

Research Article

# Prevalence of Complications in Type 2 Diabetics in Dubai, UAE: A Cross-sectional Study

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## Abstract

**Background:** Diabetes complications have been increasingly prevalent among type 2 diabetics during the past decades causing high rates of morbidity and mortality. Measures of the prevalence of diabetes complications will lead to preventive decisions and planning of health care. The main objective of this study was to assess the prevalence rates of complications in Type 2 diabetics in two Diabetes Centers in Dubai. **Methods:** A cross-sectional descriptive analytical study conducted among type 2 diabetics attending diabetes centers in Dubai. Data was collected from secondary source using patients' records from two diabetes centers involved in the study. Random sampling technique was used to collect 150 patients proportionally allocated according to the total patients (4700 attending patients) available in the two diabetes centers. Data obtained was analyzed using SPSS v.22. Descriptive statistics were calculated (mean, standard deviation, and percentages). Chi-square test was used to compare frequencies between groups. The significance level was set at 0.05. **Results:** The study showed that the most dominant prevalence type of complications were: Hyperlipidemia (84%), Neuropathy (34%), Dyslipidemia (32%), Retinopathy (28%), Lethargy (21.3%), and Nephropathy (16.7%). The associations made between three variables each separately (Date of First Visit, HbA<sub>1c</sub>, and Fasting Blood Glucose) with the prevalence type of complications, showed significant differences in some types: Dyslipidemia, Hyperlipidemia, Neuropathy, Retinopathy, and Joint & Bone pain. **Conclusions:** There is a reasonable correlation between different variables and the prevalence of complications among the diabetic population, thus studies should always follow up on this issue in order to have clear associations to prevent complications from occurring in the first place.

**Keywords:** Prevalence, Diabetes, Type 2, Complications, Diabetes Center, Dubai

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## 1. Introduction

The term diabetes refers to a group of metabolic disorders caused by continuous hyperglycemia resulting from defects in insulin secretion, action, or both (Craig, et al., 2014). Diabetes is classified into different types based on the type of insulin deflection. The classification of diabetes includes two main categories, type 1 diabetes, and type

2 diabetes (Craig, et al., 2014). Type 1 diabetes results from the deficiency of insulin secretion, and on other hand type 2 diabetes results from a combination of resistance to insulin action and an inadequate compensatory insulin secretory response from the cells which is basically an ineffective use of insulin by the body (WHO, 2016; Craig, et al., 2014). The other type of diabetes is uncommon and comes as result of a certain condition such as gestational diabetes, which refers to hyperglycemia with onset during pregnancy, it's a specific genetically defined form of diabetes (American Diabetes Association, 2010).

Health complications associated with Diabetes Miletus (DM) are a growing concern for both developing and developed countries. Epidemiological studies worldwide have shown an alarming increase in the incidences of DM. According to WHO estimates, DM is ranked to be the 8<sup>th</sup> leading cause of mortality in 2015 and is projected to turn into the 7<sup>th</sup> by 2020. This is serious considering its impact on the quality of life and the substantial economic burden on the health care system (Abdul Razzak, et al., 2017).

The UAE has witnessed a tremendous economic and financial development with the discovery of oil and natural gas over the past three decades. This rapid development has transitioned the UAE population into one of the highest income levels worldwide, which significantly contributed to changes in population lifestyle and health outcomes. The UAE has one of the highest rates of type 2 diabetes in the world, with estimates of being in the top five (Sreedharan, et al., 2015). The prevalence rate of DM 2 was reported to be 23%, with 6.6-14.6% of the residents remained undiagnosed (find out year) (Herbert F Jelinek, et al., 2017). Furthermore, 5.4% of Emirati children and adolescents were found to be in the prediabetes state (Al Amiri, et al., 2015). Proper management of diabetes and lifestyle interventions aimed at various risk factors such as obesity have been shown to be effective in preventing or delaying the onset of the disease and lowering the its complications risks.

Poor management of diabetes mellitus type 2 can lead to various complications that affect the mortality and morbidity rates. DM 2 complications are classified into two types, short-term impairments and complications and long-term impairment (Leontis & Hess-Fischl, 2016). The short-term complications associated with type 2 diabetes mellitus include anxiety, heart palpitations, and loss of concentration or dizziness (Leontis & Hess-Fischl, 2016). Long-term complications can be either micro- or macro-vascular complications. The Micro-vascular complications include retinopathy, neuropathy, nephropathy, and cataracts (McCulloch, 2016). The macro-vascular complications

include strokes, heart attacks and peripheral vascular disease (Leontis & Hess-Fischl, 2016).

Despite the alarming rise in the occurrence of DM 2 and associated complications in the UAE, very few studies have explored the prevalence of complications associated with DM 2 in the UAE. The prevalence studies were conducted in different emirates and cities within the UAE, particularly in Al Ain, Sharjah and Abu Dhabi. To our Knowledge, no complications incidence rates were reported for the emirate of Dubai (Khandoker, et al., 2017; Alsafar, et al., 2012). Therefore, this study was undertaken to assess the prevalence of diabetes' complications in the emirate of Dubai to fill the gap in the existing knowledge on DM 2 and inform future research, management and intervention programs.

## 2. Methods

A cross sectional study was conducted to assess the prevalence of complications in type 2 diabetics from two well-known diabetes centers in Dubai, the Diabetes and Endocrine and the RAK Diabetes Center. Permissions were obtained from the Diabetes Centers in Dubai to review the patients records and extract the needed information for this study. Letters from the Office of Research at Zayed University were sent to the centers to allow students collect the data from their patients records. Consents were signed by the centers to assure confidentiality. Ethical approval was obtained from Zayed University ethical committee and all information used in this study were handled in complete terms of anonymous and confidentiality.

A sample of 150 patient records were randomly selected from a total of 4700 patients attending to the two diabetes centers. Records of adults with type 2 diabetes aged 18 years old and above were reviewed and included in this study, whereas records for pregnant women, children and patients with type 1 diabetes were excluded. The information extracted from the records include: *sociodemographic data* (age, gender and education), *anthropometric measurements* (weight, height and BMI), recent *lab results* (HbA1c, Fasting Blood Glucose, Albumin, Creatinine, ALT, AST, total Cholesterol, HDL, LDL and Triglycerides), *types of complications present* (Dyslipidemia, Hyperlipidemia, Retinopathy, Neuropathy, Nephropathy, Foot Complications, Weight Fluctuations, Numbness of feet and hands, Muscles cramp, Joint and Bone pain, Lethargy, Chronic pain, and others) and the *date of the first visit* to the center.

Data collected from the records by using data sheets special for each patient record were entered and analysed using the Statistical Package for the Social Sciences (SPSS) version 22. (SPSS Inc., Chicago IL). Frequency analyses were run for all variables. Bivariate analyses were performed to identify significant differences. Chi-square values were used to measure association between complications and date of first visit to the centre, HbA1c, and Fasting Blood Glucose.

### 3. Results

The study sample age was ranged between 19-79 years old with Mean (SD) 50.42(14.1) for males and 51.6(16.3) for females. Table 1 shows the sociodemographic characteristics of the sample. According to the age group analysis, the highest percentage (38%) was from the age group of 46-60 years old, and the lowest percentage was the age group of people aged less than 30 years. Males made up the majority of the sample total (63.3%), and the entire sample is located in Dubai. The level education was classified by both centers into: Low: Did not seek education; Medium: High school; High: University & more. More than half (62%) of the sample were highly educated people, 22.7% those graduated from high school only, and 15.3% had low level education (table 1).

TABLE 1: Sociodemographic Characteristics.

Variable	N (150)	%
<i>Center Name</i>		
The Diabetes & Endocrine Center	82	54.7%
RAK Diabetes Center	68	45.3%
<i>Age</i>		
18 – 30 years	16	10.7%
31 – 45 years	37	24.7%
46 – 60 years	57	38.0%
> 60 years	40	26.7%
<i>Gender</i>		
Female	55	36.7%
Male	95	63.3%
<i>Education level</i>		
Low: Did not seek education	23	15.3%
Medium: High school	34	22.7%
High: University & more	93	62.0%

Most of the patients were overweight and obese. About one third (32%) of the sample were obese and 41% were overweight as shown in Figure 1.

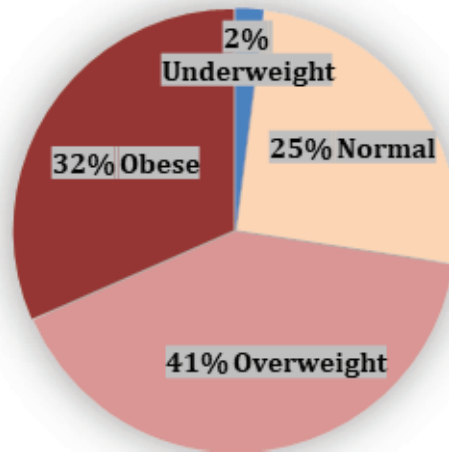


Figure 1: Weight status of the sample.

Tables 2& 3 show the mean, standard deviation, minimum, and maximum of the lab tests for HbA<sub>1c</sub>, blood lipids profile, creatinine, albumin ALT and AST by gender.

The means for the HbA<sub>1c</sub> level were 7.42 for males and 7.45 for females. The FBG was 221.1mg/dL for males and 215.4 mg/dL for females. The total cholesterol mean was 163.38 for males and 182.1 for females. The HDL mean was 41.5mg/dL for males and 44.1mg/dL for females. Both males and females were at the borderline of low HDL. The LDL mean was 99.72 mg/dL for males (at the borderline), 110.7 mg/dL (high) for females. Triglycerides was 141.38 mg/dL for males and 126.36 mg/ dL for females (table 2).

TABLE 2: Mean and Standard Deviation of Blood Glucose and Lipid Profile by Gender.

Variable	Male (N=95)		Female (N=55)	
	Mean (SD)	Min-Max	Mean (SD)	Min-Max
HbA <sub>1c</sub>	7.42(1.3)	4.5-11.5	7.45(1.4)	5.2-12
Fasting Blood Glucose	221.1(53.7)	105-408	215.4(53.0)	108-402
Total Cholesterol	163.38(37.7)	96-352	182.1(45.6)	86-379
HDL	41.5(14.04)	19-95	44.1(15.48)	17-81
LDL	99.72(35.66)	42-246	110.7(42.2)	31-217
Triglycerides	141.38(61.8)	41-413	126.36(51.1)	35-316

TABLE 3: Mean and Standard for other Lab Tests by Gender.

Variable	Male			Female		
	N (95)	Mean (SD)	Min-Max	N (55)	Mean (SD)	Min-Max
Albumin	42	3.42(1.6)	1-8	20	3.74(1.46)	1.3-8.3
Creatinine	69	1.36(1.3)	0.23-7.2	30	1.36(1.14)	0.60-5.8
ALT	68	26.82(13.8)	8-80	40	22.97(13.9)	10-89
AST	56	23.7(10.1)	11-56	37	25.49(16.3)	8-84

All lab values got high counts of normal results than abnormal except fasting blood glucose, HbA<sub>1c</sub> and albumin. From the total sample (n=150) 7 (4.7%) only had normal FBG (Fasting blood glucose) values and 143 (95.3%) had abnormal values. According to HbA<sub>1c</sub>, 53 (35.5%) had normal values and 97 (64.7%) abnormal from the total sample (n=150). Also, 28 (45.2%) had normal values of Albumin and 34 (54.9%) are abnormal.

TABLE 4: Cut off points of lab values for management of diabetes.

Lab values	Normal	Abnormal
Total cholesterol (ADA, 2016)	< 200 mg/dL	≥ 200 mg/dL
HDL (ADA, 2016)	> 40 mg/dL	≤ 40 mg/dL
LDL (ADA, 2016)	< 100 mg/dL	≥ 100 mg/dL
Triglycerides	< 150 mg/dL	≥ 150 mg/dL
Fasting blood glucose (ADA, 2016)	< 130 mg/dL	≥ 130 mg/dL
HbA <sub>1c</sub> (ADA, 2016)	< 7%	≥ 7%
Albumin (FDA, 2015)	3.5-5.5g	< 3.5g, > 5.5g
Creatinine (FDA, 2015)	0.6-1.3 mg/dL	> 1.3, <0.6 mg/dL
ALT (FDA, 2015)	0-30 U/L	> 30 U/L
AST (FDA, 2015)	0-40 U/L	> 40 U/L

TABLE 5: Lab values normal and abnormal counts / Frequencies.

Lab values	Normal		Abnormal	
	N	%	N	%
Total cholesterol	122	81.3	28	18.7
HDL	74	49.3	76	50.7
LDL	87	58.0	63	42.0
Triglycerides	105	70.5	44	29.5
Fasting blood glucose	7	4.7	143	95.3
HbA <sub>1c</sub>	53	35.5	97	64.7
Albumin	28	45.2	34	54.9
Creatinine	70	72.2	27	27.9
ALT	82	75.9	26	24
AST	84	90.3	9	9.7

The most dominant complication is Hyperlipidemia (84%), followed by Neuropathy (34%), Dyslipidemia (32%), Retinopathy (28%), Lethargy (21.3%), Nephropathy (16.7%), Joint & Bone pain (16%), Numbness of feet and hands (12.7%), Foot complications (12%), Other complaints (11%), Weight Fluctuations (9.3%), Chronic pain (8.7%), and Muscle cramps (7.3%).

Table 7 shows the association between date of first visit to the center and type of complication. Dyslipidemia (0.013), Hyperlipidemia (0.042), Neuropathy (0.032), and Joint & Bone pain (0.016) showed a significant association with the date of first visit

TABLE 6: Prevalence of Complications of Type 2 Diabetes.

Type of Complication	N	%
Dyslipidemia	49	32%
Hyperlipidemia	126	<b>84%</b>
Retinopathy	42	28%
Neuropathy	51	34%
Nephropathy	25	16.7%
Foot Complications	18	12%
Weight Fluctuations	14	9.3%
Numbness of feet and hands	19	12.7%
Muscles cramp	11	7.3%
Joint and Bone pain	24	16%
Lethargy	32	21.3%
Chronic pain	13	8.7%
Other complaints	17	11.3%

that was considered as the estimate for disease duration. *Dyslipidemia*: Those who got their first date of visit to the centers in 2010 and before got the highest valid percentage (48.5%) among the three categories of years time frame. Between 2011-2013, 40% got dyslipidemia, and those who visited the center from 2014 and on got the least percentage 22.1%. *Hyperlipidemia*: 90.9% from those who visited the centers in 2014 till the date of data collection for this study suffered from hyperlipidemia, 80% from those visited the centers between 2011-2013, and 72.7% who's first visit was in 2010 and before. *Neuropathy*: The highest percentages are among those visited the centers in 2014 till the date of data collection for this study (41.6%), followed by 36.4% in 2010 and before, and 17.5% between 2011 and 2013.

*Joint & Bone pain*: those visited the centers in 2010 and before had 27.3% suffering from joint and bone pain, 22.5% in 2011-2013, and 7.8% in 2014-2017.

Moreover, table 7 shows the association between HbA<sub>1c</sub> and type of complication. A significant difference found between HbA<sub>1c</sub> levels and Dyslipidemia (0.008), Hyperlipidemia (0.037), and Retinopathy (0.050). Results shows no significant difference between fasting blood glucose and types of complications, but this might be because of the small sample number due to limitations and other factors that will be discussed in the discussion.

TABLE 7: Associations between the type of complication and Duration of disease, HbA1c, and fasting blood glucose.

Type of complication	Duration of disease Date of First Visit (in years)						HbA1c				Fasting blood glucose				
	≤ 2010		2011-2013		≥ 2014		P-value	Nor.	Abn.	Yes	P-value	Nor.	Abn.	Yes	P-value
	N	%	N	%	N	%									
Dyslipidemia	16	48.5	16	40	17	22.1	<b>0.013</b>	10	39	49	<b>0.008</b>	3	46	49	0.56
Hyperlipidemia	24	72.7	32	80	70	90.9	<b>0.042</b>	49	77	26	<b>0.037</b>	6	120	126	0.899
Retinopathy	12	36.4	10	25	20	26	0.477	20	22	42	<b>0.050</b>	3	39	42	0.370
Neuropathy	12	36.4	7	17.5	32	41.6	<b>0.032</b>	18	33	51	0.994	4	47	51	0.186
Nephropathy	5	15.2	10	25	10	13	0.246	7	18	25	0.401	1	24	25	0.863
Foot Complications	4	12.1	5	12.5	9	11.7	0.992	8	10	18	0.389	1	17	18	0.849
Weight Fluctuations	1	3	6	15	7	9.1	0.215	6	8	14	0.536	0	14	14	0.385
Numbness of feet and hands	4	12.1	8	20	7	9.1	0.241	6	13	19	0.714	2	17	19	0.195
Muscles cramp	4	12.1	4	10	3	3.9	0.238	1	10	11	<u>0.059</u>	0	11	11	0.446
Joint and Bone pain	9	27.3	9	22.5	6	7.8	<b>0.016</b>	8	16	24	0.823	0	24	24	0.237
Lethargy	11	33.3	10	25	11	14.3	<u>0.066</u>	10	22	32	0.586	1	31	32	0.641
Chronic pain	2	6.1	1	2.5	10	13	0.134	7	6	13	0.144	1	12	13	0.588
Other complaints	4	12.1	4	10	9	11.7	0.951	6	11	17	0.997	1	16	17	0.801



## 4. Discussion

This study was aimed to identify the prevalence of complications in type 2 diabetics from diabetes centers in Dubai. In addition, it assessed the associations between the type of complication and the duration of the disease, the HbA<sub>1c</sub> and the Fasting blood glucose. The largest percentages fall in the age group of 46-60 years old (38%), and those aged 60 years and above (26.7%). A study conducted in UAE at elderly home-based primary care (EHBPC) at Dubai Health Authority from 2011- 2013, showed that diabetes is more dominant in elderly. It found that one of the highest common prevalent diseases was diabetes mellitus, it accounts for 52.4% from the sample studied (n=206) (AlShaali & Jaziri, 2015).

According to the level of education, 62% were classified as high, that indicates a university graduate or more, 22.7% falls in the medium level, which is up to high school only, and 15.3% were classified low, that indicates those who never received any type of education. Those classifications were made based on both centers' way of recording.

The mean of HbA<sub>1c</sub> level is 7.4%, which indicates that most of the sample have a poor glycemic control. For the fasting blood glucose the mean differ in both gender but somehow close. Males mean FBG is 221.1 mg/dL and females mean FBG is 215.4 mg/dL. Both genders FBG is considered very high compared to the recommendation cut off of management < 130 mg/dL (ADA, 2016).

For the lipid profile, the total cholesterol mean for males was 163.38 and 182.1 for females, which shows that most levels fall within the acceptable range < 200mg/dL (ADA, 2016). HDL mean (Males: 41.5mg/dL, Females: 44.1 mg/dL) for both were at the borderline or at risk of being under the recommended level > 40mg/dL (ADA, 2016). LDL mean in males (99.72 mg/dL) is at the borderline of the cutoff point of management < 100mg/dL (ADA, 2016). Whereas females mean average (110.7 mg/dL) is considered high and over the recommended level. For triglycerides the mean for both genders (Males 141.38 mg/dL, Females: 126.36 mg/dL) indicates that the levels are mostly normal under the cutoff point < 150mg/dL (ADA, 2016). The other lab values mean such as albumin, creatinine, ALT, and AST of both genders are considered acceptable and fall within the recommendations. In addition, each lab value showed some results in both extremes (minimum-maximum).

This study showed different prevalence of the type of complications among the total sample. The most prevalent type of complication is Hyperlipidemia, which accounts for 84% of the population studied equivalent to 126 from 150 total sample. The other

complication percentages from the total sample are Neuropathy (34%), Dyslipidemia (32%), Retinopathy (28%), Lethargy (21.3%), and Nephropathy (16.7%), Joint & Bone pain (16%), Numbness of feet and hands (12.7%), Foot complications (12%), Other complaints (11%), Weight Fluctuations (9.3%), Chronic pain (8.7%), and Muscle cramps (7.3%). The prevalence of complications result due to poor control of the disease and delay in seeking care as mentioned by Gavan (2016) regarding what contributes to the development of complications, and according to Molinaro & Dauscher (2017), poor control of the disease results in all type of complications that includes retinopathy, neuropathy, nephropathy, and cardiovascular diseases.

The second part of this study aim was to assess the associations between different factors and the prevalence of complications. One of the associations was between HbA<sub>1c</sub> levels and the type of complications prevalent. Results have showed a significant difference between HbA<sub>1c</sub> and three types of complications: Dyslipidemia (0.008), Hyperlipidemia (0.037), Retinopathy (0.050), and a borderline with Muscle cramp (0.059). HbA<sub>1c</sub> is a critical factor that influences the development of complications. To delay the onset of any further complication of the disease, the glycemic control should always be at an acceptable level (Ab Hamid, et al., 2016). The 2<sup>nd</sup> association was assessed between the date of first visit and type of complication present to identify if the duration of the disease influence the incidence of a certain type of complication. Analysis showed significant difference in four types of complications: Dyslipidemia (0.013), Hyperlipidemia (0.042), Neuropathy (0.032), and Joint & Bone pain (0.016). The Centers lack the record of disease duration, so date of first visit was collected as an indicator for the duration of the disease. Within this condition some types showed insignificant, but if duration record was found, the association would be more clear and might show other significant variables. The 3<sup>rd</sup> association was assessed between fasting blood glucose and the type of complications present. The analysis showed no significant difference but that may be due to the small sample number. According to lab values frequencies of FBG, the count of abnormalities was very high (95.3%) compared to the normal count (4.7%).

The most important limitations that might influenced the results of this study were; the sample size was relatively small (150 record), the time given by the diabetes centers to have access to their records was very constricted. Access to records was only for one day a week and should not be more than 4 hours according to the diabetes centers permission letter to access their patients records. In addition, missing information for important variables in some records.

## 5. Conclusion and Recommendations

The most prevalent types of complications in descending order are Hyperlipidemia (84%), followed by Neuropathy (34%), Dyslipidemia (32%), Retinopathy (28%), Lethargy (21.3%), and Nephropathy (16.7%) among 150 patients records with type 2 diabetics in Diabetic Centers in Dubai. High percentages of overweight (40.4%) and obesity (31.1%) are found among the total sample, and the most dominant age group is within the range from 46 to 60 years old (38%). According to the association made between the Date of First Visit and complications, a significant difference appeared in Dyslipidemia (0.013), Hyperlipidemia (0.042), Neuropathy (0.032), and Joint & Bone pain (0.016). On the other hand, the association between HbA<sub>1c</sub> and type of complications showed significant differences in Dyslipidemia (0.008), Hyperlipidemia (0.037), Retinopathy (0.050), and muscle cramps (0.059) was on the borderline. Moreover, the association between the fasting blood glucose showed no significant difference in all types of complications, whereas the counts of abnormal FBG levels are higher than the normal.

Lack of important information in the center's records (e.g: the time of onset of first complication and the duration of the disease). Knowing such information could help in assessing the associations between the disease and other factors. Therefore, recording these types of information are highly recommended which will help in taking the effective measures to prevent the complications and follow up studies to collect information and create clear associations. Moreover, since there are lack of studies involved in studying the prevalence of diabetes complications in Dubai, diabetes centers should be more collaborative with the research field in order to increase the benefits for their patients and improve the services provided in the health care centers.

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