PREVALENCE AND FACTORS ASSOCIATED WITH CHRONIC DIABETIC COMPLICATIONS AMONG PATIENTS ATTENDING PRIMARY HEALTH CARE, A MULTI-CENTRIC STUDY IN KUWAIT

Medhat K El-Shazly,[1] Rasha M Al-Shammeri,[2] Ali M Abdel Moula,[3] Ali E Ismail,[4] Waleed A Ismail.[4]

[1]MD, Department of Medical Statistics, Medical Research Institute, Alexandria University, Egypt. & Department of Health Information and Medical record, Ministry of Health, Kuwait.
[2] MRCGP, Desman Primary Health Care Center, Ministry of Health, Kuwait.
[3]MD, Preventive Medicine Department, Al-Ahmadi Health Region, Ministry of Health, Kuwait.
[4] MD, Department of Medicine, Faculty of Medicine, Zagazig University, Egypt. & Medical Department, Farwaniya hospital, Ministry of Health, Kuwait.

Receive: 15/2/2010 - Accepted: 16/3/2010

ABSTRACT

Background: *A substantial proportion of patients with diabetes develop long-term macrovascular and microvascular complications. Many risk factors have identified for development and progression of these complications.*

Objectives: *The aim of the present study was to determine the prevalence of these complications among adult diabetic patients attending primary health care centers in Kuwait and to identify factors that could be associated with especially those factors that can be considered avoidable.*

Methods: *This study was carried out in five primary health care centers representing the five health regions in Kuwait. The sample included 704 adult diabetic patients who had been diabetic for at least 2 years. The first phase of study was a cross sectional study to determine the prevalence of chronic diabetic complications. The second one was a case-control study, whereas all patients with chronic diabetic complications (case group, n = 434) were compared to diabetic patients free from chronic complications (control group, n = 270) to determine the associated factors with cases.*

Analysis was initially carried out based on a series of univariate comparisons followed by multiple logistic regression analysis.

Results: *Out of 704 diabetic patients 61.6% n= had one or more chronic diabetic complications. Cardiovascular complications were diagnosed in 30.3%, nephropathy in 12.4%, neuropathy in 32.1%, lower limb complications in 21.9%, and retinopathy in 30.7% of patients. Logistic regression analysis revealed that age, nationality, type and duration of diabetes, glycemic control, hypertension, obesity, physical exercises, and compliance with diet recommendations were proved as significant predictors of these complications.*

Conclusion: *The high economic burden raised by diabetes and its complications challenges the Kuwaiti health care system to prevent the development and progression of diabetic complications. The study identified a group of predictor factors as hypertension and hyperglycemia, enhancement of patient' compliance with regular follow-up visit, the role of health care providers in supplying patients with health information groups of patients who needed priorities of screening programs for development of complication.*

Keywords: *chronic diabetic complications* - prevalence - associated factors

INTRODUCTION

Diabetes mellitus (DM) is a chronic disease that is widespread. It has been estimated that more than 180 million people worldwide are affected, and this number is predicted to more than double by 2030.(1) It has long been recognized as a major health problem, not only for its adverse health impact on individuals, but also for its economic burden on health care system and society at large. A substantial proportion of patients with diabetes develop long-term complications. There are two major types of long-term complications of diabetes: macrovascular and microvascular diseases. Macrovascular disease may result in myocardial infarction, stroke and peripheral vascular occlusion. Microvascular disease affects the small vessels of the retina, nerves and kidneys leading to diabetic retinopathy, diabetic neuropathy and nephropathy.(2) Progressive damage to eyes, kidneys, nerves, heart and arteries represents the major threat to the health and life of diabetic patients. Dyslipidemia and prolonged hyperglycemia promote an increase in oxidative stress, inflammation, and vascular damage, which together promote endothelial dysfunction and are associated with macrovascular and microvascular complications.(3) It should be recognized by patients, physicians and government that the expectation of care usually will not be the elimination of disease, but rather maintenance of function of patient through preventing the occurrence of complications.(4)

Correspondence to: Prof. Medhat Shazly, Department of Medical Statistics, Medical, Research Institute, Alexandria University, Tel: 00965/66612524, E-mail: medhat_shazly@hotmail.com

pISSN: 1110-0834
eISSN: 2090-2948

Diabetic retinopathy is the most common diabetic eye disease and a leading cause of blindness in adults. It remains one of the major causes of vision loss and blindness in young adults despite the availability of effective treatment.[5] The prevalence of diabetic retinopathy in type 1 ranges from 14% (India) to 80% (Finland) and in Type 2 it ranges from17% (Switzerland) to 52% (United Kingdom).[6]

Microalbuminuria is an early marker of diabetic retinopathy and an independent risk factor for cardiovascular disease. It is more common in type 1 diabetes and 30 to 60% progress to microalbuminuria within 10- 20 years.[7] Diabetic nephropathy is the most common cause of end-stage renal disease of diabetic nephropathy [3] Complicated diabetes, namely the presence of chronic renal failure, carries a long-term cardiac risk that is four times higher than the risk of non-diabetic patients.[8]

Peripheral neuropathy and peripheral vascular disease are well known common long-term complications of diabetes, and although a proportion of people with these complications have severe and debilitating pain, many are asymptomatic. Diabetic patients with these complications are known to be at high risk of foot ulceration, infection and amputation. Peripheral neuropathy and peripheral vascular disease are the main causes of non-traumatic lower limb amputation. Complications affecting the lower limbs are among the most common manifestations of diabetes; it was reported that 15% of diabetic patients will eventually suffer from foot ulceration during their lifetime. These complications are a frequent cause of hospitalization and disability; with 1 in 5 hospitalizations among diabetics directly related to foot ulcers.[9]

Mortality from cardiovascular diseases increasing by a factor of 2 to 3 in persons with diabetes mellitus compared with the general population. Up to 70% of deaths in people with type 2 diabetes are attributed to cardiovascular disease and stroke.[2] The increasing worldwide diabetes prevalence will inevitably result in increasing proportion of death from cardiovascular disease, as well as in increased prevalence and associated consequences of other complications of diabetes.[10]

Many of these complications may be delayed or prevented, offering considerable opportunities for both reduction in costs to the authorities and improvements in the quality of life of those affected.[11]) Identification of the specific risk factors in a defined population will allow early modification of interventions for optimal diabetes care. Primary care physicians have a leading role in ensuring that patients with diabetes receive early and optimal care.

In a country with a high prevalence of DM, like Kuwait, revealing the extent and factors associated with chronic diabetic complications is a high public health priority. The aim of the present study was to determine the prevalence of these complications among adult diabetic patients attending primary health care centers in Kuwait and to identify factors that could be associated with especially those factors that can be considered avoidable.

METHODS

Setting and design:

This study was carried out in five primary health care centers representing the five health regions in Kuwait. The field duration of the study covered 5 months starting from June to October 2006. The current study is a part of a larger multi-centric descriptive one. The details of the methodology can be found elsewhere.[12] In brief, all diabetic patients attending to the selected centers were sequentially recruited. Two index days were randomly defined for each of the selected centers for collection of data. Newly discovered cases were excluded from the study. The sampling unit was diabetic patient who had been diabetic for at least 2 years. They should be fully examined by an ophthalmologist with an ophthalmic report in their medical record. Selection criteria included age $\geq$ 18 years. All eligible subjects were asked to participate in the study. The final studied sample size was 704 adult diabetic patients.

Study questionnaires

The structured interview method has been adopted to collect data for this study with a specially designed questionnaire. It was derived from other published studies dealing with the same topic as well as from our own experience. It included socio-demographic characteristics (age, gender, nationality, education, occupation, marital status, housing and family income) and clinical data (type of DM, treatment, glycemic state, presence of hypertension, co-morbid conditions, and obesity), in addition to pattern of care and patient' practice (need of help to reach health care center, regular follow-up, compliance with diet recommendations, regular use of drug, regular check of urine glucose, regular check of blood glucose, self monitoring of blood glucose (SMBG), smoking, and physical activity). Biochemical investigations included fasting blood glucose, Hb_{A1c}, total cholesterol, high density lipoprotein (HDL), low density lipoprotein (LDL), triglycerides and micro-albuminuria.

The present study could be differentiated into two phases. The first one was a cross sectional study to determine the prevalence of one or more of the chronic diabetic complications among adult diabetic patients attending the selected centers. The second one was a nested case-control study, whereas all patients with chronic diabetic complications (case group, n = 434) were compared with all other diabetic patients free from chronic complications (control group, n = 270) to determine the associated factors with cases. Patients were considered eligible

as cases if they had type 1 or type 2 diabetes for at least 2 years, and any chronic diabetic complications had been diagnosed. Patients were considered eligible as control if they had type 1 or type 2 diabetes for at least 2 years and had never been affected by any chronic diabetic complications.

Verbal consent was obtained from all the subjects, after explanation of the purpose and importance of the research, prior to conducting the survey.

Measurements:

Trained physicians in the chosen centers collected data by interviewing patients and reviewing their medical records. In order to ensure uniformity of data measuring methods that relied on clinical judgment, all participating physicians were trained on data collection and the questionnaire was thoroughly tested for clarity before it was accepted.

Patients were considered as having type 1 diabetes if their age at diagnosis was < 30 years and insulin was used continuously from the time of diagnosis. They were considered as having type 2 diabetes if their age at time of diagnosis was ≥ 30 years. Three blood pressure measurements were obtained by trained physicians using a standardized sphygmomanometer after a 5-minute sitting rest. Hypertension was considered as uncontrolled by treatment on the basis of clinical judgment and confirmed by the presence of systolic blood pressure value > 140 mm Hg and/or diastolic pressure > 90 mmHg.[13]

Patients were classified as having diabetic neuropathy or cardiovascular complication on the basis of the presence of clinical symptoms and signs and confirmed by medical reports in their records. Nephropathy was considered if patient had microalbuminuria (albumin excretion < 30 mg per 24 hours), clinical proteinuria, or subjected to dialysis. The glycemic state of patient referred to the last value of Hb_{A1c} and it was considered adequate if < 7%. Normal levels for blood lipids were identified as 5.6 mmol/L for total cholesterol, 2.1 mmol/l for triglycerides, 3.4 mmol/L for LDL, and 0.91 mmol/L for HDL. Major limb complications included foot ulcer, claudication, gangrene, persistent ischemic pain or amputation. Co-morbidity included conditions that had been already present prior to the diagnosis of DM (angina pectoris, hypertension, renal disease, endocrine dysfunction, dyslipidemia and liver diseases).

Physical activity was considered if it was practiced for 30 minutes at least 3-4 times a week. For height and weight measurement, we used the Detecto-Scale Instrument, which was calibrated once a day before use. Body mass index was calculated as weight in kg / height in square meters. It was used as a measure of obesity. Individuals with a BMI between 25 and 29.9 were considered as overweight, while individuals with a BMI of 30 to 34.9 more were considered obese. Subjects with BMI ≥ 35 were considered as severe obese.

Statistical analysis:

Analysis was initially carried out based on a series of univariate comparisons. In order to control simultaneously for possible confounding effect of the variables, multiple logistic regression was used for the final analysis. In the univariate analysis Chi-square test was used to detect the association between chronic diabetic complications and explanatory variables. In multiple logistic regression analysis, the association between exposure and outcome was expressed in terms of odds ratio (OR) together with their 95% confidence intervals (95% CI).

All the explanatory variables included in the logistic model were categorized into two or more levels (R = reference category): gender: male^R, female; age (years): < 40^R, 40 – 49, 50 – 59, ≥ 60; nationality: non-Kuwaiti^R, Kuwaiti; education: primary or less^R, intermediate / secondary, university or higher; occupation: unemployed^R, worker, clerk, professional; marital state: married^R, unmarried; family income / month (KD): < 500^R, 500 – 999, 1000 – 1499, ≥ 1500; type of diabetes: type 1^R, type 2, type 2 – insulin treated; duration of diabetes (years): < 10^R, 10 – 19, ≥ 20; treatment: none^R, oral, insulin, oral + insulin; glycemic state: good control^R, poor control; dyslipidemia: no^R, yes; hypertension: no^R, yes controlled, yes uncontrolled; co-morbid conditions: no^R, yes controlled, yes uncontrolled; obesity: no^R, overweight, obese, severely obese; need of help to reach health care center: no^R, yes; regular follow-up visits: no^R, yes; compliance with diet recommendations: no^R, yes; regular check of urine glucose: no^R, yes; regular check of blood glucose: no^R, yes; SMBG: no^R, yes; smoking: no^R, yes, Ex-smoking; physical activity: sedentary^R, mild, moderate. Analysis was performed using SPSS package.

RESULTS

Among 704 diabetic patients participated in the study 434 were diagnosed as having one or more chronic diabetic complications with an overall 61.6% prevalence rate. Cardiovascular complications were diagnosed in 213 patients (30.3%), nephropathy in 87 patients (12.4%), neuropathy in 216 patients (30.7%), lower limb complications in 299 patients (21.9%), and retinopathy in 216 patients (30.7%). Lower complications were classified as ischemic pain (12.2%), infection (2.9%), ulcer (5.8%), gangrene (1.0%), and amputation (0.6%). Eye complications were classified as grade I (12.4%), grade II (8.1%), grade III (5.4%), grade IV (2.8%),and grade V (1.8%).

A total of 434 diabetic patients with chronic

complications were compared with 270 patients free from complications. The socio-demographic, clinical, health care related characteristics and personal factors together with the results of unvariate analyses were presented in tables I – III. The results of the final analysis using multiple logistic regression were summarized in table IV.

Socio-demographic characteristics:

No significant association between chronic diabetic complications and socio-demographic factors was detected except for age and nationality. Patients in the age group ≥ 60 years had more than four times risk chronic diabetic complications than those under forty (OR = 4.2, 95% CI: 1.9 – 9.0). Kuwaiti patients had 5 times risks of developing chronic complications than non-Kuwaitis (OR = 5.0, 95% CI: 2.0 – 9.0).

Clinical variables:

Among clinical factors, type of diabetes was significantly associated with outcome of interest. Patients with type 2 insulin treated diabetes had an increased risk of chronic complications as compared with type 1 (OR = 4.1, 95% CI: 1.75 – 9.2). Longer duration of diabetes seamed to increase the risk of chronic complications. Patients who had diabetes for 10 – 19 years had more than double the risk as compared with those who had diabetes for less than ten years (OR = 2.6, 95% CI: 1.6 – 4.1) and patients with diabetes for 20 years or more had triple the risk of complications (OR = 3.0, 95% CI: 1.3 – 6.6). Poor glycemic state and uncontrolled hypertension were significant associated factors with chronic diabetic complications (OR = 2.0, 95% CI: 1.2 – 2.8) and (OR = 3.1, 95% CI: 2.0 – 4.9) respectively. Severely obese patients had more than triple risk of chronic complications (OR = 3.3, 95% CI: 1.8 – 5.9).

Health care and patients' practice:

Among health care and patients' practice, regular follow-up visits, compliance with diet recommendations and practicing mmild or moderate physical activities were the only amenable factor that could be proved to be a significant protective factor against chronic diabetic complications (OR = 0.4, 95% CI: 0.3 – 0.7), (OR = 0.5, 95% CI: 0.4 – 0.8), (OR = 0.6, 95% CI: 0.5 – 0.9), and (OR = 0.5, 95% CI: 0.3 – 0.7) respectively.

Table I: Socio-demographic characteristics of diabetic patients with and without chronic diabetic complications

Variables	Retinopathy				Significance
	No (n=270)		Yes (n=434)		
	No.	%	No.	%	
Gender					
Male	140	51.9	203	46.8	$X^2 = 1.72$
Female	130	43.1	231	53.2	$P = 0.19$
Age (years)					
< 40	55	20.4	37	8.5	$X^2 = 71.04$
40 - 49	105	38.9	97	22.4	$P < 0.001$
50 - 59	76	28.1	138	31.8	
≥ 60	34	12.6	162	37.3	
Nationality					
Non-Kuwaiti	149	55.2	161	37.1	$P < 0.001$
Kuwaiti	121	44.8	273	62.9	$X^2 = 22.01$
Education					
Primary or less	92	34.1	158	36.4	$X^2 = 4.03$
Intermediate / Secondary	87	32.2	160	36.9	$P = 0.13$
University or higher	91	33.7	116	26.7	
Occupation					
Unemployed	62	23.0	191	44.0	$X^2 = 49.07$
Worker	167	61.9	155	35.7	$P < 0.001$
Clerk	22	8.1	57	13.1	
Professional	19	7.0	31	7.1	
Marital state					
Married	219	81.1	237	77.6	$X^2 = 4.51$
Unmarried	51	18.9	97	22.4	$P = 0.27$
Family income / month (KD)					
< 500	153	56.7	181	41.7	$X^2 = 17.43$
500 – 999	59	21.9	129	29.7	$P = 0.001$
1000 – 1499	31	11.5	82	18.9	
≥ 1500	27	10.0	42	9.7	

Table II: Clinical characteristics of diabetic patients with and without chronic diabetic complications

Variables	Retinopathy				Significance
	No (n=270)		Yes (n=434)		
	No.	%	No.	%	
Type of diabetes					
Type 1	35	13.0	28	6.5	$X^2 = 44.53$
Type 2	215	79.6	289	66.6	$P < 0.001$
Type 2 – insulin treated	20	7.4	117	27.0	
Duration of diabetes (years)					
< 10	220	81.5	223	51.4	$X^2 = 66.6$
10 - 19	40	14.8	142	32.7	$P < 0.001$
≥ 20	1	3.7	69	15.9	
Treatment					
None	16	5.9	11	2.5	
Oral	195	72.2	276	63.6	$X^2 = 20.34$
Insulin	42	15.6	77	17.7	$P < 0.001$
Oral + insulin	17	6.3	70	16.1	
Glycemic state					
Good control	87	32.2	103	23.7	$X^2 = 6.09$
Poor control	183	67.8	331	76.3	$P = 0.01$
Dyslipidemia					
No	82	30.4	118	27.2	$X^2 = 0.83$
Yes	188	69.6	316	72.8	$P = 0.36$
Hypertension					
No	188	69.6	283	65.2	$X^2 = 14.89$
Yes uncontrolled	68	25.2	89	20.5	$P = 0.001$
Yes controlled	14	5.2	62	14.3	
Co-morbid conditions					
No	147	54.4	253	58.3	$X^2 = 15.44$
Yes uncontrolled	32	11.9	83	19.1	$P < 0.001$
Yes controlled	91	33.7	98	22.6	
Obesity					
No	95	19.5	29	13.4	
Overweight	192	39.3	77	35.6	$X^2 = 13.49$
Obese	108	22.1	57	26.4	$P = 0.001$
Severely obese	93	19.1	53	24.5	

Table III: Pattern of care and patients' practice of diabetic patients with and without chronic diabetic complications

Variables	Retinopathy				Significance
	No (n=270)		Yes (n=434)		
	No.	%	No.	%	
Need of help to reach health care center					
No	235	87.0	339	78.1	$X^2 = 9.81$
Yes	35	13.0	95	21.9	$P = 0.003$
Regular follow-up visits					
No	29	10.7	121	27.9	$X^2 = 29.16$
Yes	241	89.3	313	72.1	$P < 0.001$
Compliance with diet recommendations					
No	134	49.6	273	62.9	$X^2 = 7.12$
Yes	136	50.4	161	27.1	$P = 0.01$
Regular use of drugs*					
No	19	7.5	69	16.3	$X^2 = 10.95$
Yes	235	92.5	354	83.7	$P = 0.001$
Regular check of urine glucose					
Yes	12	4.4	9	2.1	$X^2 = 2.23$
No	258	95.6	425	97.9	$P = 0.07$
Regular check of blood glucose					
No	200	74.1	277	63.8	$X^2 = 8.00$
Yes	70	25.9	157	36.2	$P = 0.01$
SMBG					
No	244	90.4	403	92.9	$X^2 = 1.38$
Yes	26	9.6	31	7.1	$P = 0.24$
Smoking					
No	212	78.5	341	78.6	$X^2 = 0.11$
Yes	42	15.6	65	15.0	$P = 0.95$
Ex- smoker	16	5.9	28	6.5	
Physical activity					
Sedentary	89	33.0	202	46.5	$X^2 = 23.00$
Mild	106	39.3	170	39.2	$P < 0.001$
Moderate	75	27.8	62	14.3	

*: Excluding patients not on hypoglycemic drugs

Table IV: Factors associated with chronic diabetic complications, results of multivariate logistic regression analysis

Variables	Odds Ratio	95% CI
Age (years)		
< 40 [R]	1	
40 - 49	1.1	(0.6 – 2.2)
50 - 59	1.8	(0.9 – 3.6)
≥ 60	4.2	(1.9 – 9.0)
Nationality		
Non-kuwaiti [R]	1	
Kuwaiti	5.0	(2.0 – 0.9)
Type of diabetes		
Type 1 [R]	1	
Type 2	1.5	(0.7 – 3.4)
Type 2 – insulin treated	4.1	(1.7 – 10.2)
Duration of diabetes (years)		
< 10 [R]	1	
10 - 19	2.6	(1.6 – 4.1)
≥ 20	3.0	(1.3 – 6.6)
Glycemic state		
Good control [R]	1	
Poor control	2.0	(1.2 – 2.8)
Hypertension		
No [R]	1	
Yes controlled	1.1	(0.9 – 1.2)
Yes uncontrolled	3.1	(2.0 – 4.9)
Obesity:		
No [R]	1	
Overweight	1.4	(0.9 – 2.3)
Obese	1.2	(0.7 – 2.1)
Severely obese	3.3	(1.8 – 5.9)
Regular follow-up visits		
No [R]	1	
Yes	0.4	(0.3 – 0.7)
Compliance with diet recommendations		
No [R]	1	
Yes	0.5	(0.4 – 0.8)
Physical activity		
Sedentary [R]	1	
Mild	0.6	(0.5 – 0.9)
Moderate	0.5	(0.3 – 0.7)

[R] = Reference category, OR = Odds ratio, CI = Confidence interval

DISCUSSION

Diabetes and its complications are likely to constitute a sizable burden to the Kuwait society. The current study is the first one conducted in a multi-centric population including Kuwaiti and non-Kuwaiti-population attending primary care facilities, and focusing on care related risk factors that could be considered amenable for change. The present study showed that 61.6% of patients with DM were diagnosed as having one or more chronic diabetic complications. Nephropathy was diagnosed in 12.4%, neuropathy in 32.1%, retinopathy in 30.7%, diabetic foot in 21.9%, and cardiovascular complications in 30.3%. These figure more or less

consistent with that reported from other previous studies. In his study on patients with type 1 DM, Kozek, et al[14] found that the frequency of retinopathy was 41.5%, peripheral neuropathy was 29%, nephropathy was 17%, diabetic foot was 8.3% and coronary artery disease was 7.1%.Lepore et al[15] observed that nephropathy was found in 24%, retinopathy in 41%, peripheral neuropathy in 23% of patients with type 1 diabetes. In type 2 DM, Zhang et al[16] reported retinopathy in 31.5%, nephropathy in 39.7%, neuropathy in 51.1%, coronary heart disease in 25.1%, cerebral vascular disease in 17.3% and lower limb complications in 9.3% of patients. Shera found that retinopathy was seen in 43%, neuropathy in 39.6%, nephropathy in 20.2% and foot ulcer in 4% of patients with type 2 diabetes.[17] Wong reported an overall prevalence of diabetic retinopathy of 35%.[18]

The currently literature data suggest that the presence of a pre-existing mcirovascular complications may contribute to the development of another, especially in type 1 diabetes.[19]

Prevalence rates of chronic diabetic complications reported in the present study were higher than that reported for European and USA patients, that could reflects the better management of diabetes in these countries or different tools of diagnosis.[7,10,14,20]. Our figures are similar to that found in other countries in the Gulf Area like UAE, Bahrain and Saudi Arabia.[9,21,22] However, data from the Western Saudi Arabia suggested that the overall prevalence of neuropathy in diabetic patients was 82%, which was one of the highest in the world.[23]

In the present study the prevalence of lower limb complications was 21.9%. However, the fact that 32.1% of patients had neuropathy is an indication that they are at increased risk of developing foot complications in the future.

The high rates of long-term diabetic complications, found in the present study, challenge the Kuwait health care system. It implicates an urgent need of intervention to prevent the development and progression of these complications among the diabetic population.

Our data showed that several factors were involved significantly in the development of chronic diabetic complications, including age, Kuwaiti nationality, type and duration of diabetes, glycemic state, hypertension, obesity, regular follow-up visits, compliance with diet recommendations, and practicing physical exercises.

Our results went in consistent with that reported from other previous studies. Shera reported hyperglycemia, duration of diabetes, hypertension and obesity were risk factors for chronic diabetes complications,[17] and Zhang et al[15] reported that age, duration of diabetes, hypertension, dyslipidemia, hyperglycemia were risk factors for long-term diabetic complications.[16] In his study Lepore found that that microvascular complications were associated with age, duration of diabetes, hypertension and dyslipidemia. However, Nordwall found that glycemic was the only significant risk factor for the development of long-term complications.[24] According to current guidelines and practice by the authorities for drug, the biomarkers (blood pressure, blood glucose and serum lipid concentrations) are accepted as surrogates in the field of hypertension and diabetes.[25] Analysis of risk factors for different long term diabetic complications showed similar results with various degrees of variations between studies.

Kuwaiti patients were more liable to develop chronic diabetic complications than non-Kuwaiti. This reflects the adoption of modern lifestyle, with a resultant increased rate of obesity. Like in other Gulf countries, Kuwaiti population seems to have a special genetic predisposition to type 2 diabetes, which is further amplified by a rise in obesity rate, a high rate of consanguinity and the presence of other variables of the insulin resistance syndrome. Also, it should be noted that non-Kuwaiti patients are usually healthy persons that come to Kuwait for work opportunities.

We found that older age was significantly associated with increased rates of chronic complications. Many studies reported that patients with chronic diabetic complications were older than those without chronic complications.[4,15,16] This could be attributed to the association between age of patients and duration of diabetes that was proven as a significant risk of these complications. This is the result, in part, of differential survival between groups. The effect of the duration of diabetes is due to the persistence hyperglycemia that causes progressive damage to organs. However, duration of diabetes is difficult to determine in type 2 diabetes due to the long presymptomatic period. In adults, complications at presentation are not uncommon and may be the presenting feature, reflecting the long exposure of susceptible organs to damage from chronic asymptomatic hyperglycemia.[26]

Type 2 – insulin treated patients were a higher risk of chronic complications. In type 1 diabetes, diagnosis is made soon after the onset of hyperglycemia and several years are required for the resultant complications to appear clinically. The onset in type 2 diabetes is insidious and is usually recognized after 5-12 years after hyperglycemia develop.[27] Insulin treatment in type 2 diabetes could be considered as an associated factor rather than a risk factor since patients with chronic diabetic complications usually need intensive treatment for lowering hyperglycemia.

In the present study uncontrolled hypertension was

proven as a significant risk factor chronic diabetic complications. Akber [28] found that hypertension was present in 60% of patients with diabetes. And this strongly linked with other cardiovascular complications, renal failure and higher mortality. Hypertension is prevalent in type 2 diabetes. An estimated 75% of adults with diabetes have blood pressure level greater than 130/80 mm Hg or use antihypertensive medication.[29] Aggressive blood pressure control (9<140/90 mm Hg) has been shown to reduce cardiovascular disease morbidity and mortality in patients with type 2 diabets. Overall, it has been clearly shown that 2 mmHg reduction in blood pressure is related to a 7% reduction of myocardial infarction and a 10% reduction of stroke.[30] In her study, Al-Maskari and El-Sadig[9] found that hypertension was the only modifiable risk factor for peripheral vascular disease.

As proved previously, patients with poor glycemic control, as indicated by glycated hemoglobin, had double the risk of long-term diabetic complications in the present study. The syndrome of diabetes is very often associated with marked increases in other well known parameters of cardiovascular risk including hypertension and dyslipidemia. Although these alterations contribute to the overall risk of diabetic complications, hyperglycemia still remains the hallmark of diabetes mellitus and is strongly associated with the risk of developing micro- and macrovascular complications.[31] Among the risk factors that have been identified for microvascualr complications, glycemic control is perhaps one of the most important.[32] Two landmark studies, the Diabetes and Complications Trial (DCCT) study[33] involving patients with type 1 diabetes and the United Kingdom prospective Diabetes Study (UKPDS)[34] involving patients with type 2 diabetes, conclusively demonstrated that improved glycemic control contributes to significant microvascular risk reduction. The DCCT showed that a mean reduction in A1C by 25 units reduced the incidence of nephropathy by 54% and retinopathy by 76%.[35] Although improved glucose control can clearly protect against the development of microvascular complications for both type 1 and type 2diabetes, its role for prevention of cardiovascular disease seems to be established in type 1 diabetes but still a matter of debate in type 2 diabetes and implicates an additive effect of nonglycemic risk factors that often accompany diabetes, such as hypertension and hyperlipidemia. Therefore, multifactorial interventionsby aggressive management of hypertension, dyslipidemia and hyperglycemia.[36-38]

However, it was reported that undesired weight gain was an adverse effect of intensive diabetes therapy. The etiology of this is likely multifactorial, including a reduction of glcosuria, increased caloric intake to prevent hypoglycemia and anabolic effects on adipose tissue.[39]

In the present study, obese patients and those who lived sedentary life and non compliant with diet recommendations were at higher risks of developing chronic complications. In fact, obesity is the most important modifiable risk factor for type 2 diabetes mellitus the prevalence of type 2 diabetes has been matched by steady increase in the prevalence of obesity in the United States. National Center for Health Statistics indicated that in 2005 to 2006, approximately 34% of adults aged 20 years or older were obese.[40] The U.S. Centers for Disease Control and Prevention reported that approximately 55% of persons with diabetes are obese and 85% are overweight; approximately 80% of persons with type 2 diabetes are also insulin resistant, and insulin resistance is itself highly correlated with weight gain.[41] Al-Kaabi et al[42] found that 44% of patients with type 2 diabetes were obese and a further 34% were overweight. And that only 35 of patients practiced activity levels that meet the recommended guidelines to ameliorate diabetic complications.

Data from Foster study suggested that obese patients with type 2 diabetes will experience significant improvements in weight, glycemic control and cardiovascular risk factors after the use of a commercially available weight management program.[42] However, even modest weight loss has been shown to reduce the risk substantially.[43,44] Gucciardi reported that high food insecurity is high among Canadians with diabetes and was associated with increased likelihood of unhealthy behaviors, psychological distress and poorer physical health.[45]

The Italian Diabetes and exercise study (IDES) group reported that physical activity and exercise training have been recognized as treatment options for patients with type 2 diabetes. However, further research is needed to establish the volume, intensity and type of exercise.[46]

Tang found that diabetic patients with regular exercise habits showed a 2.8 fold increased chance of outcome improvement compared with those who did not exercise regularly.[47]

Little has been reported regarding food and nutrient intake in individuals diagnosed with diabetes. Overweight adults with diabetes were exceeding recommended intake of, saturated fat and sodium, which may contribute to increasing the risk of cardiovascular disease and other complications.[48] The Diabetes and Nutrition Study Group of the Spanish Diabetes Association reported that adherence to nutritional recommendations for people with diabetes in Spain was rather poor.[49]

The most appropriate recommendation for obese patients with type 2 diabetes is a nutritionally balanced, moderately hypocaloric diet with a reduced intake of of saturated fat and an increase in

physical activity. However, it is extremely important for the long time outcome that the treatment is tailored to the needs and wishes of the individuals patients.[50] Other considerations in meal planning for diabetes include alternatives sweeteners. Individualized and flexible nutrition plan, designed within established guidelines, promote adherence.[51] Patients who cut back selectively on their nutritional program are influenced by their mood and beliefs. When treating chronic conditions like diabetes, psychological aspects and quality of life have to be considered especially that patients with diabetic complications have increased levels of depression and decreased quality of life.[52]

We acknowledge some limitations in our study. As we relied upon patient interview and record study, the data obtained might be, to certain extent, affected by the quality of recording. Also, as in any case control study, the design of the study is by definition retrospective and is subjected to recall bias. There is a limitation with accuracy of the duration of diabetes as it was based on self reports from diabetic patients. Nevertheless, the results are consistent with those coming from cohort studies.

Conclusions:

The high economic burden raised by diabetes and its complications challenges the Kuwaiti health care system. It implicates an urgent need of intervention to prevent the development of long-term complications among the diabetic population. The study helped to identify the magnitude of the problem of long-term diabetic complications and risk factors likely to be avoidable in Kuwait. Among these factors, control of hypertension and hyperglycemia, enhancement of patient' compliance with regular follow-up visit, the role of health care providers in supplying patients with health information especially that related to physical activity and diet recommendations were the most effective tools to the development and progression of diabetic complications.

REFERRENCES

1. World Health Organization. Diabetes mellitus fact sheet no. 312. Geneva: WHO; 2006.
2. Campbell KR. The chronic burden of diabetes. Am J Manag Care 2009; 15: S248-S54.
3. Brown WV. Microvascular complications of diabetes: renal protection accompanies cardiovascular protection. Am J Cardiol 2008; 102: 10L-13L.
4. El-Shazly M, Zaki A, Nicolucci A. Care-realted risk factors for chronic diabetic complications in developingcountries:a case from Egypt. Public Health 2002; 116: 289-96.
5. Chang S. Diabetic retinopathy. The CAMS 2000 Semi-Annual Scientific Meeting. Chinese American Health Issues.
6. Amos SF, McCarty DJ, Zimmer P. The rising global burden of diabetes and its complications: estimates and projections of to the year 2010. Diabetic Medicine 1997; 14 (suppl.5): S1-85.
7. Vergouwe Y, Soedamah-Muthu SS, Zgibor J, Chaturvedi N, Forsblom C, et al. Progression to microalbuminuria in type 1 diabetes: development and validation of a prediction rule. Diabetologia 2010; 53: 254–62.
8. Caselvecchio S, RanucciM, Di Donato M, Menicanti L. Diabetes mellitus and long-term outcome in heartfailure patients after surgical ventricularrestoration. Ann Thorac Surg 2009; 88: 1451-6.
9. Al-Maskari F, El-Sadig M. Prevalence of risk factors for diabetic foot complications. BMC Family Practice 2007; 8: 59.
10. Setacci C, de Donato G, Seracci F, Chisci E. Diabetic patients: epidemiology and global impact. J Cardiovasc Surg (Torino) 2009; 50: 263-73.
11. Gruber W, king H. The WHO national diabetes programme initiative. Diabetes Res Clin Pract 1996; 34 (Suppl): S1-S6.
12. Jumah NA, Al-Hajeri SS, Al-Ali KA, Ismaiel AE, Kamel MI. Epidemiological, clinical, and biochemical profile of type 2 diabetes in Kuwait. Bull Alex Fac Med 2009; 45: 77-85.
13. American Association of Clinical Endocrinologists Ad Hoc Task Force for Standardized Production of Clinical Practice Guidelines. American Association of Clinical Endocrinologists protocol for Clinical Practice Guidelines. Endocr Pract 2004; 10: 353-61.
14. Kozek E, Gorska A, Fross K, Marcinowska A, Citkowska a, Sieradzki J. Chronic complications and risk factors in patients with type 1 diabetes mellitus – retrospective analysis. Przegl Lek 2003; 60: 773-7 (abstract).
15. Lepore G, Bruttomesso D, Nosari I, Tiengo A, Trevisan R. Glycemic control and microvascular complications in a large cohort of Italian type 1 diabetic out-patients. Diabetes Nutr Metab 2002; 15: 232-9.
16. Zhang B, Xiang HD, Mao WB, Guo XH, Wang JC, et al. Epidemiological survey of chronic vascular complications of type 2 diabetic inpatients in four municipalities.Zhongguo Yi Xue Ke Xue Yuan Xue Bao 2002; 24; 452-6 (abstract).
17. Shera AS, Jawad F, Maqsood A, gamal S, Azfar M, Ahmed U. prevalence of chronic complications and associated factors in type 2 diabetes. J Pak Med assoc 2004; 54: 54-9.
18. Wong TY, Cheung N, Tay WT, Wang JJ, Aung T, et al. prevalence and risk factors for diabetic retinopathy: the Singapore Malay Eye Study. Ophthalmology 2008; 115: 1869-75.
19. Pedro RA, Isabel MM, Marc BB, Juan FB, Ester SB. Review of the relationship between renal and retinal microangiopathy in diabetes mellitus

patients. Curr Diabetes Rev 2009; [Epub ahead of print] (abstract).
20. Bala MM, placzkiewicz-Jankowska E, Topor-Madry R, Lesniak W, Wiercinska W, et al. Characteristics of patients with type 2 diabetes of short duration in Poland: Rational, design and preliminary results of ARETAEUSI study. Pol Arch Med Wewn 2009; 119: 533-40.
21. Al-Mahroos F, Al-Roomi K. Diabetic retinopathy, foot ulceration, peripheral vascular disease and potential risk factors among patients with diabetes in Bahrain: a nationwide primary care diabetes clinic-based study. Ann Saudi med 2007; 27: 25-31.
22. Elhadd T, Al-Amoudi A, Alzahrani A. Epidemiologyclinical and complications profile of diabetes in Saudi Arabia: a review. Ann Saudi Med 2007; 4: 241-50.
23. Akbar DH, Mira Sa, Zawawi TH, Malibary HM. Subclinical neuropathy a common complication in Sai diabetics. Saudi med J 2000; 21: 433-7.
24. NordwallM, Arnqvist HJ, Bojestig M, Ludvigsson J. Good glycemic control remains crucial in prevention of late diabetic complications – the Linkoping Diabetes Complications Study. Pediatr Diabetes 2009; 10: 168-76.
25. Grundy SM, Benjamin IJ, burke GL, Chait A, Eckel RH, et al. Diabetes and cardiovascular disease: a statement for health are professionals from the American Heart association. Circulation 1999; 100: 1134-46.
26. Eppens MC, Craig ME, Cusumano J, Hing S, Chan A, et al. Prevalence of diabetes complications in adolescents with type 2 compared with type 1 diabetes. Diabetes Care 2009; 29: 1300-6.
27. Muggeo M. Accelerated complications in type 1 diabetes mellitus: the need for greater awareness and earlier detection. Diabetes Med 1998; 15 (Suppl 4): S60-S2.
28. Akbar DH. Is hypertension common in hospitalized type 2 diabetic patients? Saudi Med J 2001; 22: 139-41.
29. National Institutes of Health. National diabetes statistics, 2007. Accessed at diabetes.niddk.nih.gov/dm/pubs/statistics/index.htm, April 24, 2008.
30. American Diabetes Association. Complications of diabetes in the United States. Accessed at www.diabetes.org/diabetes-statistics/complications. jsp, April 23, 2009.
31. Del Prato S. In search of normoglycaemia in diabetes: controlling postprandial glucose. International Journal of Obesity 2002; 26 (supp3): S9-S17.
32. Kovatchev B, Clarke W. Continuous glucose monitoring (CGM) reduces risks for hypo- and hyperglycemia and glucose variability in diabetes. Diabetes 2007; 56 (Suppl 1): A23.
33. DCCT Research Group. The effect of intensive diabetes therapy on the development and progression of neuropathy. Ann Intern Med 1995; 122: 561-8.
34. UK Prospective Diabetes Study (UKPDS) Group. Intensive blood-glucose with sulphonylureas or insulin compared with conventional treatment and risk of complications in patients with type 2 diabetes (UKPDS 33). Lancet 1998; 352: 837-53.
35. DCCT Research Group. The effect of intensive treatmentof diabetes on the development and progression of long-term complications in insulin-dependent diabetes mellitus. The DCCT Research Group. N Eng J Med 1993; 329: 977-86.
36. Meier M, Hummel M. Cardiovascular disease and intensive glucose control in type 2 diabetes mellitus: moving practice toward evidence-based strategies. Vascular Health and Risk Management 2009; 5: 859-71.
37. Gaede P, Lund-Andersen H, Parving HH, Pedersen O. Effect of a multifactorial intervention on mortality in type 2 diabetes. N Engl J Med 2008; 358: 580–91.
38. The ADVANCE Collaborative Group. Intensive blood glucose control and vascular outcomes in patients with type 2 diabetes. N Engl J Med 2008; 358: 2560–72.
39. Purnell JQ, Weyer C. Weight effect of current and experimental drugs for diabetes melliyus: from promotion to alleviation of obesity. TreatEndocrinol2003; 2: 33-47.
40. Ogden CL, Carroll MD, McDowell MA, Flegal KM. Obesity among adults in the United States-no statistically significant change since 2003–2004. NCHS Data Brief 2007; 1–8.
41. Centers for Disease Control and Prevention. Prevalence of overweight and obesity among adults with diagnosed diabetes-United States, 1988–1994 and 1999–2002. MMWR Morb Mortal Wkly Rep 2004; 53: 1066–8.
42. Al-Kaabi J, Al-Maskari F, Saadi H, Afandi B, Parker H, Nagelkerke N. physical activity and reported barriers to activity among type 2 diabetic patients in the United Arab Emirates. Rev Diabet Stud 2009; 6: 261-8.
43. Resnick HE, Valsania P, Halter JB, Lin X. Relation of weight gain and weight loss on subsequent diabetes risk in overweight adults. J Epidemiol Community Health 2000; 54: 596–602.
44. Hauner H. Managing type 2 diabetes mellitus in patients with obesity. Treat Endocrinol 2004; 3: 223-32.
45. Gucciardi E, Vogt JA, DeMelo M,Stewart DE. Exploration of the relation between household food insecurity and diabetes in Canada. Diabetes Care 2009; 32: 2218-24.
46. Balducci S, Zanuso S, Fernando F, Fallucca S, Fallucca F, Pugliese G. Italian Diabetes Exercise

Study (ISES) Group. Physical activity/exercise trainingin type 2 diabetes. The role of the Italian Diabetes and Exercise Study. Diabetes metab Res Rev 2009; 25 (Suppl 1): S29-33.

47. Tang PL, Yuan WL, tseng HF. Clinical follow-up study on diabetes patients participating in a healthmanagement plan. Nurs Res 2005; 13: 253-62.
48. Vitolins MZ, Anderson AM, Delahhanty L, Raynor H, Miller GD, et al. Action for Healthin Diabetes (Look AHEAD) trial: baseline evaluation of selected nutrients and food group intake.J Am Diet Assoc 2009; 109: 1367-75.
49. Diabetes and Nutrition Study Group of the Spanish Diabetes Association (GSEDNu). Diabetes Nutrition and Complications Trial: adherence to the ADA nutritional recommendations, targets of metabolic control, and onset of diabetes complications. A 7-year, prospective, population-based, observational multicentric study. J Diabetes Complications 2006; 20: 361-6.
50. Hauner H. Managing type 2 diabetes mellitus in patients with obesity. Treat Endocrinol 2004; 3: 223-32.
51. Anderson JW, Geil PB. New perspectives in nutrition management of diabetes mellitus. Am J Med 1988; 28: 159-65.
52. Mukherjee AK, Reddy VS, Shah S, Jhingan AK, Ramakrishnan P, et al. Quality of life as a key indicator of patients satisfaction and treatment compliance in people with type 2 diabetes mellitus in IMPROVE study: a multicentre, open label, non-randomised, observational trial. J Indian Med Assoc 2009; 107: 464-70.