject is given a copy of the form. *NO changes may be made to this document without first obtaining the approval of the Committee.*

Investigator Responsibilities:

- It is the PI's responsibility to obtain this consent form from all subjects.
- It is the responsibility of the PI to immediately inform the Committee of any serious complications, unexpected risks, or injuries resulting from this research.
- It is also the PI's responsibility to notify the Committee of any changes in experimental design, participant population, consent procedures or documents. This can be done with a memo describing the changes and submitting any altered documents.
- Students serving as Co-Principal Investigators must obtain PI approval for any changes prior to submitting the proposed changes to the HRC for review and approval.
- The PI is ultimately responsible for the conduct of the project.
- A status report of this project will be required within a 12-month period from the date of review. Renewal is the PI's responsibility, but as a courtesy, a reminder will be sent approximately two months before the protocol expires. The PI will be asked to report on the numbers of subjects who have participated this year and project-to-date, problems encountered, and provide a verifying copy of the consent form or cover letter used. The necessary continuation form (H-101) is available from the RCO web page www.research.colostate.edu/rcoweb/.
- Upon completion of the project, an H-101 should be submitted as a close-out report.
- If approval did not accompany a proposal when it was submitted to a sponsor, it is the PI's responsibility to provide the sponsor with the approval notice.
- **Should the protocol not be renewed before expiration, all activities must cease until the protocol has been re-reviewed.**

This approval is issued under Colorado State University's OHRP Federal Wide Assurance 00000647.

Please direct any questions about the Committee's action on this project to me for routing to the Committee.

attachment Date of Correspondence: 1/8/07

Appendix E: Diabetes Education Program

Workshop Agenda

Dining with Diabetes

Workshop Agenda

for Health Professional at Primary Health Care

January 29, 30, 2007

7:30-8:30am	participants gather and sign in a. give out attendance to be filled out (participants fill in their contact information)
8:30-9:20 am	Start Module 1 and follow instructions: a. Pre-workshop survey (pause the presentation when asked)
9:20 - 9:50 am	Continue with Module 1: Background Information
9:50 - 10:05 am	Break
10:05 - 10:45 am	Modules 2: Diabetes Food Pyramid and the Plate Method
10:45 - 10:50 am	Short Break: 5 minutes
10:50 – 11:05 am	Modules 3: Carbohydrates, Glycemic Index and Glycemic Load
11:05 - 11:10 am	Short Break: 5 minutes
11:10 – 11:40 am	Modules 4: Fiber, Sugar and Sugar Substitutes
11:40am - 1:15 pm	Lunch break
1:20 - 2:15 pm	Modules 5: Fats, Calcium and Salt
2:15- 2:25 pm	Short Break
2:25- 2:55 pm	Modules 6: Physical activity & Safety Recommendations
2:55	Post-workshop survey & Program Evaluation

Lucky Number Draw

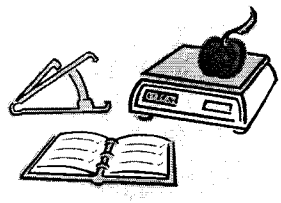
Appendix F: Diabetes Education Program

Intervention Group Recruitment and Sign up Materials

Colorado State University

Diabetes Nutrition Educational Needs

Free Workshop



Researchers from the Department of Food Science and Human Nutrition at Colorado State University are seeking health professionals (doctors, nurses, dietitians, diet technicians, and health educators) who deal with people with diabetes to participate in a study.

Oman is faced with the challenge of an increasing rate of diabetes. In 2001, there were 27,432 people registered with diabetes. By the end of 2005, the number of people registered with diabetes reached 48,972. (Ministry of Health [MOH], 2001, 2005). This change represents 78.5% increases in number of people with diabetes from 2001 to 2005. Such a non-communicable disease has an enormous economic drawback on the development of the country itself.

Purpose:

1. Pilot test a computer based diabetes nutrition education program health professionals who work with patients with diabetes within the primary health care system in Muscat, Oman.
    a. The program includes hands on training to use printed education materials for patients with diabetes.
2. Obtain health professional evaluation on the understandability and usability of the education printed materials; takes 7-10 minutes to complete.
3. Evaluate the effectiveness of the nutrition program by examining knowledge changes and behavior of health professionals pre, post the education program and one month later; takes about 20-30 minutes to complete.

Who:

Health professionals practicing with patients with diabetes within the primary health care clinics in Muscat:

*** Doctors** *** Nurses** *** Dietitians**
*** Diet technicians** *** Health educators**

Time:

January 29

OR

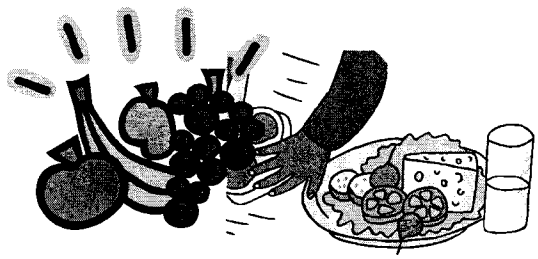
January 30, 2007; one day only (7:30 am – 3 pm)

Where:

Sultan Qaboos University. Specific location is to be provided later.

Compensation:

- Education materials
- Breakfasts and refreshments during the classes and lunches



Please Register as Space is Limited
Sign up form is Attached

Lyutha Al-Subhi; Project Co-Investigator. 99430603
Patricia Kendall, RD; Project Primary Investigator. (970)-491-1945

Registration Form

Dining with Diabetes: Nutrition Education workshop

No.	Name	Work Location-Center	Work Phone Number
1			
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31			

Appendix G: Diabetes Education Program

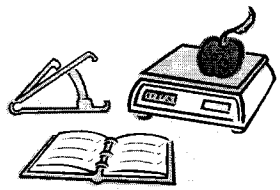
Recruitment and Sign up Materials for the Comparison Group

Consent Form for the Comparison Group

Colorado State University

Diabetes Nutrition Educational Needs

Free Nutrition Education Materials



Researchers from the Department of Food Science and Human Nutrition at Colorado State University are seeking health professionals (doctors, nurses, dietitians, diet technicians, and health educators) who deal with people with diabetes to participate in the evaluation of a diabetes nutrition education program.

Oman is faced with the challenge of an increasing rate of diabetes. In 2001, there were 27,432 people registered with diabetes. By the end of 2005, the number of people registered with diabetes reached 48,972. (Ministry of Health [MOH], 2001, 2005). This change represents 78.5% increases in number of people with diabetes from 2001 to 2005. Such a non-communicable disease has an enormous economic drawback on the development of the country itself.

Purpose:

Evaluate the effectiveness of a nutrition program by examining knowledge changes and attitudes among health professionals at three time intervals.

Who:

Health professionals practicing with patients with diabetes within the primary health care clinics in Muscat:

*** Doctors** *** Nurses** *** Dietitians**

*** Diet technicians** *** Health educators**

Time:

Starting from the first week of February, 2007

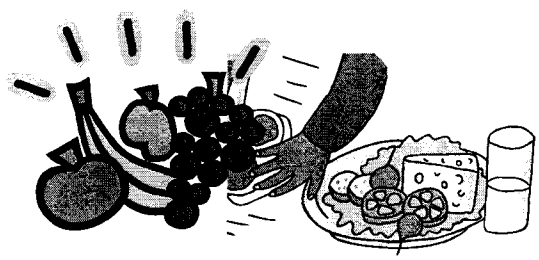
It takes about 15-20 minutes each time to complete the survey

Where:

At your work location

Compensation:

- Access to a computer based diabetes nutrition education program
- Education materials



Please Register
Sign up form is Attached

Lyutha Al-Subhi; Project Co-Investigator. 99430603
Patricia Kendall, RD; Project Primary Investigator. (970)-491-1945

Dining with Diabetes – Registration Form

Evaluation of Diabetes Nutrition Education Program-Control

No.	Name	Work Location-Center	Contact Phone Number
1			
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COLORADO STATE UNIVERSITY
INFORMED CONSENT TO PARTICIPATE IN A RESEARCH PROJECT
Health Care Professionals

TITLE OF THE PROJECT: **Diabetes Educational Needs in Oman**

NAME OF PRINCIPAL INVESTIGATOR: Patricia Kendall, Ph.D., R.D.

NAME OF CO-INVESTIGATOR: Lyutha Al-Subhi, Ms.

CONTACT NAME AND PHONE NUMBER FOR QUESTIONS/PROBLEM: Lyutha Al-Subhi, jularash@lamar.colostate.edu, U.S.A., at (970) 492-9783; Oman, Buthina at 92746310/ Dalila at 92868694

PURPOSE OF RESEARCH: The purpose of this project is to investigate the effectiveness of a diabetes nutrition education program among health care professionals including doctors, nurses, diet technicians, health educators, and dietitians. There is little if any nutrition education available for health care professionals in Oman. Therefore, it's very important that we investigate the effectiveness of any nutrition education geared towards health professionals.

PROCEDURES/METHODS TO BE USED: You are randomly selected to be in the control group while other coworkers have been randomly selected to be in the test group. As a control subject, we would only like you to complete a questionnaire, which takes about 15-20 minutes to complete, at three time intervals. Upon consent, a questionnaire will be administered to you three times, before the education program is launched, the following, and one month after the last implementation. Surveys will be sent to you by the wilayat director to which your clinic is bound. Your responses will help us in determining the effectiveness, strengths, and weaknesses of the nutrition education program that your coworkers will be completing.

After data collection, you will be given access to the nutrition education program and the education materials, which you will find helpful in your practice in educating patients with diabetes. The classes include slide show presentations with voice effect and learning activities.

RISKS INHERENT IN THE PROCEDURES: The questionnaire is for educational research only and there are no known risks associated.

It is not possible to identify all potential risks in a research project, but the researchers have taken reasonable safeguards to minimize any known and potential but unknown risks.

BENEFITS: This project is designed to enhance your knowledge in diabetes nutrition education and to train you to use the nutrition education materials provided along with the program.

CONFIDENTIALITY: We are collecting your contact information to be able to be in contact with you to send you all sets of the questionnaire. No one will be given access to any personal identifying information but the research team for follow up purposes exclusively. Personal information will not be use in data analyses or the final reporting of the project in order to maintain your confidentiality.
However, your participation in completing the questionnaire is totally anonymous. No one even members of the research team will be able to identify the information you give that it comes from you.

LIABILITY: The Colorado Governmental Immunity Act determines and may limit Colorado State University's legal responsibility if an injury happens because of this study. Claims against the University must be filed within 180 days of the injury.

Questions about participants' rights may be directed to Janell A. Meldrem at (970) 491-1553.

PARTICIPATION: Your participation to complete the questionnaire is voluntary. You may withdraw your consent and stop participating at any time without any penalty or loss of benefits to which you are otherwise entitled.

Your signature indicates that you have read this consent form and have decided to participate in the evaluation of the nutrition education program. You will be provided with a copy of this consent form containing 2 pages.

_____
Participant name (printed)

_____ _____
Participant signature Date

_____ _____
Witness to signature (project staff) Date

Appendix H: Diabetes Education Program

Intervention Group Consent Form

COLORADO STATE UNIVERSITY
INFORMED CONSENT TO PARTICIPATE IN A RESEARCH PROJECT
Nutrition Education Program Participants; Health Care Professionals

TITLE OF THE PROJECT: **Diabetes Educational Needs in Oman**

NAME OF PRINCIPAL INVESTIGATOR: Patricia Kendall, Ph.D., R.D.

NAME OF CO-INVESTIGATOR: Lyutha Al-Subhi, Ms.

CONTACT NAME AND PHONE NUMBER FOR QUESTIONS/PROBLEM: Lyutha Al-Subhi, jularas h@lamar.colostate.edu, U.S.A., at (970) 492-9783; Oman, Buthina at 92746310/ Dalila at 92868694

PURPOSE OF RESEARCH: The purpose of this project is to investigate the effectiveness of a diabetes nutrition education program among health care professionals including doctors, nurses, diet technicians, health educators, and dietitians. Also, we would like to get your opinion about education materials generated with the education program. There is little if any nutrition education available for health care professionals in Oman. Therefore, it's very important that we investigate the effectiveness of any nutrition education geared towards health professionals.

PROCEDURES/METHODS TO BE USED: You are invited to participate in a nutrition education program called "Dining with Diabetes" for 2 days that last up to 4 hours per session. Classes will be presented as a computer based long distance education prepared by the co-investigator. Two trained moderators will attend with the group to facilitate the piloting of the program and to administer the questionnaires to you. Upon consent, a questionnaire will be administered to you three times, before the education program is launched, the last day of the program and one month after program is completed. Your responses will help us in determining the effectiveness, strengths, and weaknesses of the nutrition education program.

The classes will include slide show presentations with voice effect presented by the co-investigator and learning activities that will be facilitated by the moderators.

You will also receive education materials that you will find helpful in your practice in educating patients with diabetes. You will be served beverages, snacks and lunch during the classes.

RISKS INHERENT IN THE PROCEDURES: The program is for educational research only and there are no known risks associated.

It is not possible to identify all potential risks in a research project, but the researchers have taken reasonable safeguards to minimize any known and potentially but unknown risks.

BENEFITS: This project is designed to boost your knowledge in diabetes nutrition education and to train you to use the nutrition education materials provided along with the program. Also, you will have the chance to express any concerns that you might have about nutrition education and diabetes or any topic covered in classes to the researchers in the USA.

CONFIDENTIALITY: Your participation in the education program is not anonymous. No one will be given access to any personal identifying information but the moderator and the co-investigator only for future follow up purposes exclusively. Personal information will not be use in data analyses or the final reporting of the project in order to maintain your confidentiality. However, your participation in all program evaluations is totally anonymous. No one; not even members of the research team will be able to identify you with the information you give.

LIABILITY: The Colorado Governmental Immunity Act determines and may limit Colorado State University's legal responsibility if an injury happens because of this study. Claims against the University must be filed within 180 days of the injury.

Questions about participants' rights may be directed to Janell A. Meldrem at (970) 491-1553.

PARTICIPATION: Your participation in the evaluation of the dining with diabetes program is voluntary. You may withdraw your consent and stop participating at any time without any penalty or loss of benefits to which you are otherwise entitled.

Your signature indicates that you have read this consent form and have decided to participate in the evaluation of the nutrition education program; Dining with Diabetes. You will be provided with a copy of this consent form containing 2 pages.

_____
Participant name (printed)

_____ _____
Participant signature Date

_____ _____
Witness to signature (project staff) Date