

وَقُلْ أَعْمَلُوا فِيسِرَى اللّٰهُ عَمَلِكُمْ وَرَسُولُهُ وَالْمُؤْمِنُونَ وَسَتُرَدُّونَ إِلَىٰ
عِلْمِ الْغَيْبِ وَالشَّهَادَةِ فَيُنَبِّئُكُمْ بِمَا كُنتُمْ تَعْمَلُونَ ﴿١٠٥﴾

صدق الله العظيم

Dedication

To

My father Sole..... who worked hardly for us.

To

My motherWho taught me

How I could be as I am now

To

My lovely wife Salma and our Daughters' Duaa&Aala and our

Son Mohammed

To

My beloved brothers, sistersand colleagues for their continuous support

To

My Teachers

The people whom I respect and appreciate

Acknowledgements

All praise and thanks to Allah, who blessed me with the courage for the preparation and completion of this study.

With a great deal of respect I want to thank my supervisor **Dr. Tarig Ahmed Hassan Karar**, who spared neither time nor effort in enlightening and helping me. I want to extend my deep thank to Sudan University staff teachers in the College of Medical laboratory Science whose always carrying the candle of knowledge to us in laboratory field their continuous support until reached to us in UAE, those are **Prof. Hamodi Ahmed Saied , Dr. Mohammed Siddig and Dr. Abu Elgasim Abass**.

I am very grateful to the staffs of Clinical Chemistry in **Alrahba Hospital Abudhabi UAE** who supported me on this study.

It is a pleasure to express my respect, sincere thanks and gratitude to Sudanese Social Club Administration in Abudhabi & Dubai who arranged the meetings to all participants in the study, my deep thanks to all subject groups either test group or control group for their agreement to participate in this study.

Abstract

Diabetes mellitus is one of the most common metabolic diseases worldwide. This metabolic disorder contributes greatly to the significant proportion of the burden of renal damage and dysfunction.

The aim of the study was to investigate the renal function of the diabetic patients who reside in United Arab of Emirates, diagnosed as diabetes mellitus type -2.

A cross-sectional study conducted during the period from July 2015 to June 2016 to determine and to evaluate the plasma Creatinine and Uric acid in Sudanese resides in UAE. A total of hundred of subject were recruited in the study. Fiftywith type 2 diabetes mellitus were selected as a test group 96% is male and fifty healthy volunteers as a control group 98% are male. Demographic datadescribe age and gender as well as medical history were obtained through the administration of a questionnaire. Blood samples were collected and analyzed for glucose, HbA1c, uric acid, and creatinine. Obtained results were analyzed using soft were SPSS version 16.0.

. There was a statistically increased difference between the mean of glucose, HbA1c, uric acid and creatinine among the test group when compared with control group ($P=0.000$) for all parameters respectively, as well as the mean of Glucose, HbA1c, Creatinine and Uric acid between test group with ≤ 10 years duration and test group with >10 years duration ($p=0.000$)

There was asignificant positive correlation between Blood glucose and plasma creatinine levels ($r=0.399$, $p=0.000$), also there was strong significant positive correlation between plasma levels of glucose and HbA1c % ($r=0.760$, $p=0.000$), and a significant negative correlation between plasma levels of Glucose and uric acid ($r= - 0.323$, $p= 0.001$) as well as with HbA1c ($r= -0.305$, $p=0.002$).

It was concluded that some parameter such as uric acid and creatinine were increased by type 2 diabetes mellitus and this increasing is directly proportional with the duration of DM, accordingly Diabetes mellitus type 2 could be causative disease for development of renal impairment.

المستخلص

داء السكري هو أحد الأمراض الأيضية الأكثر شيوعاً في جميع أنحاء العالم. هذا الاضطراب الأيضي يساهم إلى حد كبير في نسبة كبيرة من عبء تلف الكلى واختلالها الوظيفي. وكان الهدف من هذه الدراسة التحقق في وظائف الكلى في السودانيين الذين يقيمون في دولة الإمارات العربية المتحدة تم تشخيصهم بداء السكري النوع-2.

أجريت هذه الدراسة المقطعية خلال الفترة من يوليو 2015 إلى يونيو 2016 لتحديد وتقييم الكرياتينين البلازما وحمض اليوريك في السودانيين الذين يعانون من مرض السكري النوع-2. يقيمون في دولة الإمارات العربية المتحدة. وقد تم اختيار خمسين مصاب بداء السكري النوع-2 كمجموعة اختبار وكانت نسبة الذكور 96% مقارنة مع خمسين متطوعاً من الأصحاء كمجموعة تحكم وكانت نسبة الذكور 98%.

تم الحصول على البيانات الديموغرافية تتضمن العمر والجنس وكذلك التاريخ الطبي بواسطة استبيان تم إجراؤه من خلال اندية التجمعات المحلية للسودانيين المقيمين بدولة الإمارات العربية المتحدة، كما تم جمع عينات الدم وتحليلها للجلوكوز، نسبة الهيموغلوبين المجلز، حمض اليوريك والكرياتينين. وقد تم تحليل البيانات التي تم جمعها بواسطة البرنامج الإحصائي SPSS نسخة رقم 16.

كانت هنالك زيادة ذات دلالة إحصائية في متوسط نتائج التحليل لمجموعة الاختبار مقارنة مع مجموعة التحكم في كل المتغيرات للجلوكوز، نسبة الهيموغلوبين المجلز، حمض اليوريك والكرياتينين فكانت قيمة $p=0.000$. أيضاً لوحظ انخفاض في متوسط نتائج التحليل للجلوكوز، نسبة الهيموغلوبين المجلز، حمض اليوريك والكرياتينين عند مرضى السكري لأقل من عشرة سنوات مقارنة مع مرضى السكري لأكثر من عشرة سنوات وكانت قيمة $p=0.000$.

كانت هناك علاقة ايجابية مؤثرة بين مستويات البلازما من الجلوكوز و الكرياتينين كانت قيمة $(r = 0.399, P = 0.000)$ ، كما كان هناك ارتباط ايجابي قوي ومؤثر بين مستويات البلازما من الجلوكوز ونسبة الهيموغلوبين المجلز $(r = 0.760, P = 0.000)$ ، وجود علاقة سلبية ومؤثرة بين مستويات البلازما من حمض اليوريك والجلوكوز $(r = -0.323, P = 0.001)$ وكذلك مع نسبة الهيموغلوبين المجلز $(r = -0.305, P = 0.002)$.

تلخص الدراسة الي أن هنالك تأثير واضح لداء السكري النوع 2 في زيادة مستويات الكرياتينين وحمض اليوريك في الدم هذه الزيادة ذات دلالة طردية ومدة الاصابة بالمرض. عليه أن مرضى السكري النوع 2 عامل مسبب لاعتلال الكلى.

List ofContents

		Page
Verse		I
Dedication		II
Acknowledgements		III
Abstract English		IV
Abstract Arabic		V
List of Contents		VI
List of Tables		IX
List of Figures		X
List of Abbreviations		XI
Chapter One Introduction		
1.	Introduction	1
1.1	Introduction	1
1.2	Rationale	3
1.3	Objectives	4
Chapter Two Literature Review		
2.	Literature Review	5
2.1	Diabetes Mellitus	5
2.1.1	Definition of Diabetes Mellitus	5
2.1.2	Classification of Diabetes Mellitus	5
2.1.2.1	Type 1 Diabetes Mellitus	6
2.1.2.2	Type 2 Diabetes Mellitus	6

2.1.2.3	Gestational diabetes mellitus (GDM)	6
2.1.3	Laboratory Diagnosis of diabetes Mellitus	7
2.1.3.1	Blood Glucose Test	7
2.1.3.2	Oral Glucose Tolerance Test(OGTT)	8
2.1.3.3	Glycated Hemoglobin (HbA1c)	8
2.1.3.4	Fructose amine	9
2.1.3.5	C-peptide	9
2.1.4	Complications of Diabetes Mellitus	9
2.1.4.1	Acute Glycemic Complication	10
2.1.4.2	Chronic Glycemic Complication	11
2.2	Uric Acid (UA)	12
2.3	Creatinine	14
Chapter Three Material and Methods		
3.	Material and Methods	15
3.1	Materials	15
3.1.1	Study design	15
3.1.2	Study area and period	15
3.1.3	Study population and sample size	15
3.1.4	Ethical consideration	15
3.1.5	Inclusion criteria	15
3.1.6	Exclusion criteria	15
3.1.7	Data collection and clinical examination	15
3.1.8	Sample collection	15

3.2	Methods	16
3.2.1	Measurement of glucose	16
3.2.2	Measurement of Hba1c	16
3.2.3	Measurement of s.urate	16
3.2.4	Measurement of Creatinine	16
Chapter Four Results		
4.	Results	17
Chapter Five Discussion, Conclusion and Recommendations		
5.	Discussion, Conclusion and Recommendations	22
5.1	Discussion	22
5.2	Conclusion	24
5.3	Recommendations	24
References		
	References	25
Appendix		
	Appendix-I Consent to Participate	33
	Appendix -II Questionnaire	34
	Appendix-III Procedures for measurement of Glucose	35
	Appendix -IV Procedures for measurement of HbA1C	38
	Appendix -V Procedures for measurement of Uric acid	42
	Appendix-V I Procedures for measurement of Creatinine	45

List of Tables

Table	Title	Page
4.1	Comparison of means plasma levels of Glucose, Hba1c, Creatinine and Uric acid between test group and control group	18
4.2	Comparison of means and std deviation levels of Glucose, HbA1c, Creatinine and Uric acid between test group with ≤ 10 years duration and test group with > 10 years duration	18

List of Figures

Figure	Title	Page
4.1	The relationship between levels of Glucose in mmol/L and HbA1c in %	19
4.2	The relationship between levels of Glucose in mmol/L and Creatinine in $\mu\text{mol/L}$	20
4.3	The relationship between levels of HbA1c in % and Creatinine in $\mu\text{mol/L}$	21

List of Abbreviation

4AAP	4-Amino Anti Pyrine
ADA	American Diabetes Association
ADP	Adenosine Di-Phosphate
ATP	Adenosine Tri-Phosphate
CRF	Chronic Renal Failure
CR-S	Creatinine -Standard
CVD	Cardio Vascular Disease
DCHBS	Di-ChloroHydroxy Benzene Sulfonate
DCCT	Diabetes Control and Complications Trial
DKA	Diabetic Keto Acidosis
DM	Diabetes Mellitus
ICD	International Classification of Disease
IDDM	Insulin Dependent Diabetes Mellitus
IDF	International Diabetes Federation
IND	International Nomenclature of Disease
EDTA	Ethylene Diamine Tetra Acetic acid
ESRD	End Stage Renal Disease
FBG	Fasting Blood Glucose
GLU	Glucose

G6PDH	Glucose-6 Phosphate Dehydrogenase
HbA_{1C}	Glycated hemoglobin
HDL	High Density Lipoprotein
HHNC	Hyperosmolar Hyperglycemic Nonketotic Coma
HHS	Hyperglycemic Hyperosmolar State
HK	Hexokinase
HNS	Hyperosmolar Nonketotic State
HONKC	Hyperosmotic Non-Ketotic Coma
HPFS	Health Professional Follow up Study
IGT	Impaired Glucose Tolerance
MPG	Mean Plasma Glucose
MSU	Mono Sodium Urate
NAD	Nicotinamide Adenine Di-nucleotide
NADH	Reduced Nicotinamide Adenine Di-nucleotide
NIDDM	Non Insulin Dependent Diabetes Mellitus
OGTT	Oral Glucose Tolerance Test
PG	Plasma Glucose
SPSS	Statistical Package for Social Science
UA	Uric Acid
UAE	United Arab of Emirates
USPSTF	United State Prevention services Task Force