Addis Ababa University

College of Health Science

School of Public Health

Prevalence and Associated Factors of Chronic Kidney Disease among Diabetic Patients that attend Public Hospitals of Addis Ababa

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A Thesis Submitted to the School of Graduate Studies, Addis Ababa University in Partial Fulfillment for the Degree of Master in Public Health.

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Addis Ababa

ADDIS ABABA UNIVERSITY

Board of Examiner's (BoE) Approval Sheet

As members of the examining board of the final MPH open defense, we certify that we have read and evaluated the thesis prepared by Meron Moges entitled," Prevalence and Associated Factors of Chronic Kidney Disease among Diabetic Patients that attend Public Hospitals of Addis Ababa" and recommend that it is accepted as fulfilling the thesis required for the degree of **Master of Public Health.**

Name of chairman	Signature	Date
Name of Major Advisor	Signature	Date
Name of Internal Examiner	Signature	Date
Name of External Examiner	Signature	Date

Final approval and acceptance of the thesis is contingent upon the submission of the final copy of the thesis to the School of graduate Council (SGC) of the candidate's Major School.

Addis Ababa University

College of Health Sciences

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MPH Thesis Submission Form

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Acronyms

AKI	Acute Kidney Injury
BMI	Body Mass Index
BSA	Body SuFrface Area
BUN	Blood Urea Nitrogen
CKD	Chronic Kidney Disease
CV	Cardio Vascular
CVD	Cardio Vascular Disease
eGFR	Estimated Glomerular Filtration Rate
ESR	Estimated Sedimentation Rate
ESRD	End Stage Renal Disease
FN	First Nation
GFR	Glomerular Filtration Rate
K/DOQI	Kidney Disease Outcomes Quality Initiative
MDRD	Modification of Diet in Renal Disease
OGTT	Oral Glucose Tolerance Test
SSA	Sub Saharan Africa
WBC	White Blood Cell
WHO	World Health Organization

Summary

Background: Chronic Kidney Disease (CKD) is a global public health problem with high mortality and morbidity. It is becoming more prevalent in Ethiopia, but there are very limited researches regarding the prevalence and associated factors of the disease in general and particularly among diabetic patients. Understanding the situation in Addis Ababa would help to excel the effort on the prevention of further expansion of the disease in the city and will be used as an input for the country level efforts.

Objective: The aim of this study was to assess the prevalence and associated factors of CKD among diabetic patients that attend the public hospitals of Addis Ababa.

Methods and Materials: A hospital based quantitative cross sectional study was conducted in 3 public hospitals; the hospitals were Tikur Anbessa Specialized Hospital, Zewditu Memorial Hospital and St. Paul Hospital. Among 355 systematically selected diabetic patients. Proportion to population size was applied to determine the proportion of participants from the study areas based on the number of diabetic patients that attended the hospitals in the first quarter of 2008 Ethiopian fiscal year. Accordingly, 51 % of participants were from Tikur Anbessa Specialized Hospital while 31 % were from St Paul Hospital and 18 % were from Zewditu Memorial Hospital. The research is conducted from September 2015 to May 2016. Relevant demographic and clinical data was collected using Semi-structured questionnaire, interview and document analysis from April 20 – May 12/2016. As the aim of the research was to find the period prevalence of CKD, five years data from April 2011 to April 2016 was used. Estimated Glomerular Filtration Rate (eGFR) of participants was calculated using Cockcroft Gault and MDRD (Modification of Diet in Renal Disease) equation.The collected data was analyzed using SPSS software: version 20. For the purpose of this study, CKD is defined as K/DOQI CKD stages 3–5 (eGFR< 60 ml/min/1.73 m2): with eGFR 30–59, 15–29 and < 15 ml/min/1.73 m^2, respectively.

Result: The overall prevalence of CKD among the diabetic patients was 68 (19.1 %)) and 37 (10.4 %) by Cockcroft Gault and MDRD equations respectively. Stage (3-5) prevalence of CKD was 79.4 %, 16.2 % and 4.4 % by Cockcroft Gault equation while it is 73%, 21.6 % and 5.4 % by MDRD equation respectively. No association was found between the analyzed factors.

Conclusion: The prevalence of CKD in the study population was 19.1 % by Cockcroft Gault and10.4 % by MDRD equations.

1. Introduction

Chronic Kidney Disease (CKD) is a worldwide public health problem [1]. It is an ongoing loss in renal function over a period of months or years. The symptoms of the disease are non specific; the patients might have generally unwell feelings and decrease in appetite [2]. Kidney disease is usually evaluated in terms of both general renal function (glomerular filtration rate (GFR)) and the presence of kidney damage determined by either kidney biopsy or other signs of kidney damage such as proteinuria (albuminuria), abnormal urinary sediment, and abnormalities on imaging studies. GFR specifically estimates how much blood passes through the glomeruli. It is estimated in clinical practice using readily calculated equations that adjust serum creatinine values to age, sex and ethnicity. It is vital to be aware of that both serum creatinine and albuminuria can simply be evaluated by using readily available and inexpensive laboratory tests [3].

CKD has five stages, in which stage 1 and 2 are ascertained by protienuria that shows the presence of kidney damage and reduced GFR as well. It has been referred by many authors that clinically significant CKD also known as 'moderate' stages to be stage 3 (GFR 30-59 ml/min/1.73m^2), stage 4 (GFR 15- 29ml /min/1.73 m^2) and stage 5 also called end stage renal disease (ESRD) is characterized by GFR below15 % with < 60ml/min/ 1.73 m ^{2} chosen as a cutoff because it represents loss of about 50 % of normal renal function. While 90ml/min/1.73m^2 being the normal GFR [3].

Worldwide prevalence of CKD is anticipated to be 8 to 16 % [4]. While it's prevalence is estimated to be 10.4 % in Africa. In most cases CKD is diagnosed during the evaluation of patents that have high blood pressure and/or diabetes and those with blood relative who have Chronic Kidney Disease. In which these patients are known to be at risk of kidney problems [2]. Even though diabetes is among the main causes of CKD, routine screening of diabetic patents for CKD is not done in Sub Saharan Africa due to limited diagnostic resources.

Diabetes Mellitus (DM) commonly known as Diabetes is a chronic disease that occurs when the body cannot produce enough insulin or cannot use the insulin produced effectively. Insulin is a hormone produced in the pancreas that allows glucose from food to enter the body's cells where it is converted into energy needed by muscles and tissues to perform their functions

appropriately. The tissues of a person with diabetes do not absorb glucose properly, and glucose remains circulating in the blood (a condition known as hyperglycemia) damaging body tissues over time [5].

Table 1 Criteria for the diagnosis of Diabetes

FPG 126 mg/dl (7.0 m mol/l). Fasting is defined as no caloric intake for at least 8 h.
* OR
2-h PG 200mg/dl (11.1mmol/L) during an OGTT. The test should be performed as described by the WHO, using a glucose load containing the equivalent of 75 g anhydrous glucose dissolved in water.
* OR
In a patient with classic symptoms of hyperglycemia or hyperglycemic crisis, a random plasma glucose 200 mg/dl (11.1 m mol/l).

* In the absence of clear hyperglycemia, results should be confirmed by repeat testing. [6]

Symptoms of high blood sugar include abnormal thirst, frequent urination, extreme tiredness, constant hunger, sudden weight loss, slow-healing wounds, recurrent infections and blurred vision [5].

Diabetes can be categorized into the following general categories:

1. Type 1 diabetes is due to absolute insulin deficiency.
2. Type 2 diabetes is due to the inability of the body to respond properly to the available insulin.
3. Gestational diabetes mellitus (GDM) is diabetes diagnosed in the second or third trimester of pregnancy that is not clearly overt diabetes. It happens as a result of insulin resistance because of the hormones produced by placenta that will block the action of insulin.
4. Specific types of diabetes due to other causes such as glucocorticoid use, in the treatment of HIV/AIDS or after organ transplantation [6].

415 million people have diabetes worldwide, while it is anticipated to affect 14.2 million people in Africa. The prevalence of diabetes is estimated to be 1.3 million in Ethiopia [5]. The prevalence of diabetic nephropathy is estimated to be 6 - 16 % in SSA [7] and 6.1 % in Ethiopia [8].

People with diabetes are at risk of developing a number of disabling and life-threatening health problems. Consistently high blood glucose levels can lead to serious diseases affecting the heart and blood vessels, eyes, kidneys, and nerves. People with diabetes are also at increased risk of developing infections. In almost all high-income countries, diabetes is a leading cause of cardio- vascular disease, blindness, kidney failure, and lower-limb amputation [5].

Kidney disease (nephropathy) is far more common in people with diabetes than in people without diabetes; and diabetes is one of the leading causes of chronic kidney disease. The disease is caused by damage to small blood vessels, which can cause the kidneys to be less efficient, or to fail altogether [5]. It is estimated that more than 5 % of patients who are newly diagnosed for type 2 diabetes already have CKD. Additionally, the lifetime risk of developing CKD for both types of diabetes is estimated to be 40 % in which case most patients develop the disease within 10 years of diagnosis [3]. It is better to screen diabetic patients for CKD regularly using estimated GFR (eGFR) derived from serum creatinine measurements. Moreover, as CKD is defined as eGFR < 60 ml/min/1.73 m ^{2}, usually diagnosed after it gets advanced. So it will be cost effective and has better outcome for diabetic patients if it is early identified and treated using eGFR [9].

Maintaining blood glucose levels, blood pressure and cholesterol close to normal can help delay or prevent diabetes complications especially risk of nephropathy [5].

Even though CKD is becoming prevalent in Ethiopia, there are very limited researches regarding the prevalence of the disease in general and particularly among diabetic patients. Additionally hypertension, diabetes, obesity and cigarette smoking are considered to be determinants of Chronic Kidney Disease globally but not known in case of Ethiopia, and also in Addis Ababa. Therefore, it is necessary and has a vital importance to conduct a study on the prevalence and associated factors of CKD among diabetic patients that attend the public hospitals of Addis Ababa.

2. Statement of the Problem

Chronic kidney disease (CKD) is a global public health problem with estimated prevalence of 8 to 16 % globally [4]. The extent to which it affects individuals in largest parts of Africa is

unknown mainly because of shortage of national registries and lack of community based studies. Some studies from East Africa and Egypt tell that CKD is three or four fold frequent in the developing world [9]. But there are some studies that show estimated prevalence of CKD in Africa population to be 10.4 % [2].

In most countries of the world hypertension and diabetes are becoming the main causes of CKD. But glomerulonephritis is still the main cause in China, India and Sub-Saharan Africa. Kidney disease associated with HIV infection was responsible for a major part of end stage renal disease (ESRD) burden in Africa. Diabetes causes for 30 - 50% of all cases of CKD and ESRD worldwide [10].

415 million diabetic patients are found in the world currently [5], of which around 30 % have diabetic nephropathy even though this number is even higher in some ethnic groups [11]. In Africa 14.2 million People are affected by diabetes [5]. From these populations the prevalence of diabetic nephropathy is anticipated to be 6 - 16 % in the whole SSA [7] while it accounts 6.1 % particularly in Ethiopia [8].

Even though CKD is becoming prevalent in Ethiopia, data on its prevalence and determinant factors are very limited like other chronic non communicable diseases. But there are some health facility based studies and observations signifying the causes of CKD and a few studies both in hospital and in the community come across at the main risk factors for CKD, specifically hypertension and diabetes. Some unpublished hospital based studies from Tikur Anbessa Specialized Hospital shows that chronic glomerulonephritis, diabetes and hypertension are the major causes of CKD [12].

Despite the fact that diabetic patients are more likely to have CKD, and thus extra morbidity and mortality than those without the disease; there are virtually no published studies on the prevalence and determinants of CKD among diabetic patients in Addis Ababa. Understanding the prevalence and determinants of CKD among DM patients in Addis Ababa could help to excel the effectiveness and efficiency of effort on prevention of further expansion of the disease in Addis Ababa and could be used as an input for the country level effort. Therefore, the aim of this study is to assess the prevalence and determinants of CKD among diabetic patients that attend the public hospitals of Addis Ababa.

3. Literature Review

3.1. Introduction

3.1.1. Chronic Kidney Disease

Chronic Kidney Disease (CKD) is decrease in kidney function over a period of months or years progressively. Most patients are asymptomatic during the early stages of the disease, but as the stage of the disease increases some non specific symptoms like feeling unwell and loss of appetite can occur [2].

Chronic Kidney Disease has five stages. It is mainly classified based on the level of GFR. In case of stage 1 and 2 the patients may be asymptomatic, while GFR may be normal or elevated and decline of 70 % in respective stages. In case of the rest stages the GFR will fall below 60%, 30 % and 15 % ml/min/1.73m ^{2} respectively. In this case the normal GFR is considered to be 90ml/min/ 1.73m^2 [13].

The global prevalence of CKD is estimated to be 8 – 16 %, which shows it is becoming one of the public health problems. Lack of national registries and community based studies in Africa makes a challenge to know its prevalence in the continent. Studies from Egypt and East Africa have suggested that CKD is at least three or four times more frequent in developing countries [14]. But there are some researches done that indicate its estimated prevalence to be 10.4% in Africa [2]. Like all other chronic non-communicable disease, data's on the prevalence of Chronic Kidney Disease (CKD) in Ethiopia are very limited [12].

3.1.2. Diabetes Mellitus

Diabetes mellitus is a chronic disease condition characterized by hyperglycemia secondary to inability of the pancreas to produce enough insulin or the body does not respond properly for the produced insulin. It has four categories namely: -Type 1 happens due to b-cell destruction that leads to absolute insulin deficiency, Type 2 happens as a result of the body inability to respond properly for the produced insulin. Gestational Diabetes is diabetes that happens and recognized for the first time during pregnancy while Specific type of diabetes is due to other causes [6].

3.1.3. Diabetes and its Association with Chronic Kidney Disease

It has been estimated that 415 million peoples globally are diabetic. Among these 14.2 million people are leaving in Africa while there are 1.3 million people are leaving with diabetes in Ethiopia [5]. The prevalence of diabetic nephropathy is estimated to be 6 – 16 % in SSA [7] while it is 6.1 in Ethiopia [8].

CKD is mainly caused by diabetes. Among the newly diagnosed Type II diabetic patients more than 5 % have already developed CKD. The life time risk of developing CKD among both types of diabetes is estimated to be 40% in which the majority will develop the disease within 10 years [3].About 30 -50 % of CKD and ESRD worldwide are caused by diabetes [10].

3.2. Prevalence of Chronic Kidney Disease

3.2.1. Worldwide Prevalence of Chronic Kidney Disease

A study was conducted by Ponte B, Pruijm M, Marquis-Vidal P et al on the determinants and burden of Chronic Kidney Disease from 2003-2006 by involving 2,810 men and 3,111 women aged 35-75 in Lausanne. The result of the study showed that the prevalence of all stages CKD was 10.0 % with CKD-EPI and 13.8 % with MDRD [15].

Study was done in Iran by Farhad H, Farshad K, Amir A et al. on high prevalence of Chronic Kidney Disease on January 2009. There were 10,063 participants aged over 20. The result of the study reveals that overall prevalence of CKD was 18.9 % with MDRD equation [16].

Dietrich R, Jochen k, Michael D et al. conducted population based cohort study in southern Germany in 2012 on prevalence and determinants of Chronic Kidney Disease in community-dwelling elderly by various estimating equations. 1,506 eligible individual were selected out of 7,624 individuals whose age is 65 and older. The result of the study reveals that overall; prevalence of CKD was 34.3 % by MDRD, 33.0 % by CKD-EPI, and 14.6 % by the Cysc-based eGFR [17].

Felix B, Herriot S, Michael M et al. conducted study on the prevalence and risk factors for Chronic Kidney Disease in a rural region of Haiti in 2014. The study was conducted on 608 participants from patients that visit the outpatients department of Hospital Albert Schweitzer (HAS) in Deschapelles, Haiti. The research's result indicated that 27 % of the participants had CKD [18].

Austin G, Liam F, Cornelius j et al. conducted retrospectively observational study on the prevalence and variation of Chronic Kidney Disease in the Irish health system in 2014. The study was conducted on 207,336 adult patients, age 18 and over. The research's result indicated that the prevalence of CKD in the health system was 11.8 %, 10.9 % in men and 12.6 % in women [19].

Saleem J, Rasool B, Tazean H et al. conducted a study on prevalence, determinants and management of CKD in Karachi, Pakistan in 2014. The study was conducted on 2,873 participants aged ≥ 40 years in 12 representative communities in Karachi, Pakistan. The research's result indicated that the overall prevalence of CKD was 12.5 % [20].

Antonio R, Josep G, Josep F et al. conducted a study on the prevalence of Chronic Kidney Disease in patients with type 2 diabetes in Spain, in a sample of 1,145 DM2 patients. The research's result indicated that the prevalence of CKD was 27.9 % [21].

A study was conducted by Ronald F, Mariam N and Steward B on the prevalence, determinants and co-morbidities of Chronic Kidney Disease among First Nations adults with diabetes in the year 2012. A total number of 885 FN adults (18 years and older) with type 2 diabetes who lived in First Nations communities across seven provinces in Canada were included. The result of the study showed that, of the 15.5 % of total participants had stage 3 CKD and over 10 % had ESRD [22].

Bingcao Wu, Kelly B, Amy S et al. conducted a study on CKD among patients with T2DM: prevalence, temporal trends, and treatment patterns from 2007–2012. The study was done among 2006 type 2 diabetic patents. The result of the study reveals that, age-adjusted CKD prevalence was 38.3% during 2007–2012; 77.5% were mild-to-moderate CKD [23].

A study was conducted in by Rachel J, Robert N, Janet H et al. on the unrecognized prevalence of chronic kidney disease in diabetes from 2002 – January 2004 involving 1715 diabetic patients in Salford. The result of the study showed that the prevalence CKD from (stage 3–5 CKD) is 27.5% by MDRD equation [24].

Ohta M, Babazono T, Uchigata Y et al conducted study complications Comparison of the prevalence of chronic kidney disease in Japanese patients with Type 1 and Type 2 diabetes from January 1 2004 to December 31 2004. The study was done among 3577 adult Japanese patients (20 years or older) with Type 1 or Type 2 diabetes. The result of the study reveals that the prevalence of CKD was 25.2% [25].

A study was done by Hill J, Cardwell R, Patterson C et al among 1386184 Type 1 or Type 2 diabetes patients from January 12007 to 31 March 2008 on chronic kidney disease and diabetes in the National Health Service: a cross-sectional survey of the UK National Diabetes. The result of the study showed that prevalence o f CKD stage (3-5) is 11.7% by using eGFR only [26].

3.2.2. Prevalence of Chronic Kidney Disease in Africa

Ernest K, Eric P, Chantal V et al. conducted study on high prevalence of undiagnosed Chronic Kidney Disease among at risk population in Kinshasa, the Democratic Republic of Congo in 2009. The study was conducted on 527 people from primary and secondary health care areas in the city of Kinshasa. They were studied from random sample of at risk outpatients with hypertension, diabetes, obesity, or HIV+. The result of the study indicated that the prevalence of CKD in this study was 36 %, but only 12 % were aware of their condition [27].

Oluyombo R, Akinsola A, Ayodele O et al. conducted a study on the prevalence, risk factors and patterns of Chronic Kidney Disease in rural community of south west Nigeria in 2011. In this research adults were randomly selected. The result of the research indicated that the prevalence of CKD was 18.8 % [1].

Tandi E, Yandiswa Y, Megan A et al. conducted a cohort study on prevalence, determinants and concordance between kidney function estimators and Chronic kidney Disease in mixed ancestry South African populations in 2013. The study was conducted on 1,203 subjects. The

result of the research reveals that the crude prevalence of CKD stage 3-5 was 14.8 % for Cockcroft-Gault, 7.6 % and 23.9 % respectively for the MDRD with and without ethnicity correction, and 7.4 % and 17.3 % respectively for the CKD-EPI equations with and without ethnicity correction [28].

Christiana O, Babawale T, Rotini W et al. conducted a study in Lagos, Nigeria on Chronic Kidney Disease: a ten year study of etiology and epidemiological trends in 2014.The research was done among a total of 792 patients with CKD. The result of the study reveals that the estimated prevalence of CKD in Nigeria is 300–400 per million populations [14]

Afolabi M, Abioye E, Arogundede F et al. conducted a study on the prevalence of Chronic Kidney Disease in a Nigerian family practice population in 2014. The study was conducted on 250 participants. The result of the study showed that 45.2 % were found to have pathologic albuminuria at the initial screening, while 12.4 % had persistent albuminuria three months later. Also, 20.4 % had estimated low GFR at the initial screening and 10.4 % had persistent low GFR three months later [29].

Francois F, Diane T, Marie Patric H et al. conducted study on the prevalence and determinants of Chronic Kidney Disease in rural and urban Cameroonians in 2015. The study was conducted on 439 participants. The result of the research indicated that the overall prevalence of CKD was found to be 13.2 % [30].

Francois F, Marie Patrice H, Hermine T et al. conducted a study on Prevalence and risk factors of Chronic Kidney Disease in urban adult Cameroonians according to three common estimators of the glomerular filtration rate in 2015. The study was conducted on 500 participants. The result of the research indicated that the prevalence of CKD was 4.4 and 11 % with MDRD, 5.4 and 14.2 with CG, and 10 % with CKD-EPI [31].

A study was done in Tanzania on the prevalence of Chronic Kidney Disease in diabetic adult out patients by Mubarakali N, Samuel E, Andreas M et al. The study was done from October 2011 and March 2012 among 369 diabetic patients. The result of the study reveals that the prevalence of CKD is 24.7 % [32].

3.2.3. Prevalence of Chronic Kidney Disease in Ethiopia

Temesgen F, Mehidi K and Tilahun Y conducted a study on Prevalence of Chronic Kidney Disease and associated risk factors among diabetic patients in southern Ethiopia in 2014. The study was conducted on 214 participants. The result of the study indicated that 18.2 % and 23.8 % of the study participants were found to have CKD, according to the MDRD and cockroft-Gault equations, respectively [9].

Temesgen F, Mehidi K and Tilahun Y conducted a study on Chronic Kidney Disease and under diagnosis of renal insufficiency among diabetic patients attending a hospital in southern Ethiopia in 2014. A total of 214 diabetics attending the follow-up clinic at Butajira hospital of southern Ethiopia participated in the study. The result of the study showed that CKD was present in 18.2 % and 23.8 % of the study participants according to the MDRD and Cockroft-Gault (C-G) equations, respectively. Only 9.8 % of the total participants, and 48.7 % (for the MDRD) and 37.3 % (for C-G) of those with eGFR < 60 ml/min/1.73 m^2 had abnormal serum creatinine values. Normal serum creatinine was observed in 90.2% of the participants attending the hospital. A large proportion of the participants ranging from 38.9-56.5% have shown to have mild to moderate renal insufficiency (stage 2-3 CKD) despite normal creatinine levels. CKD was found in 10.4 and 16.9% of participants with normal serum creatinine using the MDRD and C-G equations, respectively. The researchers also concluded that CKD is present in no less than 18 % of diabetics attending the hospital, but it is usually undiagnosed [33].

3.3. Associated Factors of Chronic Kidney Disease

3.3.1. Worldwide Associated Factors of Chronic Kidney Disease

A study was conducted in Lau sane by Ponte B, Pruij M, Marquis Vidal P et al. the determinants and burden of Chronic Kidney Disease from 2003-2006.The participants in the study were 2810 men and 3111 women aged 35- 75. The result of the study indicated that age and obesity were more strongly associated with CKD in men than women. Hypertension, type 2 diabetes, serum homocystenine and uric acid were positively independently associated with CKD in men and women [15].

Study was done in Iran by Farhad H, Farshad K, Amir A et al on high prevalence of Chronic Kidney Disease on January 2009. 10,063 participants whose age was over 20 were included in the study. Factors including age, sex, BMI, high waist circumference, hypertension and dis lipidemia were founded to have association with CKD [16].

Population based cohort study was conducted in southern Germany in 2012 by Dietrich R , Jochen K , Michael D et al. on prevalence and determinants of Chronic Kidney Disease in community-dwelling elderly by various estimating equations.1,506 were selected out of 7,624 individuals whose age is 65 and older. The result of the study reveals that females had a higher risk for CKD stages 3-5 with MDRD [17].

Felix B, Herriot S, Michael M et al. conducted study on the prevalence and risk factors for Chronic Kidney Disease in a rural region of Haiti in 2014. The study was conducted on 608 participants from patients that visit the outpatients department of Hospital Albert Schweitzer (HAS) in Deschapelles, Haiti. The research's result indicated that the overall prevalence of hypertension and diabetes mellitus was 49.2% and 36.3%, respectively. Risk factors independently associated with CKD were hypertension, HIV infection and age > 60 years, whereas diabetes mellitus was not independently associated [18].

Austin G, Lism F, Cornelius J et al conducted retrospectively observational study on the prevalence and variation of Chronic Kidney Disease in the Irish health system. The study was conducted on 207,336 adult patients, age 18 and over. The research's result indicated that the prevalence of CKD was significantly higher in women than in men, older age groups, and among patients with a history of Acute Kidney Injury (AKI) than without [19].

Saleem J, Rasool B and Tazean conducted a study on prevalence, determinants and management of CKD in Karachi Pakistan in 2014. The study was conducted on 2,873 participants aged ≥ 40 years in 12 representative communities in Karachi, Pakistan. The research's result indicated that the factors independently associated with CKD were older age, hypertension, raised fasting plasma glucose, raised triglyceride and history of stroke [20].

Antonio R, Josep G, Josep F et al. conducted a study on the prevalence of Chronic Kidney Disease in patients with type 2 diabetes in Spain, in a sample of 1,145 DM2 patients. The research's result indicated that age; sex (women), systolic arterial blood pressure (SABP) ≥

150 mmHg and a previous history of cardiovascular disease were significantly associated with CKD [21].

A study conducted in First Nations adults with diabetes in 2012 by Ronald F, Mariam N and Steward B on the prevalence, determinants and co- morbidities of Chronic Kidney Disease reveals that independent determinants of CKD were male gender and increasing diabetes duration, systolic BP and total cholesterol. A total number of 885 FN adults (18 years and older) with type 2 diabetes who lived in First Nations communities across seven provinces in Canada were included [22].

Ohta M, Babazono T, Uchigata Y et al conducted study complications Comparison of the prevalence of chronic kidney disease in Japanese patients with Type 1 and Type 2 diabetes from January 1 2004 to December 31 2004. The study was done among 3577 adult Japanese patients (20 years or older) with Type 1 or Type 2 diabetes. The result of the study reveals that type 2 diabetic patients are more than twice to have CKD than type 1 patients [25].

A study was done by Hill J, Cardwell R, Patterson C et al among 1386184 Type 1 or Type 2 diabetes patients from January 12007 to 31 March 2008 on chronic kidney disease and diabetes in the National Health Service: a cross-sectional survey of the UK National Diabetes. The result of the study showed that higher proportion of people with Type 2 diabetes had renal dysfunction compared with those with Type 1 diabetes [26].

A study was done by Igor C, Vera S, Serijiu G et al on the prevalence of hypertension and diabetes and coexistence of Chronic Kidney Disease and cardiovascular risk in population of the Republic of Moldova in 2012.1025 subjects from the general population were selected. The result of the study reveals that the prevalence of CKD is high among male gender and individuals with age >40 years [34].

3.3.2. Associated Factors of Chronic Kidney Disease in Africa

Oluyombo R, Akinsola A, Ayodele O et al. conducted a study on the prevalence, risk factors and patterns of Chronic Kidney Disease in rural community in south west Nigeria in 2011.In this research adults were randomly selected. The result of the research indicated that increasing age, female gender, systolic blood pressure and DM were predictive of CKD [1].

Christiana O, Babawale T, Rotini W et al conducted a study in Lagos, Nigeria on Chronic Kidney Disease: a ten year study of etiology and epidemiological trends in 2014.The research was done among a total of 792 patients with CKD. The result of the study reveals that hypertensive nephropathy, diabetes mellitus, obstructive nephropathy, and sickle cell nephropathy were the most common causes of CKD [14].

Tandi E, Yandiswa Y, Megan A et al conducted a cohort study on prevalence, determinants and concordance between kidney function estimators and Chronic Kidney Disease in mixed ancestry South African populations in 2013. The study was conducted on 1,203 subjects. The result of the research reveals that sex, age and known hypertension were consistently associated with CKD stage 3–5 [28].

Afolabi M, Abioye E, Arogundade F et al conducted a study on the prevalence of Chronic Kidney Disease in a Nigerian family practice population in 2014. The study was conducted on 250 participants. The result of the study showed that significant risk factors for CKD in the study subjects were increasing age, elevated blood pressure, history of diabetes mellitus (DM), habitual intake of analgesics and herbs, and an abnormal waist to hip ratio [29].

Francois F, Diane T, Marie Patrice H et al conducted study on the prevalence and determinants of Chronic Kidney Disease in rural and urban Cameroonians in 2015. The study was conducted on 439 participants. The result of the research indicated that there was a high prevalence of hypertension, diabetes, smoking, and alcohol consumption, longstanding use of traditional medicine and street medications, and overweight/obesity which was predominant in rural area [30].

Francois F, Marie patricie H, Hermine T et al conducted a study on Prevalence and risk factors of Chronic Kidney Disease in urban adult Cameroonians according to three common estimators of the glomerular filtration rate in 2015. The study was conducted on 500 participants. The result of the research indicated that advanced age, known hypertension and diabetes mellitus, increasing body mass index and overweight/obesity were the predictors of albuminuria, decreased GFR and CKD according to various estimators [31].

A study was done in Tanzania on the prevalence of Chronic Kidney Disease in diabetic adult out patients by Mubarakali N, Samuel E, Andreas M et al. The study was done from October 2011 and March 2012 among 369 diabetic patients. The result of the study reveals that older age was significantly associated for with CKD [32].

3.3.3. Associated Factors of Chronic Kidney Disease in Ethiopia

Temesgen F, Mehidi K and Tilahun Y conducted a study on Prevalence of Chronic Kidney Disease and associated risk factors among diabetic patients in southern Ethiopia in 2014. The study was conducted on 214 participants. The result of the study indicated that the majior reisk factors for the development of CKD were; older age, longer duration of diabetes and family history of kidney disease [9].

Temesgen F, Mehidi K and Tilahun Y conducted a study on Chronic Kidney Disease and under diagnosis of renal insufficiency among diabetic patients attending a hospital in southern Ethiopia in 2014. A total of 214 diabetic patients attending the follow-up clinic at Butajira hospital of southern Ethiopia participated in the study. The result of the study showed that CKD was higher in female, older, and patients with high BMI [33].

4. Basic Research Questions

1. What is the prevalence of CKD among diabetic patients that attend public hospitals in Addis Ababa?
2. What are the associated factors of CKD among diabetic patients that attend public hospitals in Addis Ababa?

5. Objectives of the Research

5.1. General Objective

The general objective of the research was to assess the period prevalence and associated factors of Chronic Kidney Disease among diabetic patients that attend public hospitals in Addis Ababa.

5.2. Specific Objectives

The specific objectives of the study that emanated from the general objective were;

- To assess the period prevalence of Chronic Kidney Disease among diabetic patients that attend public hospitals in Addis Ababa, and
- To identify associated factors of CKD among diabetic patients that attended public hospitals in Addis Ababa.

6. Methodology

6.1. Study Setting

According to the data obtained from Addis Ababa City Administration Health Bureau there are 11 public and 34 private hospitals in Addis Ababa, which are giving different services for the public. Three hospitals (Tikur Anbessa Specialized Hospital, St Paul Hospital and Zewditu Memorial Hospital) among the public hospitals were selected for the purpose of this study. The reason for this selection was first due to diverse socio economic background of the patients attending the mentioned hospitals, specialization on the areas of study that is diabetes and CKD and also high load of diabetic patients.

One of the major services these hospitals provide for the public is internal medicine which comprises treatment and follows up of diabetes and CKD. DM related services provided by the hospitals include: Laboratory tests: WBC, ESR, Fasting Blood Sugar, BUN & Creatinine, ; specific drugs for diabetes management: Insulin and Insulin Syringes; Drugs for management of complications of diabetes: Aldomet, Propranol, Hydrochlorothiazide drugs, Lasix, Digoxin, Vitamin.

6.2. Study Period

The study was conducted from September 2015 to May 2016.

6.3. Study Design

The study was a hospital based quantitative cross sectional study conducted on public hospitals in Addis Ababa.

6.4. Source and Study Population

The source population for this study was diabetic patients that attend public hospitals in Addis Ababa. From these sources the study population is taken from three public hospitals found in the city. The hospitals were selected purposively by DM patient load within the selected hospitals. The hospitals were Tikur Anbessa Specialized Hospital, Zewditu Memorial Hospital and St. Paul Hospital. The sample size was 355 diabetic patients coming to the outpatient department of selected hospitals that fulfill the inclusion criteria.

6.4.1. Inclusion Criteria

Diabetic patients who attend the hospitals' outpatient department at the time of data collection and who are willing to participate in the study were included.

6.4.2. Exclusion Criteria

Pregnant women were excluded in order to avoid the effect of gestational diabetes whose effect may not last long. Individuals less than 18 years were excluded.

6.5. Sample Size Determination

The sample size for the study was calculated by using both sample size for proportion in a single population and proportion in two populations. The worldwide prevalence of CKD is found to be 16 % [4], and margin of error 4 % in case of a single population. While confidence interval 95 %, power 80 % ratio 1 to 1, odds ratio 2 and assuming prevalence of CKD in non diabetic people's is 16 % [4] is used in the two populations. By inserting the above number in to Epi info software and by adding 10 % on the result obtained 355 using single population and 271 using population in two populations have been found respectively. The highest sample size was selected that is 355.

6.6. Sampling Method

Among the DM patients that attended the 3 hospitals mentioned above 355 patients were selected by systematic sampling method. Proportion to population size was used to determine the proportion of participants from each Hospital.

Proportion to population size is equal to sample size multiplied by the number of patients who attended one of the hospitals in the first quarter of 2008 Ethiopian fiscal year divided by the sum of patients that attend the three hospitals. Based on this formula 181,110 and 64 patient from Tikur Anbessa Specialized Hospital, St Paul Hospital and Zewditu Memorial Hospital respectively were included.

Table 2: Number of Participants

S.No (A)	Study area (B)	First quarter 2008 fiscal year DM attendants (C)*	Rate (D)	Sample Size (E) = C*D
1	Tikur Anbesa	2766	51%	181
2	St Paul	945	31%	110
3	Zewditu Memorial	847	18%	64
Total		4558	100 %	355

*Obtained from Addis Ababa Health Bureau 2008 budget year first quarter report

6.7. Data Collection Instrument

From the samples of the study that were chosen based on the above mentioned sampling technique, data for the research was collected through partially closed-ended questionnaires, interview and document analysis. The data collection was done by five diploma holding nurses and the investigator play a supervisory role.

The questionnaire was open ended and closed ended (i.e. partially closed ended) and distributed to participants who fulfilled the inclusion criteria. It was used to collect data that enabled to know the prevalence and determinant factors of CKD among the DM patients. Document analysis was used to gather the necessary data that enabled to know the CKD status and type of diabetes of the participants.

6.8. Data Quality Management

To ensure the quality of data, preceding data collection, training of the data collectors was carried out for one day by the principal investigator on the objective, relevance of the study and confidentiality of information. The data collection tool was prepared in English and translated to Amharic with the intention that the respondents will understand it and provide an accurate response.

The research's data collection mechanisms were pre-tested before proceeding to the research participants with the objective of checking the validity and appropriateness of the questions included there in. The pre-test was conducted in 36 patients (10% of the sample size) from Tikur Anbessa among the 3 hospitals mentioned above.

6.9. Operational Definition

1. Chronic Kidney disease is defined as eGFR< 60 ml/min/1.73 m^2 by both MDRD and Cockcroft Gault equations.
2. Diabetes Mellitus is defined as a case identified for having the disease by the clinician.
3. Type 1 Diabetes is defined as a case identified for having this type of diabetes by the clinician.
4. Type 2 Diabetes is defined as case identified for having this type of diabetes by the clinician.

6.10. Method of Data Analysis

The data that collected by the above mentioned methods was analyzed in a descriptive statistics binary regression using SPSS version 20 and computer programmes: ms excel. The data was presented using statistical data presentation methods: tables and bar graphs.

Estimated GFR is a test that is used to assess how well kidneys are working. The test estimates the volume of blood that is filtered by kidneys over a given period of time. It can be measured by using readily available equations and formulas like MDRD and Cockcroft – Gault.

Modification of Diet in Renal Disease (MDRD) study equation: 186 × [serum creatinine (mg/dl)] $^{-1.154}$ × (age) $^{-0.203}$ × (0.742 if female) x (1.210, if African American) and Cockcroft-Gault formula (normalized for the body surface area [BSA]): (140 - Age [years]) x weight (kg) x (0.86, if female) x 1.73/72 x serum creatinine (mg/dl) x BSA (m2). In this case BSA will be calculated by using Mosteller formula that is BSA is equal to √W*H divided by 60, while weight is measured in kilogram and height in centimetre.

For the purposes of this study, CKD will be defined as K/DOQI CKD stages 3–5 (eGFR< 60 ml/min/1.73 m2): with eGFR 30–59, 15–29 and < 15 ml/min/1.73 m2, respectively.

6.11. Ethical Consideration

Ethical approval for the research was obtained from Addis Ababa University, College of Health Science, and School of Public Health Research Ethics Committee. Official letter written by the university was given for the mentioned hospitals so that permission could be secured at all levels.

After introduction of the data collector, participants were informed about the objectives and benefits of the research and its findings, preceding the data collection. They were informed about the confidentiality of the information they give and written consent was obtained from each participant immediately. The participants were not required to write their names on the questionnaires.

7. Result

7.1. Demographic, Clinical and Behavioral Characteristics of Participants

7.1.1. Demographic Characteristics of Participants

Table 3: Demographic Characteristics of Participants (n=355)

		Frequency	
	Variables	No	%
Age	18 – 39	90	25.4
	40 – 49	83	23.4
	50 & above	182	51.2
Gender	Male	170	47.9
	Female	185	52.1
Educational Status (n = 342)	Primary Education	100	29.24
	Secondary Education	142	41.52
	Higher Education	100	29.24
Marital Status (n = 350)	Unmarried	43	12.28
	Married	260	74.28
	Separated/Divorced/Widowed/Widower	47	13.42

Demographic and clinical data of the 355 participants of the study was collected from April 20/2016 up to May 12/2016. The analysis of the demographic data found reveals the following results regarding age, sex, educational and marital status of the respondents:

The mean age of the participants is 49.9 years. Among the participants 90 (25.4 %) are between the age of 18 and 39 years, of which 50% are males and the remaining 50 % are females. 83 (23.4 %) of the participants are between the age of 40 and 49 years, of which 36.14 % are males. 182 (51.2 %) of the participants are 50 and above years of which 52.19 % of them are males and the remaining 47.80 % are females.

One hundred seventy five (47.9%) and one hundred eighty five (52.1 %) of the participants are males and females respectively. 26.47 % of male participants are between the age of 18-39, 17.64 % are between the age of 40 - 49, 55.88 % 50 and above. Among the female participants 24.32 % are between the age of 18- 39, 28.65 % are between the age of 40-49 and 47.03 % are aged 50 and above.

Concerning the educational background of the participants, 100 (29.24 %) attended primary education of which 32 % are males and the others are females. One hundred forty two (41.52 %) of the participants attended secondary education, of which 47.89 % are males and 52.11% are females. 100 (29.2 %) of the participants attended higher education of which 66 % are male and the remaining 34 % are females.

Regarding marital status of the respondents 43 (12.28 %) of them are unmarried while two hundred sixty (74.28 %) are married, and 47 (13.24 %) are separated, divorced, widowed and widower.

7.1.2. Clinical Characteristics of Participants

Table 4: Clinical Characteristics of Participants (n=355)

Variables		Frequency	
		No	%
BMI	Under weight	20	5.6
	Normal	167	47
	Over weight and Obese	168	47.3
Type of Diabetes	Type 1	77	21.7
	Type 2	278	78.3
Duration of Diabetes (n = 351)	Less than 10 years	218	62.1
	≥ 10 years	133	37.89
History of Hypertension (n = 343)	Present	167	48.7
	Absent	176	51.3
History of Cardiovascular disease (n= 294)	Present	55	18.7
	Absent	239	81.3
Previous History of Kidney Disease (n = 325)	Yes	95	29.2
	No	230	70.8
Family History of CKD (n = 322)	Yes	38	11.8
	No	284	88.2

All the 355 respondents of the study are diabetic patients who were randomly selected for the purpose of the study. The clinical data obtained discloses that out of the 355 respondents 77 (21.7%) are found to have type 1diabetes and the remaining 278 (78.3%) have type 2 diabetes. Among the respondents with type 1 diabetes 53.2 % are males and 46.8% are

females. Out of the 278 respondents found to have type 2 diabetes 46.4 % are males and 53.6% are females.

The mean creatinine and BMI of the participants are found to be 1.01 and 25.19 respectively. The mean of eGFR of the participants found to be 92.1 % by Cockcroft Gault and 112.3 % by MDRD equations.

218 participants (62.1%) had diabetes duration less than ten years and 133 (37.89%) greater than or equal to 10 years. 167 (48.7 %) of the participants has a co-existence of hypertension and 176 (51.3 %) of the participants had no hypertension. History of cardiovascular disease was present among fifty five (18.7 %) of the respondents while two hundred thirty nine (81.3 %) do not have the disease. 95 (29.2 %) of the respondents had previous attack of recurrent kidney related illnesses while 230 (70.8 %) do not have the disease. Thirty eight (11.8 %) of the participants have family member with CKD, two hundred eighty four (88.2 %) do not have the disease in their families.

7.1.3. Behavioral Characteristics of Participants

Table 5: Behavioral Characteristics of Participants (n = 355)

Variables		Frequency	
		No.	%
Previous Smoking Habit (n = 333)	Yes	46	13.81
	No	287	86.19
Current Use of Alcohol (n = 340)	Yes	60	17.65
	No	280	82.35
Previous Alcohol Use (n = 334)	Yes	106	31.74
	No	228	68.26
Previous Use of Traditional Medicine (n = 337)	Yes	54	16.02
	No	283	83.98
Current Use of Traditional Medicine (n = 327)	Yes	23	7.03
	No	304	92.97
Habitual Use of Anti Pain (n= 337)	Yes	122	36.2
	No	215	63.8

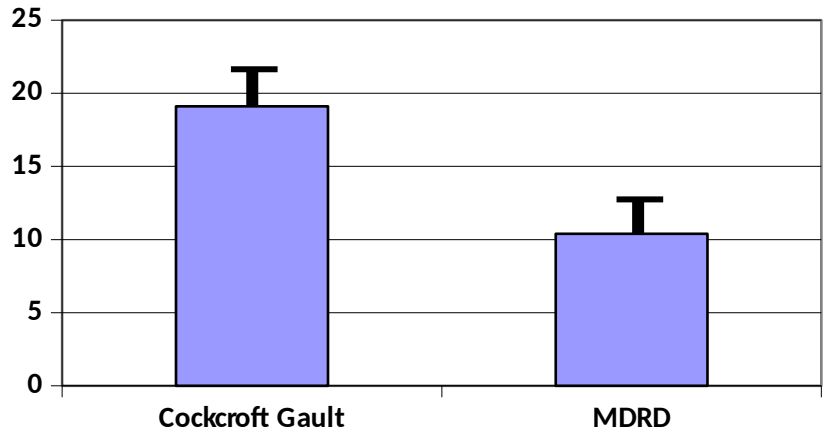
As mentioned in the above table 46 (13.81 %) of the respondents were smokers previously while 287 (86.19 %) were not. 60 (17.65 %) of the participants currently consume alcohol while 280 (82.35 %) do not consume alcohol currently. One hundred six (31.74 %) of the respondents used to consume alcohol while two hundred eight (68.26 %) does not. Respondents who had a previous history of using traditional medicine count 54 (16.02%), the remaining 283 (83.98 %) do not use. Twenty three (7.03 %) of the participants use traditional medicines currently while the remaining three hundred four (92.97%) did not use. 122 (36. 2 %) of the participants habitually use anti pains and 215 (63.8 %) do not.

7.2. Prevalence of CKD

As it was mentioned earlier, for the purpose of this study CKD is defined as a state where eGFR of respondents is less than 60/ml/min/1.73 m ^{2}. And also this definition works for both Cockcroft Gault and MDRD equations used to calculate eGFR. Based on this, as it can be seen from the above figure, the prevalence of CKD is 19.1 % (CI 95% 15 - 23.2) and 10.4% (CI 95 % 7.2 – 13.3) by Cockcroft Gault and MDRD equations respectively.

The prevalence of CKD classified by stages as per Cockcroft Gault equation is 79.4 % stage 3, 16.2 % stage 4 and 4.4% stage 5. According to MDRD equation 73% of the participants have stage 3, 21.6 % stage 4 and 5.4 % stage 5 CKD. This shows that the prevalence of CKD is higher for stage 3 and lower for stage 5.

Figure 1: General Prevalence of CKD (n=355)



95 % CI (15 - 23.2) **95 % CI (7.2 – 13.3)**

7.3. Associated factors of CKD

7.3.1. Demographic Associated factors of CKD

The prevalence of CKD with respect to age as per the Cockcroft Gault equation is 12.22 % for those aged 18 – 39 years, 12.05 % for those aged 40 – 49 years and 25.52 % for those aged 50 and above. And according to the MDRD equation the prevalence for the age groups mentioned here above is 10 %, 8.43 % and 11.54 % respectively.

The highest and lowest prevalence of CKD belongs to participants aged 50 years and above and 40 - 49 years respectively.

According to the result of the study the prevalence of CKD among the male respondents is 20 % and 9.41% by Cockcroft Gault and MDRD equations respectively where as it is 18.39% and 11.35 % for females.

The prevalence with respect to marital status of the respondents is found to be 18.6%, 17.31 % and 29.79 % respectively for unmarried, married and separated, divorced, widowed and widower as per the Cockcroft Gault equation. By the MDRD equation 18.60 %, 6.54 % and 23.40% respectively for the above mentioned respondents.

By the Cockcroft Gault equation out of the respondents who attended primary education 20% are affected by CKD. 17.61 % of the respondents who attended secondary education are found to have CKD. And 18 % of those who enrolled higher education have CKD.

By the MDRD equation out of the respondents who attended primary education 12 % are affected by CKD. 8.45% of the respondents who attended secondary education are found to have CKD. And 9 % of those who enrolled higher education have CKD.

The rank order of the prevalence with respect to educational status from highest to lowest belongs to primary education, higher education and secondary education. This shows that the prevalence of CKD does not have a proportional relationship with educational background.

Table 6: Distribution of CKD by demographic characteristics of study participants using MDRD and Cockcroft –Gault (n=355)

		Cockcroft Gault					MDRD				
		Present		Absent			Yes		No		
	Variables	No	%	No	%	Crude OR (95% CI)	No	%	No	%	Crude OR (95% CI)
Age	18 – 39	11	12.22	79	87.78	1	9	10.00	81	90.00	1
	40 – 49	10	12.05	73	87.95	0.98 (0.39 , 2.45)	7	8.43	76	91.57	0.83 (0.294 , 2.34)
	≥ 50	47	25.82	135	74.18	2.50 (1.23 , 5.10)	21	11.54	161	88.46	1.17 (0.51 ,2.68)
Gender	Male	34	20.00	136	80.00	1	16	9.41	154	90.59	1
	Female	34	18.39	151	81.61	0.90 (0.53 , 1.53)	21	11.35	164	88.65	1.39 (0.69, 2.79)
Educational Status	Primary Education	20	20.00	80	80.00	0.98 (0.50 , 1.91)	12	12.00	88	88.00	1.05 0.45 , 2.42)
n = 342	Secondary Education	25	17.61	117	82.39	0.84 (0.45 , 1.57)	12	8.45	130	91.55	0.71 (0.31 , 1.62)
	Higher Education	18	18.00	82	82.00	1	9	9.00	91	91.00	1
Marital Status	Unmarried	8	18.60	35	81.40	1	8	18.60	35	81.40	1
n = 340	Married	45	17.31	215	82.69	0.91 (0.90 , 9.32)	17	6.54	243	93.46	0.31 (0.12 , 0.76)
	Separated/Divorced/Widowed/Widower	14	29.79	33	70.21	1.69 (0.17 , 16.57)	11	23.40	36	76.60	1.34 (0.48 , 3.72)

7.3.2. Clinical Associated Factors of Chronic Kidney Disease

Regarding the prevalence by BMI; 20 % of the underweight respondents, 19.16 % of the respondents with normal BMI and 19.05 % overweight and obese respondents and are found to have CKD by the Cockcroft Gault equation. This prevalence by the MDRD equation is found to be 10 %, 11.98 % an 8.93 % respectively for the above mentioned respondents.

This indicates that the prevalence of CKD does not have a proportional relationship with BMI.

According to the type of DM, out the respondents with type 1 diabetes 12.99 % and 9.09 % out type 2 of have CKD by the Cockcroft Gault and MDRD equation. Out of the respondents with type 2 diabetes 20.86% and 10.79% have CKD by the Cockcroft Gault and MDRD equations respectively.

This shows that the prevalence of CKD among respondents with type 2 diabetes is higher than that of the respondents with type 1 diabetes by both equations.

By duration of diabetes 17.43 % and 22.56% of respondents who got diabetic less than ten years ago and greater than or equal to 10 years have CKD by the Cockcroft Gault equation respectively.

By duration of diabetes 9.17 % and 12.78 % of respondents who got diabetic less than ten years ago and greater than or equal to 10 years have CKD by the Cockcroft Gault equation respectively.

These results indicate that the prevalence of CKD increases as the duration of diabetes increases.

Out of the respondents with hypertension 22.75% and 13.17% have CKD by the Cockcroft Gault and MDRD equations respectively. Out of the respondents who do not have hypertension 17.05% and 8.52% are found to have CKD by the Cockcroft Gault and MDRD equations respectively.

The result dictates that the prevalence of CKD among hypertensive diabetic respondents is higher than those who are not hypertensive.

Among the respondents with Cardiovascular disease 20 % and 12.73 % have CKD by the Cockcroft Gault and MDRD equations and out of those who do not have Cardiovascular disease 20.08 % and 10.04 % are found to have CKD by the Cockcroft Gault and MDRD equations respectively.

By the Previous history of recurrent kidney related disease, Out of the respondents with previous history of recurrent kidney related disease 21.05 % and 12.63 % have CKD by the Cockcroft Gault and MDRD equations respectively.

Out of the respondents who do not have previous history of recurrent kidney related disease, 19.13% and 10 % have CKD by the Cockcroft Gault and MDRD equations respectively.

The prevalence of CKD among respondents with previous history of recurrent kidney related disease is more than that of the respondents who do not have previous history of recurrent kidney related disease.

Out of the respondents who reported that their family members have CKD, 13.16 % and 7.89 % have CKD by the Cockcroft Gault and MDRD equations respectively. Out of the respondents who reported that they do not have a family member with CKD 20.42 % and 11.27 % are found to have CKD by the Cockcroft Gault and MDRD equations respectively.

The result shows that the prevalence is higher among those respondents with no family member with CKD.

Table 7: Distribution of CKD by clinical characteristics of study participants using MDRD and Cockcroft –Gault (n=355)

Variables		Cockcroft Gault					MDRD				
		Yes		No			Yes		No		
		No	%	No	%	Crude OR (95% CI)	No	%	No	%	Crude OR (95% CI)
BMI	Under weight	4	20.00	16	80.00	1	2	10.00	18	90.00	1
	Normal	32	19.16	135	80.84	0.95 (0.29 ,3.03)	20	11.98	147	88.02	1.22 (0.26 ,5.68)
	Over weight and Obese	32	19.05	136	80.95	0.94 (0.29 ,3.01)	15	8.93	153	91.07	0.88 (0.19 , 4.17)
Type of Diabetes	Type 1	10	12.99	67	87.01	1	7	9.09	70	90.91	1
	Type 2	58	20.86	220	79.14	1.77 (0.86 , 3.65)	30	10.79	248	89.21	1.00 (0.44 , 2.29)
Duration of Diabetes (n= 351)	Less than 10 years	38	17.43	180	82.57	1	20	9.17	198	90.83	1
	³ 10 years	30	22.56	103	77.44	1.38 (0.81 , 2.36)	17	12.78	116	87.22	1.45 (0.73, 2.88)
Presence of Hypertension (n=343)	Present	38	22.75	129	77.25	1.43 (0.84 , 2.45)	22	13.17	145	86.83	1.16 (0.81 , 3.26)
	Absent	30	17.05	146	82.95	1	15	8.52	161	91.48	1
Cardiovascular disease (n=294)	Present	11	20.00	44	80.00	0.99 (0.48 , 2.07)	7	12.73	48	87.27	1.31 (0.52 , 3.21)
	Absent	48	20.08	191	79.92	1	24	10.04	215	89.96	1
Previous History of Kidney Disease (n= 325)	Yes	20	21.05	75	78.95	1.13 (0.62 , 2.04)	12	12.63	83	87.37	1.30 (0.62 , 2.73)
	No	44	19.13	186	80.87	1	23	10.00	207	90.00	1
Family History of CKD (n=322)	Yes	5	13.16	33	86.84	0.59 (0.22 , 1.88)	3	7.89	35	92.11	0.67 (0.19, 2.32)
	No	58	20.42	226	79.58	1	32	11.27	252	88.73	1

7.3.3. Behavioral Associated Factors of CKD

Out of the respondents who used to smoke, 23.91% and 6.52% have CKD by the Cockcroft Gault and MDRD equations respectively. Out of the respondents who did not have a previous smoking habit 19.16% and 11.5% are found to have CKD by the Cockcroft Gault and MDRD equations respectively.

Out of the respondents who smoke a cigarette currently none of them are found to have CKD by both equations. Out of the respondents who do not smoke a cigarette currently 19.88% and 10.98 are found to have CKD by the Cockcroft Gault and MDRD equations respectively.

Out of the respondents with previous history of alcohol consumption 17.92 % and 8.49 % have CKD by the Cockcroft Gault and MDRD equations respectively. Out of the respondents who do not have previous history of alcohol use 19.3 % and 10.96 % are found to have CKD by the Cockcroft Gault and MDRD equations respectively.

Out of the respondents who currently take an alcohol, 15 % and 6.67 % have CKD by the Cockcroft Gault and MDRD equations respectively. Out of the respondents who do not take alcohol currently 21.07 % and 11.79 % are found to have CKD by the Cockcroft Gault and MDRD equations respectively.

Out of the respondents who used to take traditional medicine, 22.2 % and 18.52 % have CKD by the Cockcroft Gault and MDRD equations respectively. Out of the respondents who do not have previous history of traditional medicine 19.43 % and 9.54 % are found to have CKD by the Cockcroft Gault and MDRD equations respectively.

The prevalence of CKD is higher among those who used to take traditional medicine.

Out of the respondents who currently use traditional medicine 13.04 % have CKD by both the Cockcroft Gault and MDRD equations. Out of the respondents who do not use traditional medicine currently 20.07% and 10.53 % are found to have CKD by the Cockcroft Gault and MDRD equations respectively.

The result based on Cockcroft Gault equation shows that the prevalence is higher among respondents who currently do not take traditional medicine. But the result as per the MDRD equation shows the reverse.

Out of the respondents who reported that they habitually use anti pains, 22.13 % and 12.3% have CKD by the Cockcroft Gault and MDRD equations respectively. Out of the respondents who do not use anti pains habitually 17.67 % and 9.3% are found to have CKD by the Cockcroft Gault and MDRD equations respectively.

The result indicates that the prevalence among those who habitually use anti pains is higher than those who do not take anti pains habitually.

Table 8: Distribution of CKD by behavioral characteristics of study participants using MDRD and Cockcroft –Gault (n=355)

		Cockcroft Gault					MDRD				
		Present		Absent			Present		Absent		
Variables		No	%	No	%	Crude OR (95% CI)	No	%	No	%	Crude OR (95% CI)
	Yes	11	23.91	35	76.09	1.33(0.63, 2.77)	3	6.52	43	93.48	0.54 (0.16 , 1.83)
Previous Smoking Habit (n=333)	No	55	19.16	232	80.84	1	33	11.50	254	88.50	1
	Yes	19	17.92	87	82.08	0.91 (0.50 ,1.66)	9	8.49	97	91.51	0.75 (0.34 , 1.68)
Previous Alcohol Use (n=334)	No	44	19.30	184	80.70	1	25	10.96	203	89.04	1
	Yes	9	15.00	51	85.00	0.66 (0.31, 1.42)	4	6.67	56	93.33	0.53(0.18 , 1.57)
Current Use of Alcohol (n= 340)	No	59	21.07	221	78.93	1	33	11.79	247	88.21	1
Current Use of Traditional Medicine	Yes	3	13.04	20	86.96	0.59 (0.12 , 2.08)	3	13.04	20	86.96	1.27 (0.36 , 4.53)
(n= 327)	No	61	20.07	243	79.93	1	32	10.53	272	89.47	1
	Yes	27	22.13	95	77.87	1.32 (0.76 , 2.30)	15	12.30	107	87.70	1.38 (0.67, 2.77)
Habitual Use of Anti Pain (n=337)	No	38	17.67	177	82.33	1	20	9.30	195	90.70	1
	Yes	12	22.22	42	77.78	1.18 (0.58 , 2.39)	10	18.52	44	81.48	2.15 (0.97 , 4.76)
Previous use of traditional medicine	No	55	19.43	228	80.57	1	27	9.54	256	90.46	1

Table 9: Associated Factors of Chronic Kidney Disease

		Cockcroft Gault		MDRD	
		Crude OR	Adjusted OR	Crude OR	Adjusted OR
Marital Status (n = 340)	Unmarried	1	1	1	1
	Married	0.91 (0.90 , 9.32)	0.36 (0.12 , 1.05)	0.31 (0.12 , 0.76)	0.60 (0.25 , 1.48)
	Separated/Divorced/Widowed/Widower	1.69 (0.17 , 16.57)	0.64 (0.18 , 2.22)	1.34 (0.48, 3.72)	1.21 (0.42 , 3.47)
Duration of Diabetes (n= 351)	Less than 10 years	1	1	1	1
	³ 10 years	1.38 (0.81 , 2.35)	1.15 (0.65 , 1.04)	1.45 (0.73-2.88)	1.30 (0.75 , 2.29)
Presence of Hypertension (n=343)	Present	1.43 (0.84 , 2.45)	0.96 (0.52 ,1.78)	1.16 (0.81-3.26)	1.26 (0.71 , 2.23)
	Absent	1	1	1	1
Age	18 – 39	1	1		
	40 – 49	0.98 (0.39 , 2.45)	0.85 (0.29 , 2.47)	------	--------
	³ 50	2.5 (1.23 , 5.10)	2.49 (0.96 , 6.44)		
Type of Diabetes	Type 1	1	1		
	Type 2	1.77 (0.85 - 3.65)	1.43 (0.53 -3.87)		
Current Use of Alcohol (n= 340)	Yes			0.53(0.18-1.57)	0.72 (0.33 -1.58)
	No	--------	----------	1	1
Previous use of traditional medicine	Yes			2.15 (0.97 -4.76)	1.21 (0.57-2.55)
	No	--------	---------	1	1

The univariate analysis showed significant association between CKD (eGFR <60 ml/min/1.73 m^2) and marital status, duration of diabetes, and presence of hypertension have p value < 0.2 by both Cockcroft Gault and MDRD equation. While age and type of diabetes by Cockcroft Gault equation and current use of alcohol and previous use of traditional medicine by MDRD equation. The above variable was then subjected to multivariate analysis and no significant association was found by both equations.

8. Discussion

In this hospital based quantitative cross sectional study, prevalence and associated factors of CKD among diabetic patients that attend public hospitals of Addis Ababa have been studied. By using Cockcroft Gault and MDRD equation, prevalence of CKD have been found to be19.1 % and 10.4 % by the respective equations. Stage (3-5) prevalence of CKD is 79.4 %, 16.2 % and 4.4% respectively by Cockcroft Gault equation. Where as it is 73%, 21.6 % and 5.4 % respectively by MDRD equation. Even though the difference is not statistically significant MDRD underestimates the prevalence compared to Cockcroft Gault.

The prevalence of CKD among diabetic patients, as addressed in several studies, differs in different countries worldwide. The estimated prevalence of CKD by eGFR < 60 ml/min/1.73 m^2 obtained in this study is higher than the study conducted in the adult population of Moldova was 8.2% [34]. And lower than the prevalence of CKD by MDRD in Canada, 15.5% [22].The reason for the difference might be due to the use of the laboratory finding of the participants at the time of data collection. Among the 15.5 % participants with CKD by MDRD equation found in the study conducted in Canada 80 % had eGFR 30 – 60 (Stage 3 CKD) which is comparable with this research finding but over 10% (1.6% of total participants) [22] had ESRD which is 5.4 % in this research finding by the same equation. The study done in Tanzania shows the prevalence of CKD among adult diabetic patients by Cockcroft Gault equation was 24.7% [32].The research done in Ethiopia among diabetic patients by using similar equations with this study have found the prevalence of CKD to be 18.8% and 23.8% by MDRD and Cockcroft Gault equation respectively[9]. Not too many studies have reported results similar prevalence to this study because the studies found have determined the prevalence by using point prevalence where as this research uses period prevalence. The CKD prevalence done among type 2 have found to be 27.9% [21] in Spain,

while its prevalence found in this study is 10.79 % by the MDRD equation which was the equation used in both studies.

Regarding associated factors, different associated factors that have been presented in similar research were assessed to see whether they are associated factors in these study population or not. Even though associated factors which were presented by other researches as that of presence of other chronic diseases have been included in the questionnaire, were not able to be analyzed because of the difficulty of categorizing the responses given by the participants. Due to less number of respondents who smoke currently the result obtained regarding the prevalence of CKD among current smokers (0 %) may not be reliable.

Older age, type 2 diabetes, family history of CKD, smoking habit, alcohol use, obesity, co – existence of hypertension have been assessed but no significant association was found. This might be due to the small sample size.

As it is the first study done in Addis Ababa, this research has its own limitations. Primarily, due to financial reasons the period prevalence of CKD is done by using the serum creatinine level of patients which is done recently among the tests done in the last five years. This in turn affects the reliability of the prevalence obtained as some patients who had a normal creatinine level before two or three years may have elevated or normal status had the test been done during the data collection. The prevalence of CKD would have been much higher than the result obtained by this study, had the research used current level of creatinine. Third, some questions had not been filled by the respondents and that in turn affects the analysis and the result of the study.

This study has its own strength, mainly the ability to express the prevalence obtained by different demographic, clinical and behavioral characteristics.

9. Conclusion

In conclusion this study identified prevalence of CKD (10.4 % - 19.4 %) by MDRD and Cockcroft Gault equations respectively among diabetic patients that attend the public hospitals of Addis Ababa.

10. Recommendation

As the prevalence used in this research is period prevalence, it will be better if prevalence of the disease is studied by measuring the laboratory tests needed for the research in order to know the point prevalence of the disease in question. This study, therefore, proposes that a large scale study to be conducted encompassing a large number of diabetic population to find out the point prevalence of CKD and its associated factors so that a preventive strategy especially for the preventable associated factors or for an entire defensive framework could be implemented or designed to reduce the expansion of the disease.

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Annex I: English Questionnaire Form

Information Sheet

Good morning/Good afternoon. This questionnaire is prepared for research work to be conducted on the prevalence and determinants of Chronic Kidney Disease among diabetic patients that attend public hospitals of Addis Ababa. The research is conducted to fulfill the thesis requirement of MSc degree in Public health: **Addis Ababa University, School of Public Health.**

Dear respondents, below are questions, which are designed to assess the determinants of Chronic Kidney Disease among diabetic patients. Knowing the determinants will help us at a city level as well as country level to work on the prevention of further expansion of the disease. You are selected for you are a diabetic patient and your participation depends on your voluntariness only. Even though you are sacrificing your time there is no benefit in personal or payment that you get for your participation in this study. But your honest response to these questions will help us to better understand the determinants of chronic kidney disease in diabetic patients and will also help as the contribution for the countries level effort to prevent the disease. You are not required to write your name, and it will never be used in connection with any of the information you provide.

We would like to express our heartfelt appreciation for your collaboration and thank you in advance.

In case you need to contact the investigator you may use the following address:

Name: Meron Moges

Tel: 0913 06 30 88

Email: meronmoges579@gmail.com

Consent Form

I the selected participant heard the information in the study's information sheet and understood the purpose and benefits; and what is required from me as well. I understood that all the information regarding me like name and all answers given by me will never be transferred to a third party. So, I am willing to participate in the study.

Signature of Participant _____Date _____

Data Collector Name _____Signature _____ Data _____

English Questionnaire Form

Section 1: Distribution of Participants by their Demographic Characteristics

NO	Questions	Alternative Responses(coding category)	Skip to
101	Sex	1. Male 2. Female	
102	Age	Age in year ----------	
103	Marital Status	1. Married 2. Single 3. Separated 4.Divorced 5. Widower/widowed	
104	Please circle the highest year of school completed	Illiterate 1 2 3 4 5 6 7 8 9 10 11 12 (Primary) (High school) 13 14 15 16 17 18 19 20 21 22 (College/University) (Graduate School)	

Section 2: Physical Condition of Participants

NO	Questions	Alternative responses (coding category)	Skip to
201	Height	---------- cm	

Section 3: History of Diabetes, Hypertension and Cardiovascular Disease

NO	Questions	Alternative responses (coding category)	Skip to
301	How long is it since you got diabetic?	1. Below 10 years 2. Greater than or equal to 10 years 3. Do not know	
302	Are you diagnosed to have hypertension?	1. Yes 2. No 3. I don't know	If 'no' and 'I don't know' skip to 304, If 'yes' skip to 303
303	Are you diagnosed to have cardiovascular disease?	1. Yes 2. No 3. I don't know	
304	Do you have other chronic diseases?	1. Yes 2. No 3.I don't know	If 'no' skip to the next section
305	Please specify		

Section 4: Smoking Habit and Alcohol Consumption

NO	Questions	Alternative responses (coding category)	Skip to
401	Do you smoke cigarette currently?	1. Yes 2. No	
402	Have you been a smoker before?	1. Yes 2. No	
403	Do you consume alcohol currently?	1. Yes 2. No	
404	Have you been alcohol consumer?	1. Yes 2. No	

Section 5: Use of Traditional Medicine

NO	Questions	Alternative responses (coding category)	Skip to
501	Do you have a previous history of using traditional medicine?	1. Yes 2. No 3. I don't know	
502	Do you still use traditional medicine?	1. Yes 2. No	

Section 6: Medications.

NO	Questions	Alternative responses (coding category)	Skip to
601	Do you have habitual use of anti-pains?	1. Yes 2. No	

Section 7: History of Kidney Disease

NO	Questions	Alternative responses (coding category)	Skip to
701	Do you have family members who have Chronic Kidney Disease?	1. Yes 2. No 3. I don't know	
702	Do you have previous frequent kidney related illnesses?	1. Yes 2. No 3. I don't know	

Thank You!

Annex II: Amharic Questionnaire Form

የጥናቱ መግለጫ

ጤና ይስጥልኝ። ይህ መጠይቅ የተዘጋጀው በአዲስ አበባ ዩኒቨርሲቲ የሕብረተሰብ ጤና ትምህርት ክፍል በሕብረተሰብ ጤና ለድህረ ምረቃ ዲግሪ መመረቂያ በስኳር ሕመምተኞች ላይ ያለውን ስር የሰደደ የኩላሊት ሕመም ስርጭትና አጋላጭ ሁኔታዎች ላይ ለሚደረግ ጥናት ነው።

ክቡር መላሻችን ከዚህ በታች ስር የሰደደ የኩላሊት ሕመም ስርጭት እና አጋላጭ ሁኔታዎችን ለማወቅ የሚረዱ የተለያዩ ጥያቄዎች ይገኛሉ።

እነዚህን ሁኔታዎች ማወቅ በአዲስ አበባም ሆነ በአገር አቀፍ ደረጃ የበሽታዎቹን ስርጭት ለመግታት ለሚደረገው ጥረት ከፍተኛ የሆነ አስተዋጽዖ ይኖረዋል።

 በዚህ ጥናት ላይ ተሳታፊ እንዲሆኑ የተደረገው የስኳር ህመምተኛ በመሆኖ ሲሆን ጥናቱ ላይ የሚሳተፉት ፈቃደኛ ከሆኑ ብቻ ነው።ምንም እንኳን ጊዜዎትን መሰዋእት ቢደርጉም በዚህ ጥናት ላይ በመሳተፎት በግለሰብ ደረጃ የሚያገኙት ጥቅምም ሆነ ክፍያ አይኖርም።ሆኖም ግን የእርስዎ ቀና እና ትክክለኛ መልስ ከላይ የተገለጹትን ነገሮች ይበልጥ እንድንረዳ የሚያግዘን ሲሆን በተጨማሪም በሀገር ደረጃ በሽታውን ለመከላከለል ለሚደረገውን ጥረት አስተዋጽኦ ያደርጋል ።

ይህን ቃለ መጠይቅ ሲሞሉ ስምዎን እንዲጽፉ አይፈለግም።በመሆኑም ለሚያደርጉልን ቀና ትብብር በቅድሚያ ከልብ እናመሰግናለን።

አጥኚዋን ማነጋገር ከፈለጉ ይህንን አድራሻ መጠቀም ይችላሉ፡

ስም፡ ሚሮን ሞገስ

ስልክ፡ 0913 06 30 88

ኢሜይል፡ meronmoges579@gmail.com

የፈቃደኝነት መግለጫ

እኔ የጥናቱ ተሳታፊ የጥናቱን አላማ እና ጥቅም እንዲሁም ከእኔ የሚጠበቁትን ነገሮች ተረድቼአለሁ። ስሜ እና የምሰጣቸው መረጃዎች ለሶስተኛ ወገን ተላልፈው እንደማይሰጡም ተረድቼአለሁ። ስለዚህም በጥናቱ ላይ ለመሳተፍ ፈቃደኛ ነኝ።

የተሳታፊው ፊርማ _____ ቀን _____

የመረጃ ሰብሳቢው ስም _____ፊርማ _____ቀን _____

የአማርኛ መጠይቅ ፎርም

ክፍል 1፡ የተሳታፊዎች አጠቃላይ መረጃ

ተ.ቁ	ጥያቄዎች	አማራጮች	ይለፍ
101	ጾታ	1. ወንድ 2. ሴት	
102	እድሜ	እድሜ ----------	
103	የጋብቻ ሁኔታ	1. ያገባ 2. ያላገባ 3. የተለያየ 4.የተፋታ 5. የሞተበት(ባት)	
104	በትምህርት ላይ የቆዩበት ጊዜ	ያልተማረ/ች 1 2 3 4 5 6(የመጀመሪያ ደረጃ) 7 8 9 10 11 12(ሁለተኛ ደረጃ) 13 14 15 16 (ኮሌጅ/ዩኒቨርሲቲ) 17 18 19 20 21 22(ድህረ ምረቃ)	

ክፍል 2፡ የተሳታፊዎች አካላዊ ሁኔታ

ተ.ቁ	ጥያቄዎች	አማራጮች	ይለፍ
201	ቁመት	---------- ሴ.ሜ	

ክፍል 3 ፡የስኳር፣ የግፊት፣ የልብ ሕመምና ሌሎች ተላላፊ ያልሆኑ በሽታዎች ሁኔታ

ተ.ቁ	ጥያቄዎች	አማራጮች	ይለፍ
301	የስኳር ሕመምተኛ ከሆኑ ስንት ጊዜ ሆነዎት?	1. ከ 10 ኣመት ያነሰ 2. 10 ዓመት እና ከዚያ በላይ 3. አላውቅም	
302	የደም ግፊት ሕመም አለብዎት?	1 አለብኝ 2. የለብኝም 3. አላውቅም	የለብኝም ወይም አላውቅም ካሉ ወደ 304 ይለፉ። አለብኝ ካሉ ወደ 303 ይለፉ።
303	የልብ ሕመም አለብዎት?	1 አለብኝ 2. የለብኝም 3. አላውቅም	
304	ሌሎች ስር የሰደዱ በሽታዎች አለብዎት ?	1. አለብኝ 2. የለብኝም 3. አላውቅም	የለብኝ ካሉ ወደሚቀጥለው ክፍል ይለፉ
305	እባክዎን ግለጹት		

ክፍል 4፡ የማጨስና አልኮል የመጠቀም ልምድ

ተ.ቁ	ጥያቄዎች	አማራጮች	ይለፍ
401	ሲጋራ ያጨሳሉ?	1. አጨሳለሁ 2. አላጨስም	
402	በፊት ያጨሱ ነበር?	1. አዎ 2. አይ	

403	አልኮል መጠጥ ይጠቀማሉ?	1. አዎ 2. አይ	
404	አልኮል መጠጥ ይጠቀሙ ነበር?	1. አዎ 2. አይ	

ክፍል 5፡ የባህል መድሀኒት መጠቀም

ተ.ቁ	ጥያቄዎች	አማራጮች	ይለፍ
501	ከዚህ ቀደም የባህል መድሃኒት የመጠቀም ልምድ አልዎት ?	1. አዎ 2. አይ 3. አላስታውስም	
502	የባህል መድሃኒት አሁንም ይጠቀማሉ?	1.አዎ 2. አይ	

ክፍል 6፡ ለረዥም ጊዜ እና በሀኪም ያልታዘዙ መድሃኒቶችን መጠቀም

ተ.ቁ	ጥያቄዎች	አማራጮች	ይለፍ
601	የሕመም ማስታገሻዎችን አብዝተው የመጠቀም ልምድ አልዎት?	1.አዎ 2. አይ	

ክፍል 7፡ የኩላሊት ሕመም ሁኔታ

ተ.ቁ	ጥያቄዎች	አማራጮች	ይለፍ
701	ስር የሰደደ የኩላሊት ሕመም ያለበት የቤተሰብ አባል አልዎት?	1. አለኝ 2. የለኝም 3. አላውቅም	
702	ከዚህ ቀደም በተደጋጋሚ የኩላሊት ህመም ገጥሞት ያውቃሉ?	1. አዎ 2. አይ 3. አላስታውስም	

እናመሰግናለን!

Annex III: Curriculum Vitae

Personal Information

Name: Meron Moges Bekele

Date of Birth: 03/05/1981 E.C

Marital Status: Married

Educational Background

Primary Education from grade 1-8 at Yelibe Fana Primary School

Secondary Education grade 9 and 10 at Bole High School

Preparatory School grade 11 and 12 at Medhanialem Secondary and Preparatory School

Higher Education: Addis Ababa University, Medical Faculty School of Nursing

Qualification

Bsc Degree in clinical Nursing from Addis Ababa University with cumulative GPA of 3.16 in 2001 E.C

Language skills

Amharic and English both written and spoken

Computer Skill

Office applications

Experience

5 years and 9 months as a BSc Nurse in different health centers.

Trainings

1. ANC/PMTCT
2. IMNCI
3. BEMONC
4. ART
5. TBL, TB/HIV and MDR-TB
6. TOT on Integrated Emergency Care

Hobbies

Visiting spiritual places

Reading books

Addresses

09-13-06-30-88

09-19-81-92-70

09-13-06-30-86

Annex IV: Assurance of Principal Investigator

The undersigned agrees to accept responsibility for the scientific ethical and technical conduct of the research project and for provision of required progress reports as per terms and conditions of the research publications office in effect at the time of grant is forwarded as the result of this application.

Name of the student Meron Moges Bekele

Date June/2016 **Signature** _____

Approval of the Primary Advisor

Name of the primary Advisor Dr. Negussie Deyassa

Date June/2016 **Signature** _____