

Prevalence of Type 2 Diabetes Associated Complications in Kurdistan Region Iraq

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ABSTRACT

Background and aim: Diabetes Mellitus (DM) complications are increasing among patients of Kurdistan region of Iraq creating a growing public health concern. The study aimed to determine the prevalence of DM complications among Kurdistan region provinces and the associated factors.

Methods: A cross-sectional study design was chosen. A total of 5186 diabetic patients were selected for this study from the three provinces of Kurdistan region of Iraq (Duhok, Erbil and Suleimania). The data collected from the files of patients registered at the diabetic centers in each of the mentioned provinces were retrospectively extracted to obtain a complete history of each individual patient.

Results: The majority of the diabetic patients had hyperlipidemia (38.4%) and hypertension (37.7%) as complications, and about (0.7%) of the diabetic patients had stroke. A significant association was found between some of DM complications with demographic variables. This study showed highly significant differences in diabetic laboratory tests among other variable groups (DM types, duration and the body mass index BMI). The results obtained indicated that the levels of HbA1c, fasting blood sugar (FBS) and random blood sugar (RBS) showed a significant increase (positive correlation) with the duration of the disease.

Conclusion: The common chronic complications among the selected

patients were hyperlipidemia, hypertension, chronic heart disease (CHD), nephropathy and neuropathy. Early screening is highly recommended for any patient with suspected DM. Lifestyle changes to lose weight are important in both treating and preventing DM and to prevent the development of DM complications such as hypertension, hyperlipidemia, neuropathy and nephropathy.

Key words: Diabetes, complications, hyperlipidemia, hypertension, Kurdistan, Iraq

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INTRODUCTION

In 1997, the World Health Organization (WHO) estimated the global prevalence of diabetes to be more than 135 million and by the year 2025 there will be a 120% increase in the number of patients affected. It is estimated that 50% of persons with diabetes in the USA are undiagnosed.[1] Despite advances in pharmacotherapy and diabetes treatment devices and the emphasis placed on treatment adherence over the last decade, National Health and Nutrition Examination Survey (NHANES) data showed that 43-45% of patients with diabetes did not achieve glycaemic targets of HbA1C <7%. Almost one million people die because of diabetes each year; two thirds of these are in developing countries.[2] DM was the leading cause of chronic complications including micro vascular and macro vascular.[3] It also accounts for approximately 82,000 lower extremity amputations annually in USA.[4] Although efforts to control hyperglycaemia and associated symptoms are important, the major challenges in better managing the patient with DM are targeted at reducing or preventing complications, and improving life expectancy and quality of life. Research and drug development efforts over the past few decades have provided valuable information that applies directly to improving the outcomes in patients with DM and have expanded the therapeutic process. Additionally, interventions attempting to prevent disease in high-risk populations have been reported for type 1 and type 2 DM.[4]

The greatest proportion of diabetic patients is classified into one of two broad categories: type 1 diabetes or insulin-dependent

DM (IDDM) or type 2 diabetes, non-insulin-dependent DM (NIDDM).[4] The incidence of type 2 DM is increasing. This has been attributed in part to a Western style diet, increasing obesity and sedentary lifestyle.[3] In 2007, the prevalence of type 2 diabetes in Iraq reached epidemic proportions, impacting an estimated 2 million people or 7.43% of the overall Iraqi population.[5] All forms of diabetes increase the risk of long-term complications. These may develop after many years (10–20 years), but may be the first symptoms in those who have not previously received a diagnosis. The major long-term complications relate to vascular damage. Diabetes doubles the risk of cardiovascular disease.[6] Early diagnosis and treatment through opportunistic screening of type 2 DM may reduce the lifetime incidence of major micro vascular complications which is cost-effective and results in gains in both life-years and quality adjusted life years. [7] The objectives of study are to estimate the prevalence of DM complications in Kurdistan, to study the association between DM complications with demographic variables, and to evaluate DM treatment in Kurdistan.

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METHODOLOGY

Research Design

A cross-sectional study design was chosen to determine the prevalence of DM complications among patients in the three provinces of Kurdistan region (Duhok, Erbil and Suleimania) of Iraq and the factors associated with these complications. The data collected from the files of patients registered at the diabetic centers in each of the mentioned provinces was retrospectively extracted to obtain a complete history of each individual patient. Research forms (data collection form) depend on the standard form applied by Ministry of Health (MOH) in Kurdistan region.

Inclusion and exclusion criteria of the study

Inclusion criteria

Iraqi patients, patients registered in the Diabetic Centers, from 1st of January 2013 to end of December 2013, and patient with DM disease for 1 year or more.

Exclusion criteria

Patients, less than 16 years old, gestational DM, and patients without information regarding DM complications.

Data collection form

The data collection form consisted of five major parts, as shown in (Appendix I): 1) Demographic patient data, 2) Clinical & laboratory assessments of cardiovascular and urinary system, 3) Measurements, 4) Current therapy for diabetes, 5) DM complications.

Ethical considerations

The research proposal was submitted to the scientific committee in the faculty of medical sciences at the University of Duhok (UOD); in addition, the research proposal and the approval from the faculty of medical sciences were submitted to the Directorate of Health (DOH) in each province. The data were collected after permission was received from each Directorate of Health in Duhok, Erbil and Suleimania.

Sample size and data collection procedure

A cluster sampling method used to collect data from the three provinces of Kurdistan region (Duhok, Erbil and Suleimania); each city has its own diabetic center with working hours from 8:00 a.m. to 2:00 p.m., so we were obliged to comply with this time period during data collection, and we spent about one month in each city.

Statistical analysis of the data

The data were analyzed by using the Statistical Package for Social Science, version 20.0 for Windows (IBM SPSS Statistics 20). Descriptive statistics were used for the distribution of patients, percentages and frequencies were used for categorical variables and means and standard deviations (SD) were calculated for the normally distributed continuous variables. The chi-square test was used to measure associations between nominal variables; the level of significance was set at less than 0.05 for all analyses.

The Mann-Whitney test and Kruskal-Wallis test were used to measure the differences of the diabetic tests among patients groups.

RESULTS

Overall results

A total of 5186 diabetic patients data were collected from three diabetic centers in Kurdistan region of Iraq. Kurdistan region consists of four provinces, with Halabcha being added as a new governorate in Kurdistan region of Iraq after Kurdistan region parliament approved this decision on 5 February 2015. However, because diabetic centers are present only in the three cities of Duhok, Erbil and Suleimania, we relied on collecting diabetic patients' data from these three aforementioned governorates only. We collected information on diabetes which was available in patients' files; the number of files in each city was: Duhok 1768, Erbil 1365 and Suleimania 2053. The final sample size of 5186 diabetic patients was included in the analysis of this study.

Demographic characteristics

The average age of the diabetic patients was 53.25 years, with minimum and maximum ages of 16 and 100 years, respectively. The percentage of type 2 DM (95.5%) was higher than that of type 1 DM (4.5%). The numbers of male and female diabetic patients were 2207 and 2972, respectively. Thus the ratio of males to females was (0.75:1.0). Regarding duration of DM, most (51.4%) diabetic patients in Kurdistan were diagnosed with DM over one year ago. About 38% of the diabetic patients were overweight with a body mass index (BMI) of 24-30. (Table 3.1) shows the frequency and demographic characteristic percentages of the subjects.

DM complications

The majority of the diabetic patients have hyperlipidaemia (38.4%) and hypertension (37.7%) as a complication. The frequency of chronic heart diseases (CHD) was (14.8%) while for nephropathy, it was (14.2%). Only 44 diabetic patients had diabetic foot problems, and about (0.7%) of the diabetic patients had stroke as shown in the (Table 3.2).

Laboratory tests profile

More than 2000 diabetic patients (92%) have abnormal hyperglycaemia test values of HbA1c > 7%. About 98% of diabetic patient have high fasting blood sugar FBS test values, while only 71 diabetic patients have normal random blood sugar RBS test values. (Table 3.3) shows the laboratory measurements of our patients.

Treatment and instruments profile

The majority of diabetic patients in Kurdistan region (71.4%) used oral hypoglycaemic agents (OHA), but only about (6.5%) used injectable hypoglycaemic agent (Insulin). There is no information available in Erbil and Suleimania regarding the use of glucometer (diabetic instrument) among their diabetic patients, as shown in (Table 3.4).

Table 1: Demographic Characteristics

Variables	Duhok n (%)	Erbil n (%)	Suleimania n (%)	Total Kurdistan n (%)
DM Types				
Type 1	66(3.8)	64(4.7)	103(5.0)	233(4.5)
Type 2	1677(96.2)	1297(95.3)	1950(95.0)	4924(95.5)
Gender				
Male	646(36.7)	620(45.4)	941(45.8)	2207(42.6)
Female	1115(63.3)	745(54.6)	1112(54.2)	2972(57.4)
Duration				
≥1 - <2	480(27.8)	835(61.7)	1089(53.0)	2404(46.8)
≥2 - <5	631(36.5)	272(20.1)	592(28.8)	1495(26.6)
≥5 - <10	267(15.4)	111(8.2)	200(9.7)	578(10.3)
≥10	351(20.3)	135(10.0)	172(8.5)	658(11.7)
Family history				
No	645(38.0)	220(31.6)	1127(54.9)	1992(44.8)
Yes	1051(62.0)	476(68.4)	926(45.1)	2453(55.2)
BMI				
Underweight (<18)	45(2.5)	8(0.8)	11(1.1)	64(1.7)
Normal (18-23)	105(6.0)	84(8.9)	97(9.4)	286(7.6)
Overweight (24-30)	624(35.3)	380(40.3)	438(42.3)	1442(38.5)
Obese class I (31-34)	455(25.7)	257(27.3)	267(25.8)	979(26.1)
Obese class II (35-40)	396(22.5)	162(17.2)	162(15.7)	720(19.2)
Obese class III (>40)	142(8.0)	52(5.5)	59(5.7)	253(6.8)

Table 2: DM Complications

Variables	Duhok n (%)	Erbil n (%)	Suleimania n (%)	Total Kurdistan n (%)
Hyperlipidemia				
Yes	1030(58.3)	404(29.6)	557(27.1)	1991(38.4)
No	738(41.7)	961(70.4)	1496(72.9)	3195(61.6)
Hypertension				
Yes	514(29.1)	817(59.9)	623(30.3)	1954(37.7)
No	1254(70.9)	548(40.1)	1430(69.7)	3232(62.3)
Chronic Heart Disease				
Yes	216(12.2)	413(30.3)	137(6.7)	766(14.8)
No	1552(87.8)	952(69.7)	1916(93.3)	4420(85.2)
Nephropathy				
Yes	24(1.4)	74(5.4)	636(31)	734(14.2)
No	1744(98.6)	1291(94.6)	1417(69)	4452(85.8)
Retinopathy				
Yes	268(15.2)	35(2.6)	88(4.3)	391(7.5)
No	1500(84.8)	1330(97.4)	1965(95.7)	4795(92.5)
Neuropathy				
Yes	275(15.6)	58(4.2)	2(0.1)	335(6.5)
No	1493(84.4)	1307(95.8)	2051(99.9)	4851(93.5)
Diabetic Foot				
Yes	19(1.1)	24(1.8)	1(0)	44(0.8)
No	1749(98.9)	1341(98.2)	2052(100)	5142(99.2)
Stroke				
Yes	19(1.1)	14(1.0)	2(0.1)	35(0.7)
No	1749(98.9)	1351(99.0)	2051(99.9)	5151(99.3)

Association between DM complications and independent variables

Cross-tabulation and Chi-square tests were used to examine

associations between DM complications and independent variable groups.

Association of DM complications with kurdistan provinces

The present study found significant association of DM complications with different Kurdistan provinces (Duhok, Erbil and Suleimania). Diabetic patients in Erbil had a higher percentage of hypertension, CHD and diabetic foot, while hyperlipidemia, retinopathy and nephropathy had a higher percentage among diabetic patients in Duhok. Diabetic patients in Suleimania had the highest percentage of nephropathy among other provinces, as shown in Table 3.5.

Association of DM complications with gender

There was a significant association between gender and some DM complications (hypertension, CHD, hyperlipidaemia, retinopathy, neuropathy and nephropathy), while there was no significant association between gender and other diabetic complications such as stroke and diabetic foot, and the percentage of females with diabetic disease complications was higher than in males, as shown in Table 3.6.

Table 3: Diabetic Laboratory Tests

Variables	Duhok n (%)	Erbil n (%)	Suleimania n (%)	Total Kurdistan n (%)
HbA_{1c}				
Normal	77(10.6)	50(9.7)	66(5.6)	193(8.0)
Non-Normal	648(89.4)	464(90.3)	1107(94.4)	2219(92.0)
Mean±(SD)	8.75±(1.87)	9.18±(2.29)	9.24±(1.87)	9.08±(1.98)
(Min. - Max.)	(4.30-15.10)	(1.00-15.00)	(3.80-20.00)	(1.00-20.00)
FBS				
Normal	31(1.9)	18(3.8)	22(2.2)	71(2.3)
Non-Normal	1617(98.1)	456(96.2)	1000(97.8)	3073(97.7)
Mean±(SD)	234.42±(83.52)	211.12±(83.63)	221.70±(83.01)	226.77±(83.80)
(Min. - Max.)	(62.00-594.00)	(77.00-503.00)	(72.00-556.00)	(62.00-594.00)
RBS				
Normal	0(0)	46(5.5)	25(8.1)	71(6.1)
Non-Normal	30(100)	790(94.5)	282(91.9)	1102(93.9)
Mean±(SD)	310.40±(102.61)	280.01±(99.43)	294.50±(104.47)	284.58±(101.05)
(Min. - Max.)	(183.00-528.00)	(56.00-600.00)	(51.00-547.00)	(51.00-600.00)

Table 4: Treatment and Instruments Profile

Variables	Duhok n (%)	Erbil n (%)	Suleimania n (%)	Total Kurdistan n (%)
OHA (Tablets)				
Yes	1426(80.7)	1167(85.5)	1112(54.2)	3705(71.4)
No	342(19.3)	198(14.5)	941(45.8)	1481(28.6)
Insulin (Injectables)				
Yes	163(9.2)	81(5.9)	93(4.5)	337(6.5)
No	1605(90.8)	1284(94.1)	1960(95.5)	4849(93.5)
Mixed (TAB. + INJ.)				
Yes	73(4.1)	109(8.0)	69(3.4)	251(4.8)
No	1695(95.9)	1256(92.0)	1984(96.6)	4935(95.2)
Instrument Availability				
Yes	282(16)	0(0)	0(0)	282(5.4)
No	1486(84)	1365(100)	2053(100)	4902(94.6)

Table 5: Association of DM Complications in Kurdistan Provinces

Variables	Duhok n (%)	Erbil n (%)	Suleimania n (%)	Total Kurdistan n (%)	p-value
Hyperlipidemia					
Yes	1030(58.3)	404(29.6)	557(27.1)	1991(38.4)	<0.001 ^a
No	738(41.7)	961(70.4)	1496(72.9)	3195(61.6)	
Hypertension					
Yes	514(29.1)	817(59.9)	623(30.3)	1954(37.7)	<0.001 ^a
No	1254(70.9)	548(40.1)	1430(69.7)	3232(62.3)	
Chronic Heart Disease					
Yes	216(12.2)	413(30.3)	137(6.7)	766(14.8)	<0.001 ^a
No	1552(87.8)	952(69.7)	1916(93.3)	4420(85.2)	
Nephropathy					
Yes	24(1.4)	74(5.4)	636(31)	734(14.2)	<0.001 ^a
No	1744(98.6)	1291(94.6)	1417(69)	4452(85.8)	
Retinopathy					
Yes	268(15.2)	35(2.6)	88(4.3)	391(7.5)	<0.001 ^a
No	1500(84.8)	1330(97.4)	1965(95.7)	4795(92.5)	
Neuropathy					
Yes	275(15.6)	58(4.2)	2(0.1)	335(6.5)	<0.001 ^a
No	1493(84.4)	1307(95.8)	2051(99.9)	4851(93.5)	
Diabetic Foot					
Yes	19(1.1)	24(1.8)	1(0)	44(0.8)	<0.001 ^a
No	1749(98.9)	1341(98.2)	2052(100)	5142(99.2)	
Stroke					
Yes	19(1.1)	14(1.0)	2(0.1)	35(0.7)	<0.001 ^a
No	1749(98.9)	1351(99.0)	2051(99.9)	5151(99.3)	

Chi-square test, ^ap < 0.05

Table 6: Association of DM Complications with Gender

Complications		Gender		Total n (%)	p-value
		Male n (%)	Female n (%)		
Hypertension	Yes	659(12.7)	1302(25.1)	1955(37.7)	<0.001 ^a
	No	1551(29.9)	1675(32.3)	3226(62.3)	
Chronic Heart Disease	Yes	285(5.5)	482(9.3)	768(14.8)	0.002 ^a
	No	1924(37.1)	2494(48.1)	4418(85.2)	
Hyperlipidemia	Yes	762(14.7)	1229(23.7)	1991(38.4)	<0.001 ^a
	No	1447(27.9)	1748(33.7)	3195(61.6)	
Retinopathy	Yes	130(2.5)	259(5.0)	389(7.5)	<0.001 ^a
	No	2080(40.1)	2717(52.4)	4797(92.5)	
Neuropathy	Yes	114(2.2)	223(4.3)	337(6.5)	0.001 ^a
	No	2095(40.4)	2754(53.1)	4849(93.5)	
Nephropathy	Yes	347(6.7)	389(7.5)	736(14.2)	0.008 ^a
	No	1862(35.9)	2588(49.9)	4450(85.8)	
Stroke	Yes	16(0.3)	21(0.4)	36(0.7)	0.841
	No	2194(42.3)	2956(57.0)	5150(99.3)	
Diabetic Foot	Yes	21(0.4)	26(0.5)	47(0.9)	1.000
	No	2199(42.2)	2951(56.9)	5150(99.2)	

Chi-square test, ^ap < 0.05

Differences of diabetic tests (HbA_{1c}, FBS and RBS) among different variables

There were non-significant differences in HbA_{1c}, FBS and RBS between male and female patients, while diabetic laboratory tests among other independent groups showed highly significant differences, as shown in Table 3.7.

Table 7: Differences of Diabetic Tests (HbA_{1c}, FBS and RBS) among Different Variables

Variables	HbA _{1c} (median)	FBS(median)	RBS(median)
DM Types[†]			
Type 1	10.3	268	330
Type 2	9.0	210	275
p-value	<0.001 ^a	<0.001 ^a	0.007 ^a
Gender[†]			
Male	9.0	211	281
Female	9.0	211	271
p-value	0.267	0.296	0.038 ^a
Duration[§]			
≥1 - <2	8.9	200	268
≥2 - <5	8.8	206	270
≥5 - <10	9.2	234	291
≥10	9.3	252	310
p-value	<0.001 ^a	<0.001 ^a	0.017 ^a
BMI[§]			
Underweight (<18)	11.35	281	402
Normal (18 – 23)	10.2	265	308
Overweight (24 – 30)	9.2	220	290
Obese class I (31 – 34)	8.8	207	260
Obese class II (35 – 40)	8.5	199	263
Obese class III (>40)	8.7	196	253
p-value	<0.001 ^a	<0.001 ^a	<0.001 ^a

^a: significant p < 0.05

[†]: Mann-Whitney test

[§]: Kruskal-Wallis test

DISCUSSION

Demographic characteristics

A total of 5186 diabetic patients with an average age of 53.25 ± 12.27 years were selected for this study from Kurdistan region of Iraq. The other demographic characteristics studied were diabetic type, gender, duration of disease and body mass index (BMI). This study showed that the percentage of type 2 diabetic patients (95.5%) in Kurdistan region is higher than the percentage of type 1 DM, which is an accurate reflection of the fact that type 2 is higher than type 1. These results were consistent with a study carried out in Basra, south of Iraq, which showed that type 2 DM in Basra is higher than type 1 DM.[8] In addition, the percentage of type 2 diabetic patients in the USA is higher than type 1 diabetic patients.[9] Also, the same results were shown in a study carried out in china.[10] Worldwide, type 2 DM is more prevalent for many reasons including hereditary issues, genetic defect, physical activity, non-healthy diet and sedentary lifestyle that predisposes people to be overweight, and prone to other diseases (hyperlipidemia, hypertension and chronic heart disease). The ratio of male to female diabetic patients in Kurdistan region was (0.9:1.0). Thus, the percentage of females is higher than males. This result is consistent with the results in Basra which showed a higher percentage of female diabetic patients than male diabetic patients [8, 11], and also with the results from the USA which showed the percentage of females with DM as 67.7%, while the percentage of males with DM was 32.3%.[12] Although males and females in Kurdistan

region have the same culture, physical activity is higher in males than females; for this reason, females are more prone to type 2 DM. Regarding to the duration of DM among patients in Kurdistan region, most of them had been diagnosed with DM for 1 to 2 years; in Duhok most of the patients had DM for more than 2 years, while according to the results from Basra, most of the patients had been diagnosed with DM more than 5 years previously.[11,13] The diabetic centers in Duhok and Suleimania were established in 2007, in Erbil in 2009, but in Basra, in 2003. The short time of establishment of DM centers in Kurdistan region is the most probable reason for the higher percentage of newly diagnosed cases; this does not mean that DM was not present before this time, but explains the absence of statistics prior to 2007. Then the patients slowly came to register at these centers, and the inexperienced collection of data caused the percentage of those diagnosed with DM to appear as a massive increase in this disease among people of Kurdistan region after 2013.

DM Complications

Regarding DM complications, the study's results are consistent (in some DM complications) with a study which was done in Basra, Iraq, which specifically found that the incidence of hypertension and ischemic heart disease (IHD) were the highest among other DM complications, heart failure and peripheral neuropathy were less than them, only very little number of diabetic patients were found to have diabetic foot problems[11] and less number of the Basra diabetic patients had stroke.[14] Also our study results are consistent with a study done in Tehran, Iran which found that the incidences of hyperlipidemia and hypertension were the highest among other DM complications.[15] In addition, the results of this study are consistent with the results of a study carried out in 4 major urban cities in China, which found that the incidences of cardiovascular conditions (hypertension, chronic heart failure and heart disease) among type 2 diabetic patients were higher than other microvascular complications.[10] Due to diabetic patients remained without diagnosis for years, the effects of diabetes hyperglycemia began to impact on the body systems, there were a development of these chronic DM complications.[16]The adoption of Western Life style in Iraqi society with obesity, physical inactivity, sedentary behavior and unhealthy dietary habits (non-healthy life style) explains the prevalence of DM complications among diabetic patients.[17] Therefore, effective approaches for the preventions of cardiovascular complications among diabetic patients are substantial for decreasing the whole risks of DM.[10]

Laboratory tests profile

This study showed that more than 90% of diabetic patients have abnormal hyperglycemia test values of HbA1c > 7%. The same for fasting blood sugar (FBS) test values and random blood sugar (RBS) test values. This study is consistent with the study conducted in Basra, which found the value of hyperglycemia test values of HbA1c > 7% was above 90%.[11] Also, in the same area (Basra), it was found that most diabetic patients had non-optimal glycemic control.[18] The average value of (HbA1c, FBS

and RBS) of this study is consistent with the value of (HbA1c, FBS and RBS) of a multinational study that was conducted in accordance with the Helsinki declaration.[19] The highest percentages of abnormal laboratory tests values among diabetic patients considered as the large evidence base for developing DM complications those positively associated with these variables. [20] Overall, the raised HbA1c is the main indication of the poor glycemic control that will worsen the chronic complications of type 2 diabetic patients.[10] The unstable situation in Iraq is also the reason for many shortages of some diabetic medicines in Kurdistan region. In addition, medicines are not properly controlled since quality control started at the beginning of 2013, but many medicines still leak onto the market without control.

Treatment and instruments profile

Regarding diabetic treatments in Kurdistan, the results are consistent with the study conducted in Basra that showed that majority of diabetic patients used OHA, about one tenth of them were on insulin and very little of them used mixed treatment. [21] These results reflect the normal picture regarding DM treatment because most of the patients have type 2 diabetes. But, the presence of high percentages of DM complications among type 2 diabetic patients return to the suboptimal diabetic therapy in general, also the use of vascular disease preventive therapy is not up to the required level. [22]

Association of DM complications with kurdistan provinces

There is a study in China showed that there are essential variations in chronic DM complications between different cities of China. [23] Diabetic patients in Erbil are more prone to hypertension and CHD complications than to other complications of DM, may be due to the low compliance of diabetic patients with the cardiovascular therapy, low health conscious and defect in nutrition awareness. Also other differences like the lifestyle (smoking, drinking, etc.), climate and housing and the defect in the coverage of health services to some of the countryside areas such variations have their impacts on chronic complications of diabetes between different cities.[10]

Association of DM complications with gender

This study showed a significant association between gender and most DM complications (hypertension, CHD, hyperlipidemia, retinopathy, neuropathy and nephropathy); These associations are consistent with a study conducted in Basra that showed a significant association between gender and diabetic complications such as hypertension, CHD and neuropathy; diabetic foot also had a non-significant association with gender in the same study in Basra.[11] Another study in China showed that gender contributed to the observed differences in chronic complications among diabetic patients.[10] According to the Iraqi tradition in general and also in Kurdistan region, women in particular are more prone to DM complications because they are less physically active than men and more in contact with non-healthy diets; also most of their time is spent at the home with a very poor physical activity and sedentary lifestyle. In addition,

some special conditions lead to a higher predisposition to DM than males, such as gestational diabetes on becoming pregnant and illness due to polycystic ovary syndrome (PCOS).

Differences of diabetic tests (HbA1c, FBS and RBS) among different variables

This study showed that there were no significant differences in HbA1c and FBS between male and female patients, however gender had significant differences only with RBS, while highly significant differences in diabetic laboratory tests appeared among other variable groups (DM types, duration and body mass index). It appeared that type 1 DM values of diabetic tests (HbA1c, FBS and RBS) are higher than type 2 values of the same tests. These results are normal because of the absence of insulin in type 1 diabetes, but type 2 diabetic patients have insulin in small amounts and with less activity due to insulin resistance in some receptors. The results obtained indicated that the levels of HbA1c, FBS and RBS showed a significant increase (positive correlation) with the duration of the disease and this is consistent with a study in India that showed a significant increase in the levels of HbA1c, FBS and RBS with increase in duration.[24] While the levels of HbA1c, FBS and RBS were significantly different with BMI groups. These results are consistent with study results in Japan which showed a negative correlation between BMI and the ratio of glycated albumin to HbA1c.[25] Another study in America showed no concurrent associations between glycaemic indexes and BMI.[26] Also, other studies published by ADA in 2015 showed the absence of association of the glycemic index with levels of BMI and waist circumference.[27]

CONCLUSION

This study provides the baseline for chronic complications of diabetes in Kurdistan region. Erbil had a higher percentage of diabetic patients with hypertension and CHD than Duhok and Suleimania. Therefore, efforts are needed for more effective measures for prevention of diabetic cardiovascular complications that will be essential for decreasing the morbidity due to diabetes mellitus. Screening for early complications is recommended before advance complications develop, and primary prevention of diabetes should be planned. Education of diabetic patients in Kurdistan region is mandatory and concerns routine screening for foot, eyes, kidneys and other important organs, in addition to the diet, oral hypoglycemic use and insulin. The computerized system for all the diabetic centers in Kurdistan region (Erbil, Duhok and Suleimania) needs to be implemented with a proper universal program in order to facilitate data requirements of researchers and scientists.

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