KNOWLEDGE, ATTITUDE AND PRACTICE OF DIABETES MELLITUS; A COMPARATIVE STUDY BETWEEN MALAYSIAN AND THE UNITED ARAB EMIRATES PATIENTS

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By

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DEDICATION

To

My father, and to my father and mother in law who are diabetic for their motivation and prayers, and to my precious mother who was taking care of my two little babies while I was busy in my study work, and to my dearly loved husband Feras J. Jirjees who gave me lots of encouragement and supports especially during my study time and finally to my lovely babies Lara and Layth.

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LIST OF ABBREVIATIONS

AD	Abu-Dhabi
ADA	American Diabetes Association
BMI	Body Mass Index
CDCP	Centers for Disease Control and Prevention
CPG	Clinical Practice Guideline
DAWN	Diabetes Attitudes, Wishes and Needs
DHMS	Department of Health and Medical Services
DKT	Diabetes Knowledge Test
DM	Diabetes Mellitus
Dr.	Doctor
EMHJ	Eastern Mediterranean Health Journal
FBS	Fasting Blood Sugar
FPG	Fasting Plasma Glucose
GDP	Gross Domestic Product
HbA1C	Hemoglobin A1c
IDDM	Insulin Dependent Diabetes Mellitus
IDF	International Diabetes Federation
JDC	Journal of Diabetes and its Complications
KAP	Knowledge, Attitude and Practice
KL	Kuala Lumpur
MDA	Malaysian Diabetes Association

MDFCPG	Malaysia Diabetic Foot Clinical Practice Guideline
MDRTC	Michigan Diabetes Research and Training Center
MJM	Medical journal of Malaysia
MMOL/L	Millimol/Liter
MOH	Ministry of Health
NA	Not Applicable
NDI	National Diabetes Institute
NHAM	National Heart Association of Malaysia
NHMS	National Health and Morbidity Survey
NIDDM	Non Insulin Diabetes Mellitus
NS	Not-Significant
NPC	National Pharmaceutical Council
PECJ	Patient Education and Counseling Journal
PGH	Penang General Hospital
PVD	Peripheral Vascular Disease
RM	Ringgit Malaysia
S	Significant
SD	Standard Deviation
SKMC	Sheikh Khalifa Medical City
SMJ	Singapore Medical Journal
SPSS	Statistical Package for Social Sciences
UAE	United Arab Emirates
UK	United Kingdom

UKPDS	United Kingdom Prospective Diabetes Study
UNFPA	United Nations Fund Population of East Asian and Pacific Affairs
UOM	University of Michigan
USA	United States of America
Vs.	Versus
WHO	World Health Organization

PENGETAHUAN, SIKAP DAN AMALAN DIABETES MELLITUS: KAJIAN PERBANDINGAN DI ANTARA PESAKIT MALAYSIA DAN EMIRATE ARAB BERSATU

ABSTRAK

Diabetes melitus merupakan masalah kesihatan yang terjadi di serata dunia. Prevalensnya berbeza-beza di pelbagai tempat di dunia. Diketahui bahawa pendidikan yang baik tentang diabetes adalah suatu kaedah berkesan untuk mengawal diabetes. Setengah kajian ke atas program pendidikan kesihatan yang berbeza, yang dijalankan di Malaysia dan juga di Emirate Arab Bersatu (UAE) menunjukkan bahawa secara umumnya pengetahuan tentang penyakit dan pengurusana diabetes di kedua-dua negara ini adalah kurang jika dibandingkan dengan negara-negara lain. Objektif utama kajian ini adalah untuk mengetahui perbezaan dalam tahap pengetahuan, sikap dan amalan (KAP) pesakit diabetes dan juga kesannya (kawalan glisemia) di kalangan pesakit diabetes di klinik pesakit luar endokrin dan di pusat diabetes di antara Malaysia dan UAE Kajian prospektif perbandingan telah dijalankan daripada September 2006 hingga Jun 2008. Seramai 202 orang Pesakit Luar Klinik Diabetes daripada Hospital Pulau Pinang, Malaysia dan 201 orang Pesakit Luar Endokrin, Pusat Diabetes, Sheikh Khalifa Medical City di Abu Dhabi (UAE) terlibat dalam kajian ini. Pesakit yang memenuhi ciri-ciri yang dikehendaki telah ditemubual secara individu dan secara sukarela mengisi boring soalselidik berhubungkait dengan pengetahuan mereka tentang diabetes, sikap mereka tentang penyakit dan amalan yang mereka lakukan dalam pengurusan

penyakit yang telah divalidasikan,. Data tentang ciri-ciri demografi, sejarah perubatan, analisis urin dan darah yang terkini dan terapi drug semasa dicatat dalam borang khusus. Regresi logistik pelbagai digunakan untuk membandingkan perbezaan perkadaran di antara kedua-dua kumpulan berasaskan pakej statistik untuk sains sosial (SPSS) versi 12.0. Ujian Khi-kuasa dua, ANOVA post hoc dan ujian-t bebas digunakan untuk membandingkan purata bagi KAP, HbA1c dan kepekatan gula darah sewaktu puasa di antara dua kumpulan. Kajian ini menunjukkan secara signifikan responden-responden diabetes Malaysia lebih baik KAP daripada responden–responden UAE dengan purata skor pengetahuan, sikap dan amalan adalah 25.6 ±3.34 berbanding 20.26 ±2.96, 4.29±1.17 berbanding 2.90 ±0.086 dan 4.25 ±1.33 berbanding 4.1 ±0.99 masing-masing (P <0.001). Kajian ini juga menunjukkan perbezaan dalam ciri-ciri sosial, faktor risiko, kekerapan kehadiran kelas pendidikan diabetes, sumber maklumat dan kawalan glisemia di antara pesakit diabetes di Malaysia dan UAE. Dalam usaha mengawal diabetes, disyorkan agar kerajaan Malaysia dan juga UAE dapat mengaplikasikan pengalaman negara lain, yang telah berjaya dengan program pendidikan kesihatan. Selain pengetahuan, sikap dan amalan pesakit juga penting kerana pengetahuan semata-mata tidak mampu memberi kesan terhadap kawalan glisemia atau mencegah terjadinya komplikasi yang signifikan.

KNOWLEDGE, ATTITUDE AND PRACTICE OF DIABETES MELLITUS:

A COMPARATIVE STUDY BETWEEN MALAYSIAN AND THE UNITED ARAB EMIRATES PATIENTS

ABSTRACT

Diabetes mellitus is an emerging health problem worldwide, the prevalence varies widely in different regions around the world. It is well known that good diabetes education is a cornerstone of diabetes control. Some studies of different health education programs in Malaysia and the United Arab Emirates (UAE) have shown that diabetics in these countries generally know less about the disease and its management than diabetics in other countries. The main objective of this study is to determine the differences in the levels of the knowledge, attitudes, and the practice (KAP) of diabetic patients and also the impact (glycemic control) at endocrine outpatient clinic and diabetes center, between Malaysia and the UAE. A comparative prospective study was conducted from September 2006 to June 2008. Two hundreds and two outpatients of Diabetic Clinic from Penang Hospital of Malaysia and 201 patients from Endocrine Outpatient's Clinic, Diabetic Center of Sheikh Khalifa Medical City in Abu-Dhabi (UAE) participated in this study. Patients who fulfilling the desired criteria were interviewed individually and voluntarily filled a validated questionnaire about their knowledge of diabetes, their attitudes toward the disease, and their disease management practices. Data on the

demographic characteristics, medical history, latest blood tests and urine analyses, and current drug therapies were collected in a specific data collection form. Multiple logistic regressions were used to compare the proportional differences between these two groups based on statistical package for the social sciences (SPSS) version 12.0. Chi-square test, ANOVA post hoc, and independent t-test were used to compare the means of KAP, HbA1c, and fasting blood sugar concentrations between the two groups. This study shows Malaysian diabetic respondents has significantly better KAP than the UAE respondents with mean scores of knowledge, attitude and practice were (25.6 ±3.34 vs. 20.26 ±2.96), (4.29±1.17 vs. 2.90 ±0.086) and (4.25 ±1.33 vs. 4.1 ±0.99) respectively (P <0.001). This study also reveals differences in the social characteristics, risk factors, frequency of attendance at the diabetes education class and the sources of information between Malaysian and the UAE patients. Achieving better diabetes control, and reducing the prevalence of the disease, it is suggested that Malaysian people and the UAE may benefit from the experiences of the each other and from other countries with specific health education programs. Attitudes and practices of patients are also important beside their knowledge, as knowledge alone cannot affect glycemic control a lot, or cannot significantly prevents the incidence of complications.

CHAPTER 1

INTRODUCTION

1.1 Background

Diabetes mellitus is an emerging health problem worldwide, the prevalence of diabetes varies widely in different regions around the world, but there is a significant increase in the prevalence of this chronic disease in developing and developed countries. The prevalence of diabetes in adults is expected to rise by about 170% in developing countries, whereas developed countries are expected to see an increase in diabetes prevalence of 42% (King *et al.,* 1998).

United Arab Emirates (UAE) had positioned as the 2nd country with highest prevalence of diabetes in the world (18.7%) (IDF, 2009). This may refer to the rapid economic development has been associated with incredible changes in lifestyle towards the westernized pattern reflected by changes in nutrition, less physical activity, and tendency to increased obesity.

Whereas, Malaysia has ranked the 10th position with (13.8%) of the top 10 of the highest countries with diabetes prevalence in 2009 (IDF, 2009). While it was 11.6% in 2006 and 6.3% in 1986 (Third National Health and Morbidity Survey, 2006). The increases of prevalence in Malaysia probably related to the increases in the size of the aging population, increased urbanization, lifestyle changes, dietary changes, and improvements in the diagnostic testing (Rampal *et al.,* 2009). This concern about the explosion in the prevalence of diabetes around the world is compounded by the difficulties involved with the diabetes control. Generally, diabeties patients

cannot easily achieve the glycemic control goals, despite all the advances in diabetes treatment. This inability to obtain glycemic control goals may refers to many factors such as; lacking of sufficient knowledge about the diabetes, poor attitude and poor diabetes management practices.

Patients with diabetes mellitus are often lacking for sufficient knowledge about their disease and thus frequently will have poor self-management skills. The patients' ability to understand and to carry out their individual treatment regimen is critical to the diabetes mellitus glycemic control.

Unfortunately, the gap between what diabetic patients understood about the disease and what they do to control it, is still increasing in Malaysia and in the UAE. Many factors contribute in the widening of this gap; one of these factors could be due to the lacking in number of research in this field especially in the Asian countries. Therefore, this study was designed to detect and to compare the differences in the KAP levels of the diabetic patients in two different sites. Malaysia and the UAE, were have deficiencies in outlining of some practical steps in the improving knowledge, awareness, behaviors and attitudes toward better quality of life of the both populations.

1.2 Diabetes prevalence and cost worldwide

According to the estimation of the United Nations Fund Population of East Asian and Pacific Affairs, around 284.6 million people worldwide in 2009 were estimated to have diabetes, with over 438.4 million predicted to have the condition by 2030 (IFD, 2009). However, these figures may significantly underestimate the extent of this problem. Up to 50% of those who were diabetic are thought to remain undiagnosed and therefore untreated. There is likely to be a substantial increase in the number of individuals presenting with diabetes associated microvascular and macrovascular complications.

The number of people with diabetes is expected to increase at an alarming rate in the coming decades. As in 1985, it was expected that 30 million people worldwide had diabetes, whereas in 2000 the figure had risen to over than 150 million people with diabetes around the world (Zaini, 2000).

The cost of treatment has also increases dramatically and destructive to the human, social and economic effects. The largest costs of diabetes worldwide are its devastating effects on families and national economies (International Diabetes Federation, 2007).

A diabetes cost includes direct costs such as; hospital stays, outpatient visits, drugs and supplies. And indirect costs such as; loss of productivity, absenteeism, disability, and early mortality (American Diabetes Association, 2008).

1.2.1 Diabetes in Malaysia

Malaysia is the heart of central Southeast of Asia, The total population of Malaysia is over 28,609,844 Population, Malaysia (2010). Approximately half (49.4%) of them are females. Ethnic groups in Malaysia include, Malays (50.3%), Chinese (23.8%), Non-Malay indigenous population (11.0%) and Indians (7.1%) (August, 2008) (Department of Statistics - Malaysia, 2008). The Malaysian Government expenditures on health are 2% of the gross domestic product United Nations Population Fund (UNFPA, 2005). Diabetes is a growing concern in Malaysia. It has been observed that the number of people with diabetes in Malaysia is increasing and that complications rates and associated diseases amongst diabetics are extremely high. The prevalence of diabetes mellitus in this country has also steadily increased over the years, from an estimated 0.65% in 1960 up to 2% in 1982 (Lim, 1991).

In the First National Health and Morbidity Survey (NHMS I) conced in 1986, the prevalence of diabetes mellitus was estimated to be 6.3%. This prevalence had increased by 1996, and in the Second National Health and Morbidity Survey showed that the national prevalence of diabetes in Malaysia was 8.3%, and it is continued to increase (Second National Health and Morbidity Surveys, 1996).

In the (NHMS III), the prevalence was 11.6%, based on the prevalence among adults aged 30 years and above, it has been estimated that there were 700,000 to 900,000 persons with diabetes in 1999 (Zanariah *et al.*, 2006).

At this time, near 1.2 million people in Malaysia have diabetes

(Malaysian Diabetes Association, 2009). Moreover, the prevalence of undiagnosed diabetes is 2.5%. Unfortunately, more than half of the people are not aware that they have the disease (Ooyub *et al*., 2004).

The prevalence of diabetes mellitus by Malaysian states varies geographically. The highest observed prevalence of known diabetes was recorded in Penang and Selangor (7.3%), whereas the highest prevalence of undiagnosed diabetes was observed in Negeri Sembilan (4.1%), Penang (3.5%), and Melaka (3.1%). For the two categories of diabetes mellitus, urban areas recorded significantly higher prevalence compared to the rural areas (Bakri, 2007). From the World Health Organization report about mortality by country for 2006, diabetes is the 6th leading cause of death in Malaysia, accounting for 4% of deaths annually (World Health Organization, 2006). While, the department of statistics Malaysia, reported diabetes mellitus is the 8th cause of death in Malaysia with 1.8% of all death in 2007 (Statistics on causes of death, 2007).

In 2010, Malaysia is ranking 10th with diabetes all over the world (IDF, 2009). This increase in the prevalence of diabetes also parallels a dramatic increase in the medical costs. Statistics from the Malaysia Ministry of Health (MOH) records showed that the number of admissions to government hospitals in Peninsular Malaysia for diabetes mellitus increased from 19,629 cases in 1991 to 30,661 cases in 2001, an increase of 56% over a span of 10 years, Moreover, mortality due to diabetes has also increased from 254 deaths in 1991 to 380 deaths in 2001, an increase of 50% (Ooyub *et al.*, 2004).

In Selangor in 2002, a previous study showed that the provider's cost per diabetes patient per year was RM 185.97, whereas the direct cost per diabetes patient visit was RM 53.03 (Nabila, 2002).

A big portion of the Health Ministry's budget on medicine has been spent on drugs for (hypertension, diabetes, and high cholesterol). The Health Minister Datuk Seri Dr. Chua Soi Lek said that, since the beginning of the 2008 year, RM180 million, or 20% out of its annual RM 900 million budget was spent on such drugs (Chua, 2007).

From the Malaysian statistics on medicines, the drug therapy of diabetes is one of the top expenditures in Malaysia, of the total amount spent on medications, the most was spent on medicines for the treatment of blood pressure, cholesterol, and diabetes, which accounted for 63% of the expenditures for the top 40 utilized medicines and for 18.5% of all medicinal expenditures for 2005 (2.24 billion) (Goh, 2005).

In another previous study, the most commonly used medications in Malaysia during 2005 were the anti-diabetic medications (3.6% of the population), glibenclamide was used in (1.3% of the population) while, metformin was used in (1.2%) as the most commonly used drugs. Moreover, in 2005, diabetic drugs were among the top 30 most widely used therapeutic drugs as defined by dose per 1000 population per day (Lim *et al.*, 2005).

1.2.2 Diabetes in the United Arab Emirates

The United Arab Emirates is a union of seven Sovereign Sheikhdoms. It is located in the Middle East, with an estimated population of 4,621,399 (2005). Local national make up around 20% of the total populations, and the

majority of the populations (nationals and non-nationals) in the UAE is male (67.7%), whereas females represent 32.3% (UAE Ministry of Economy, 2007). Diabetes mellitus was the fifth leading cause of disability, mortality, and morbidity in the UAE in 2006, whereas it was the seventh leading cause of death in 2002 (World Health Organization, 2006).

Deaths attributed to diabetes accounted for (2–3%) of all deaths in the past 10 years. Almost all deaths were reported among persons aged 45 years and older. A recent joint WHO/UAE study showed that the prevalence of diabetes is approximately 17%, which could serve as a preliminary baseline on which to build a solid database to guide the national plan, The UAE government expenditure on health is about 3.3% of its gross domestic product (WHO report, 2002- 2006; UAE -Ministry of Health report, 2006).

The Ministry of Health of the United Arab Emirates studied the prevalence of diabetes mellitus in the country from 1998 to 2000, The study was conducted on 6,609 men and women, including 2,363 nationals and 4,246 expatriates, it was reported that the overall percentage of people with diabetes was (19.6%), in the UAE citizen group the percentage was (24%), whereas in the expatriates it was (17.4%), highlighting the higher prevalence in the native UAE population (El-Sharkawy, 2004). In a study in 2006, the prevalence of diabetes was (20%), and it was higher among the UAE citizens (25%) than in the expatriates (13-19%) depending on the country of origin (Malik *et al.,* 2006). The prevalence of diabetes rose with age to a maximum of 40% after age 55 years old (Malik *et al.*, 2006).

The most likely reason for that huge increase in diabetes among the UAE population is due to extraordinary social changes resulting in the adoption of

an increasingly western lifestyle that has resulted in dramatic changes in diet and in nutrition, more sedentary lifestyle shifting, and an increasing prevalence of the obesity and increasing smoking habits among adults. These socioeconomic changes were believed to be responsible for the explosion of diabetes across the region (Abduelkarem *et al*., 2008).

The direct cost of diabetes mellitus treatment was 300 million dollars per year in 2007; this cost is for approximately 350,000 of the UAE citizens who have been diagnosed with diabetes mellitus (10.9%) of the population of the UAE, The cost is nearly 900 dollars per person per year (Tadmori, 2007).

In Al-Ain, the second largest city in the Abu Dhabi Emirate, diabetes accounted for 6% of all general medical admissions to the hospital over a five year period between 1980 and 1984 (Omar *et al.,* 1985).

1.3 Literature Review

1.3.1 Demographic data

1.3.1 (a) Diabetes and age

Diabetes is a disease that affects people of all ages. However, the incidence rates of type I diabetes, type II diabetes or/and other forms of this disorder vary from one age group to another. The risk for developing type II diabetes increases with the age and most are diagnosed after the age of 45 years. Moreover, the number of obese children has risen dramatically over the years, as has the number of children and teens diagnosed with type II diabetes (Malik *et al.,* 2007). The Centers for Disease Control and Prevention, the United States of America reported that from 1980 through

2005, the age-adjusted prevalence of diagnosed diabetes increased among all race groups examined (CDCP, 2007).

From the Third National Health and Morbidity Survey III, Malaysia, there was 2% prevalence of diabetes with age range 18-19 years old. While, there was an alarming prevalence among 50-64 years old which ranging between 20.8% -26.2% (Letchuman *et al.*, 2006).

In a published study in 2005, the highest percentage of diabetes patients were aged (50-59) years old (Mafauzy, 2005). In another study, 35% of patients who had uncontrolled type II diabetes were aged > 50 years old (Adliah *et al.*, 2004). In the UAE, the prevalence of diabetes rose with age to a maximum of 40% after the age of 55 years old (Malik *et al.*, 2006). The latest study published in 2009 found that among 7683 respondents aged ≥30 years (Rampal *et al.*, 2009).

1.3.1 (b) Diabetes onset

The longer the period of the disease, the patient's glycemic levels tends to be elevated more, and this will increase the risk of complications. This does not mean that the knowledge about the disease and diabetic management practices of patients who have had diabetes for a long time are better than those who have been newly diagnosed or who have only been diagnosed with diabetes for a short period of time.

In one study done in Malaysia, 39% of the uncontrolled hyperglycemic patients had been diagnosed with type II diabetes mellitus for more than 10 years (Adliah *et al.*, 2004).

One study done in the UAE indicated that there was no significant difference between the time since diagnosis and changes in glycosylated hemoglobin levels over a period of two years (Andrews *et al.*, 2002).

1.3.1 (c) Diabetes and gender

As for gender distribution, a previous report suggests that the female dominated in the number of patients with diabetes. Females were about 10% more to have diabetes than men (International Diabetes Federation, 2006).

In the Second and Third National Health and Morbidity Surveys of Malaysia has reported that, no significant differences were found between the gender and knowing or undiagnosed diabetes (Third National Health and Morbidity Survey, 2006). One study found that 55% of diabetes patients were females and 45% were males (Yun *et al*., 2007).

Whereas another previous study was found that 61.4% of diabetes patients were females and 38.6% were males (Sulaiman *et al.*, 2004).

In addition, the complications incidences were vary between the male and female. National Diabetes Institute reported that diabetic macrovascular complications including ischemic heart disease and stroke were higher among Malays and Indian females (Mafauzy, 2005).

In another published study in Malaysia, females were twice as likely as males to have diabetes, and the familial association was greater (Mustafa, 1985). One study published in 2001 reported that out of 300 diabetes patients, 51% were males and 49% were females (Abdullah *et al.*, 2001).

In 1995, another previous study with 322 subjects reported that the diabetes gender prevalence was 11% in males and 7% in females (El Mugamer, 1995).

In the UAE, the percentage of male with diabetes is slightly higher than that of female. In a study done in Rashid Hospital, Dubai, in 2005-2006, of 4,713 diabetes patients who visited the diabetes clinic, 56.7% were female (Statistical Analysis Section-Department of Health and Medical Services, Dubai, 2007).

At the same hospital, the number of in-patients hospitalized due to diabetes complications was 538, 56.4% of whom were male. Finally, a previous study found, 51.8% of the 2,548 patients enrolled in the study were male (Khattab *et al.*, 2007).

1.3.1. (d) Diabetes and race

The NHMS II mentioned that the prevalence of known diabetes among Indians (11.5%) was significantly higher than that of other races (Second National Health and Morbidity Survey, 1996). Malaysian Indians are at greater risk of being diabetes compared to the other ethnic groups with the estimated prevalence ranging from 3.5% -16% (Ooyub *et al*., 2006).

In a previous study describe the diagnosing of diabetes among patients in Malaysia according to the races and means of age, it was found that the mean of age in Malays were, 56.7 years; Chinese, 62.7 years; Indians, 57.3 years; and in other ethnic group 76.0 years. The complications were also different for different races (Chan, 2005).

Another study published in *Medical Journal of Malaysia* found that diabetic macrovascular complications including ischemic heart disease, stroke, and peripheral vascular disease were higher in Malay and Indian females (Mustafa, 2004).

From the NHMS III, Indians have the highest prevalence of diabetic complications (19.9%), followed by Malays (11.9%) and Chinese (11.4%) (Third National Health and Morbidity Survey, 2006). In a recent study done in Malaysia, Indians had higher risk of having diabetes by 10% than the Chinese (Rampal *et al*., 2009).

In the UAE, there seems to be a genetic predisposition to diabetes among the UAE nationals, and statistics show that they have a higher prevalence than other nationalities within the UAE (Barakat, 2007).

Increasing the risk of diabetes may be due to intra-familial marriages between the Emirates because 92% marry their relatives (Amin, 2009).

El-Sharkawy, 2007 stated that the percentage of local diabetic was higher (24%) than the expatriates (17.4%) in the UAE community

In another previous study, out of 300 diabetes patients, 58% was Emirati, and 42% were from other nationalities (Abdullah *et al.*, 2001).

In Rashid Hospital, Dubai in the period of (2005-2006), 4,713 diabetes patients who were visiting the diabetes clinic, 68.7% were from Emirati nationality (Department of Health and Medical Services UAE, 2007).

Another study reported that 66% of the diabetics patients were Emirati population (Khattab *et al*., 2007).

1.3.2 Social characteristics

1.3.2 (a) Diabetes and educational level

Most of the previous studies done in Malaysia and the UAE on the educational level of diabetes patients have reported a lower educational level of diabetes patients than those of non-diabetic. High percentage of illiteracy and primary school were among diabetes patients. A previous study done in Kelantan, Malaysia reported that education level was low in diabetes patients, with 25.4% having no formal education, 42.1% having a primary school education, 30.7% having a secondary school education, and only 1.8% having attended college/university (Sulaiman *et al.*, 2004). In another study, 128 diabetes patients, 77% had less than 6 years of formal schooling (Tan, 2004). In yet another study done in 1997 in Kuantan, Malaysia, the more educated group of patients had better glucose control than the less-educated group (Adibah *et al.*, 1998).

Finally a study reported a significant difference in the glycemic control in patients with different educational status (Ismail *et al.*, 2000).

In a study on patients in the UAE 512 female diabetes patients, 32% did not have formal education, 11% had primary education, 28% secondary education, and 29% post-secondary education (Carter *et al.*, 2004).

In another study in the UAE, there were 172 illiterate patients out of 300 (57%) respondents, 18 self-educated patients (6%), 38 patients with primary school education (13%), 45 patients with secondary school education (15%), and 27 patients with post-secondary education (9%) (Abdullah *et al.*, 2001).

In yet another study, out of 219 diabetic patients, 58% were uneducated (Bakir *et al.*, 2004).

Finally a study reported out of 513 diabetic patients, 62.8% were illiterate, 19.6% had completed primary school, 11.9% had completed secondary school, and 5.7% had completed university. Of these patients, 62.4% were in poor control of their diabetes (Al Maskari, 2004).

1.3.2 (b) Diabetes and occupation

The Second National Health and Morbidity Survey, 1996 in Malaysia reported that the prevalence of diabetes decreased with increasing status of diabetic patients in term occupation; the unemployed had a high prevalence of known (12.8%) and undiagnosed (3.6%) diabetes, the pensioners had a high prevalence of known (12%) and undiagnosed (4%) diabetes (Second National Health and Morbidity Survey, 1996). This trend may have been due to an increased prevalence among older patients, who tend to be unemployed or retired people.

In a previous study, there was not a big difference in the level of glycemic control between the patients who were sedentary or non-sedentary (72% vs. 69.8 %), (Adibah *et al.*, 1998).

In another pervious study done in the UAE it was found that, 52.7% of patients in Dubai were employed, with 20% of all patients having a controlled HbA1c or less than 7% (Khattab *et al.*, 2007).

1.3.2 (c) Diabetes and marital status

In one previous study done in Malaysia, with 400 patients reported a significant association between blood glucose control and marital status ($P < 0.05$). Patients who were unmarried had a 4-fold higher risk of having poor blood glucose control compared to married patients (Adibah *et al.,* 1998).

1.3.3 Risk factors

Many risk factors predispose patients to developing diabetes. Besides genetics, there is sufficient evidence to show that one of the main factors influencing the explosion of diabetes in modern times is lifestyle related changes that lead to obesity and its related co-morbidities.

1.3.3 (a) Diabetes and family history

Positive family history is a risk factor for diabetes. In a study published in the *Malaysian Journal for Medical Science*, 62 out of 211 Malaysian diabetic patients (29%) had a positive family history of diabetes mellitus (Eid *et al.,* 2003). In a study done in the UAE, 121 diabetes patients out of 300 (40%) had a family history of diabetes (Abdullah *et al.,* 2001).

In another study, 54.3% of 513 diabetic patients had a family history of diabetes mellitus (Al Maskari *et al.,* 2007).

1.3.3 (b) Diabetes and obesity

The prevalence of obesity is rising to epidemic proportions worldwide. Being overweight or obese seriously increases an individual's risk of developing other health problems such as type II diabetes. The means by

which excessive body fat causes type II diabetes is not clearly defined, but it appears that excess fat increases insulin resistance, raising blood glucose levels and the likelihood of developing diabetes (International Diabetes Federation, 2006).

In the Second National Health Morbidity Survey in 1996 reported that 20.1% of males were overweight and 4.0% were obese, whereas 21.4% of females were overweight and 7.6% obese. Amongst those with diabetes mellitus, 18.8% were either obese or overweight (Second National Health Morbidity Survey, 1996).

In a study in Kelantan, 38.4% of diabetic patients were either obese or overweight compared to 24.1% of those with normal glucose tolerance (Mafauzy, 2006). In a countrywide survey that was conducted in 1997, 43-52% was either overweight or obese, in Malay and Indian females (Mustafa, 2004).

Obesity is a point of concern in the UAE population. A study of national nutrition performed by the UAE Ministry of Health in 2000 revealed that 33% of married women in the UAE were overweight and 38% were obese, whereas for married men, 40.3% were overweight, but only 15.8% were obese. A study done in the UAE showed that around 20% of the population suffers from obesity (United Arab Emirates Ministry of Health, 2001).

In a study published in the *Diabetes Research and Clinical Practice Journal*, obesity was common in nearly all ethnic groups in the UAE. Approximately three-quarters of all diabetes patients of this previous study were either obese or overweight (Malik *et al.*, 2006).

1.3.3 (c) Diabetes and smoking

Although there is no direct relationship between tobacco smoking and the development of diabetes or the ability to achieve glycemic control, smoking can aggravate many of the problems that people with diabetes already face, such as heart and cardiovascular disease. Moreover, it can also make managing diabetes more difficult for those who already have it (Cleveland Clinic, 2008). Generally, from many statistics in Malaysia and the UAE, more than 20% of the population smokes.

In Malaysia, about half of men smoke, and 30% of men in the UAE are smokers (World Health Organization, 2006). A previous study done in Malaysia was reported that 15.9% of the respondents were smokers. Moreover, same study found that smoking had no significant effects on glycemic control in type II diabetic patients (Eid *et al.*, 2004).

In a previous study done in Dubai, UAE, 24.7% of the diabetic patients were smokers (Khattab *et al.*, 2007). In a published previous study in Sharjah, UAE it was reported that (52%) of male diabetes patients were heavy smokers (Abduelkarem and Sackville, 2008).

1.3.4 Diabetes and source of information

A study published in the *Patient Education and Counseling Journal* (*PECJ*) in 2007 about the knowledge of diabetes patients in northern Malaysia reported that most (54%) of the information about diabetes and its management that diabetic patients knew was obtained from health-care professionals such as medical officers, pharmacists, and nurses, followed by

friends and relatives (17%) and books and magazines were 9.16% (Yun *et al.*, 2007).

In a study published in the *Eastern Mediterranean Health Journal* (*EMHJ*) about the source of information for diabetes patients in the UAE, results showed that the most common sources of patient information about diabetes were nurses and doctors (59%), and then written and electronic media (40%). Ineffective sources of information about diabetes were pharmacists with 0% (Abdullah *et al.*, 2001).

1.3.5 Glycemic control

Glycemic control is the maintenance of the blood glucose levels at or slightly above the “normal” blood glucose level for the average of non-diabetic individual. The goal of glycemic control is to keep the blood glucose levels of diabetics as close to a “normal” level as possible. Much evidence suggests that many of the long-term complications of diabetes, especially the microvascular complications, result from many years of hyperglycemia (elevated levels of glucose in the blood). Good glycemic control, in the sense of a "target" for treatment, has become an important goal of diabetes care. There are many tests used for monitoring blood glucose level; the most important tests are Hemoglobin A1c and fasting blood glucose (University of Michigan, 2008; American Diabetes Association, 2008).

The Hemoglobin A_{1C} test provides an index of a patient's average blood glucose level during the past 2-3 months and is considered the most objective and reliable measure of long-term metabolic control. The benefit of

this monitoring is to evaluate the effects of lifestyle and drug therapy in their ability to control the disease. Many studies have been performed to investigate the effects of monitoring blood glucose level and therapy plans on the ability of patients to maintain good glycemic control. The Diabetes Control and Complications Trial establishes that maintaining HbA1c levels as close as possible to the normal range, results in considerable reductions in the long-term health complications (Delamater, 2006).

In the UK, a total of 4,075 diabetic patients who maintained target glycemic levels decreased markedly over 9 years of follow-up by 8% of monotherapy with diet, 42% of insulin treatment, and 24% of sulfonylurea therapy, achieved target fasting plasma glucose levels, and achieved target HbA_{1c} levels by 9% of monotherapy with diet, 28% of insulin treatment, and 24% of sulfonylurea therapy (Turner *et al.,* 1999).

In a study published in Malaysia showed that only 41% of the patients had HbA1c less than 7% and only 18% had FPG less than 6.1 mmol/L (Mafauzy, 2005). In another study in Malaysia, only 20% of the patients had HbA1c less than 7% and 11% had FPG less than 6.7 mmol/L (Mafauzy, 2006).

In a study was performed in outpatient diabetes clinics from 2001 to 2002, 211 patients were observed, Abnormal fasting plasma glucose and high glycated hemoglobin levels were observed in 60% and 73% of type 2 diabetic patients, respectively. Glycated hemoglobin levels of 28% of the subjects were (less than 7%), (36%) were between (7 - 9%), and (36%) were (more than 9%). The worst glycemic control was observed in Malay

patients, as HbA1C levels of Malays and Non-Malays subjects were 8.7±2.3%) and (7.7±1.7%), respectively (Eid *et al.*, 2004).

In a previous study done in Malaysia in 2004, the mean of HbA1c level was (9.9 ± 2.82) and (85.7%) of the patients had HbA1c levels (above 7%) (Sulaiman *et al.*, 2004). In another previous study, the glycemic control was optimal in 28% of the patients HbA1c (less than 6.5%), and fair in 34% whereas HbA1c is between (6.5-7.5%), and poor in 38% where HbA1c is (more than 7.5%) (Wong *et al.*, 2004).

In another study in Malaysia, the overall glycemic control for 926 patients with diabetes diagnosed before 40 years of age was poor, with an average HbA1c of 8.6% and with 61.1% of the patients with an HbA1c greater than 8% (Ismail *et al.*, 2000). A study done in the UAE included 513 diabetic patients, of whom 62.4% were found to have poor glycemic control based on HbA1c >7% (Al Maskari *et al.*, 2007).

In another previous study, the proportion of subjects with diagnosed diabetes mellitus who achieved the internationally recognized target for HbA1c of <7% was 33.3% (Saadi *et al.*, 2007). In study done in the UAE, only 31% had an HbA1c of less than 7% (Al Kaabi *et al.*, 2008).

1.3.6 Diabetes and chronic complications

Chronic complications have conventionally been divided into two categories: Microvascular complications, which include nephropathy, neuropathy, and retinopathy, and Macrovascular complications, which include disorders of the cardiovascular, stroke, and peripheral vascular systems (American Association of Clinical Endocrinologists, 2007).

1.3.6 (a) Microvascular complications

1.3.6. a (i) Nephropathy

Diabetes is the leading cause of kidney failure in the developed world, and it accounts for approximately 35% to 40% of new cases each year. In the United States, 10% of all people with diabetes develop kidney disease (International Diabetes Federation 2003; Chaplin, 2005).

Diabetic nephropathy is now the primary cause of end-stage renal failure in Sarawak, Malaysia (Wong, 2005).

Data from the Malaysia National Renal Registry showed an increasing number of diabetic patients who required dialysis, from 40% in 1999 to 44% in 2000 and 45% in 2001. In 2002, it was reported that 47% of all new patients for dialysis had end-stage renal failure due to diabetes. Moreover, other results from this registry showed that 2,236 (28%) out of 7,984 diabetes patients had one positive microalbumin test (Ooyub *et al.,* 2004).

In a study the nephropathy complications were albuminuria (22.9%) and microalbuminuria (20.4%) (Mafauzy, 2005).

In a later study, the rate of albuminuria was 15.7%, and the rate of microalbuminuria was 6.6% (Mafauzy, 2006).

In another study, the rate of microalbuminuria complication in 1997 was 52% among diabetes patients (Mustafa, 2004). A previous study found that 48% of the diabetic patients in a public primary care clinic had proteinuria and advocated screening and treatment of proteinuria in diabetics in the primary care setting to retard the progress of nephropathy (Wong, 2005).

In yet another study the prevalence of macroalbuminuria and microalbuminuria were 15.7% and 39.7%, respectively (Knog, 2006).

In the UAE the prevalence rate for nephropathy was 40.8% among diabetic patients (Saadi *et al.*, 2007).

The prevalence rate of glycemic control is defined as the maintenance of blood glucose levels at or slightly above "normal" blood glucose levels for the average non-diabetic individual. The goal of glycemic control is to keep the blood glucose levels of diabetics as close to a "normal" level as possible; microalbuminuria was considerably higher (61%) among diabetic patients in the UAE (Al Maskari *et al.*, 2008).

Diabetic nephropathy was the cause of end-stage renal disease in approximately 25-35% of patients on hemodialysis in the UAE (Yahya, 1998).

1.3.6. a (ii) Retinopathy

Diabetes is the leading cause of blindness and visual impairment in adults in developed countries. Each year, 15,000 to 39,000 people lose their sight because of diabetes. The incidence of blindness is 25 times higher in people with diabetes than in the general population (International Diabetes Federation, 2006).

In 2002, the Malaysia National Registry reported that 2,138 diabetic cases or 34% of diabetic patients had some forms of retinopathy (Ooyub *et al.*, 2004). In another study it was found that the prevalence of eye complications among diabetes patients was 53% having retinopathy and 1% with developed blindness (Mustafa, 2004).

The Second National Health and Morbidity Survey (NHMS II) showed that the most common complication associated with diabetics was vision

problems (42.2-53.9%). In two other studies the percentages of the subjects with retinopathy who were Malays were 11.1% and Indian and 23.5%, respectively (Mafauzy, 2005; Mafauzy, 2006).

In two different studies in Malaysia, diabetic retinopathy has been reported to be as prevalent as 51.6% -59.2% among diabetic patients (Tajunisah *et al.*, 2006; Hien *et al.*, 2006). In another study conducted in the UAE, the prevalence rates for retinopathy were (19-54.2%) among patients with diabetes. The disease was more common among the male than female (24.2% vs. 13.9%), and the prevalence increased with increasing age and with disease duration (Al Maskari *et al.*, 2004). In another study Type I diabetes was highly significantly contributing risk factor for type I (38.3% vs. 16.4%) for type II (Saadi *et al.*, 2007).

1.3.6. a (iii) Neuropathy, foot complications and amputation

Foot complications result from a complex interplay of ischemia, ulceration, infection and diabetic Charcot's joint. Approximately 50% of all those who have diabetes for over 25 years have evidence of nerve damage in their feet. Nerve damage can lead to loss of feeling, muscular weakness, amputation, and impotence (Malaysia Diabetes Association, 2005).

Diabetic foot complications pose a substantial problem in the Malaysian diabetic population. They are a major source of morbidity and a leading cause of hospital bed occupancy, and they account for substantial health care costs and resources. Foot complications have been found to account for 12% of all diabetic hospital admissions, which in turn make up 17% of all

hospital admissions at Hospital Kuala Lumpur, Malaysia (Malaysian Ministry of Health and Academy of Medicine, 2004).

The prevalence of neuropathy complications was reported to be 58% in 1997 in diabetes patients (Mustafa, 2004).

The Second National Health and Morbidity Survey reported that a commonly perceived complication associated with diabetic condition among known diabetics was numbness (34.8-42.1%) (Second National Health and Morbidity Survey, 1996). Two previous studies showed that the prevalence of neuropathy complications in the diabetic study population was 30.1% and 19% respectively (Mafauzy, 2005; Mafauzy, 2006). In another study peripheral neuropathy was reported in 39% out of a study population of 513 diabetic patients in Al-Ain, UAE (Al Maskari, 2004).

Also upon neurological examination, 26/60 UAE diabetes patients (43%) had clinical signs of polyneuropathy and a positive neuropathy deficit score (NDS) (Baba *et al.*, 1998). The prevalence rate for neuropathy in the UAE was 34.7% (Saadi *et al.*, 2007). Nerve damage combined with peripheral vascular disease makes diabetes the most common cause of amputation that is not a result of an accident. People with diabetes are 15 to 40 times more likely to require a lower-limb amputation compared to the general population. Diabetic foot disease has become a major medical, social and economic challenge worldwide. While 5% of patients with diabetes have a history of ulceration, the cumulative lifetime incidence is 15%, and, 20% of those with peripheral vascular disease will require amputation. In developing countries, it has been estimated that foot problems may account for as much as 40% of available healthcare resources. Extensive epidemiological surveys

have indicated that between 40% and 70% of all lower extremity amputations are related to diabetes (International Diabetes Federation, 2005).

In Malaysia in 1997, 2% of diabetes patients had had amputations (Mustafa, 2004). It was shown that 66.5% of patients who underwent amputation during the period from 2003 to 2005 in Kelantan Hospital were diabetic and these amputations were related to the diabetic foot conditions. In addition, 59.3% of these patients were less than 60 years old (Yousf *et al.*, 2007).

1.3.6 (b) Macrovascular Complications

1.3.6. b (i) Cardiovascular diseases

People with diabetes are two to four times more likely to develop cardiovascular diseases. The risk of mortality for cardiovascular disease is 40 times greater than in people without diabetes. The risk of peripheral vascular disease (PVD) in diabetics is four times higher (International Diabetes Federation, 2005; American Diabetes Association, 2003).

From the Second National Health and Morbidity Survey, 10% of the known diabetics perceived that they suffered slow wound healing, stroke, and cardiovascular diseases associated with their diabetic condition (Second National Health and Morbidity Survey, 1996).

A study published in 2003 mentioned that the prevalence of diabetes mellitus amongst hospitalized patients with stroke was 55.2%, which is higher than that reported in other international studies (Hamidon *et al.*, 2003). Other results of this study included data showing that diabetes was a