THREE YEARS RETROSPECTIVE STUDY ON PREVALENCE OF CHRONIC KIDNEY DISEASE AMONG DIABETIC PATIENTS AT WOLKITE UNIVERSTY SPECIALIZED HOSPITAL, GURAGE ZONE ,SNNPR, ETHIOPIA.

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A RESEARCH PAPER SUBMITTED TO DEPARTMENT OF MEDICAL LABORATORY, COLLEGE OF MEDICINE AND HEALTH SCIENCE AND WOLKITE UNIVERSITY FOR PARTIA LFULFILMENT OF THE REQUIREMENT FOR BACHELOR SCIENCE OF DEGREE IN MEDICA LABORATORY SCIENCES.

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WOLKITE UNIVIRISTY COLLAGE OF MEDICINE AND HEALTH SCIENCE DEPARTEMENTOF MEDICAL LABORATORY SCINICE.

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ABBREVIATIONS AND ACRONYMS

ADA America diabetes association

BMI Body mass index

C-G Cock croft - Gaul equation

CKD Chronic kidney diseases

CKD-EPI Chronic Kidney Disease Epidemiology Collaboration

CVD Cardiovascular disease

DM Diabetes Mellitus

DN Diabetic nephropathy

DURH Dilla university referral hospital

eGFR Estimated glomerular filtration rate

ESRD End-stage renal disease

RBG Random blood glucose

GBD Global burden of disease

GFR GLOMERULAR filtration rate

IDF International diabetic federation

IFG Impaired fast glucose

IGT impaired glucose tolerance

KDIGO kidney disease improving global outcome

MDRD Modification of Diet in Renal Disease

mGFR Measured glomerular filtration rate

NCDs Non-communicable diseases

SNNPR South nation national people region

WC Waist circumference

WHO World health organization

WKUSH Wolkite University specialized hospital

ABSTRACT

Background: *Chronic kidney disease is now recognized as a global public health problem. Diabetes is the leading cause of chronic kidney disease in developed countries and is becoming the leading cause of death in developing countries as well. The increasing prevalence of diabetes worldwide, especially type-2, virtually assures that the proportion of CKD attributable to diabetes will continue to rise. Therefore the aim of this study is to assess the severity of renal function by eGFR (using CKD-EPI equation) for early detection of CKD among DM patients which is used for intervention of the problem attending at Wolkite University specialized Hospital.*

Objective*: The objective of this study to be assessed the prevalence of CKD among DM patient over the last three years at Wolkite University Specialized Hospital, Gurage zone, SNNPR, Ethiopia.*

Method*: Institutional-based retrospective descriptive study was conducted on total of 238 DM patients to be assessed the prevalence of a three year chronic kidney disease among DM patient by reviewing registration Clinical chemistry laboratory logbook at wolkite university specialized hospital from May 2-June 20 2023 GC. Then the data obtained was entered to EPI info version 3.5.3 and then transferred to SPSS version 20 statistical package for analysis. Descriptive statistics results presented with tables and graphs.*

Results*: Among 238 subjects, 48 were suffering from CKD giving an overall estimated prevalence of CKD 20.2 %. From all the CKD patients, 33 (13.9 %) were stage 3 a (eGFR of 46 -60 ml/min/1.73m2, 13 (5.5%) were stage 3 b (eGFR of 31-45 ml/min/1.73m2) and 2(0.8%) were stage four (eGFR of 15-30 ml/min/1.73m2). Older age (P=0.001) and sex patients (P=0.001) were significant associated with CKD in DM patients but not with residence.*

Conclusion and Recommendation*; The finding of this study, the overall prevalence of CKD among diabetic adult patients at WKUSH was high. Older age and sex were significantly associated with CKD. The renal insufficiency corresponding to stage 3 CKD was also higher in DM patients despite normal Scr level. Everybody who responsible should be screen CKD in DM patients, soon after diagnosis of diabetes because CKD can appear independent of the duration of DM -post-diagnosis.*

Key words*: Chronic Kidney Disease, Diabetes, Estimated Glomerular Filtration Rate*

CHAPTER ONE

INTRODUCTION

1.1 Background

Kidney disease means damage of the kidneys and their function become slowly gets worse over time (1). The two main types of kidney disease are short-term (acute kidney injury) and lifelong (chronic kidney disease). Most people recover fully from a short-term kidney disease, but it can increase their risk of developing a chronic kidney disease later in life (2).Chronic kidney disease (CKD**)** is defined as structural or functional abnormalities of the kidney that persist for at least 3 months and is manifested by either kidney damage (most frequently detected as persistent albuminuria or proteinuria), or a decreased glomerular filtration rate (GFR), which is < 60 ml/min per 1.73 m2 (3). Stages and their clinical manifestations of CKD, Stage 1 CKD means that a person GFR is at least 90 milliliters per minute (ml/min) per 1.73 meters squared (m^2). This is normal kidney function but with evidence of kidney damage. Some signs of kidney damage in stage 1 CKD can include protein in a person urine or physical damage (4)

.A patient at Stage 2 CKD has a GFR of 60-89. There is usually are few or no physical symptoms at this stage. Althou0gh the kidneys are not working at 100% at this stage most people will not know they are at Stage 2 CKD because the kidneys are still well. If a person is diagnosed at Stage 2 CKD it is because they are being treated for diabetes of high blood pressure or they have a family history of kidney disease (5).At stage 3 CKD, a person's GFR is 30–59 ml/min per 1.73 m^2. This range indicates that a person has some damage to the kidneys.Stage 3 CKD can be separated into two subcategories:Stage 3a: Stage 3a means that a person has a GFR of 45–59 ml/min per 1.73 m^2.Stage 3b: Stage 3b means that a person has a GFR of 30–44 ml/min per 1.73 m^2.People with stage 3 CKD may experience:Swelling in the hands and feet, back pain, more frequent urination, anemia, high blood pressure, bone-disease are symptoms at this stage (6).

Stage 4 CKD occurs when persons estimated glomerular filtration rate (eGFR) falls between 15–29, indicating a severe loss of kidney function. At this stage of chronic kidney disease (CKD), its important to manage patients health preserve kidney function and start planning ahead for potential treatments like a kidney transplant or

dialysis (7).The final stage of chronic kidney disease (CKD) is referred to as stage 5 CKD, At Stage 5 CKD, eGFR is at 15 ml/min or less, meaning that kidneys are functioning at 15% or less, and kidney failure is imminent. When kidneys fail to filter blood, wastes build up in blood and turn body toxic (8).

Complication of CKD**;** If CKD progress to kidney failure, complication can include: Anemia, Fluid retention, Gout, Heart disease, Hyperkalemia (blood potassium level rise which may lead to heart damage), metabolic acidosis, pericarditis and Secondary hyperthyroidism and others (9).

Chronic kidney disease (CKD**)** is now recognized as a global public health problem and is associated with a range of adverse outcomes including increased all-cause mortality, cardiovascular disease, progression to end stage renal disease (ESRD), acute kidney injury, anemia, cognitive decline, and overall mortality (10).
Diabetes mellitus (DM**)** refers to group of common metabolic disorders that share the phenotype of hyperglycemia. Several distinct sorts of DM exist and are caused by interaction of genetics and environmental factors. Depending on the etiology of DM, factor contributing to hyperglycemia include reduced insulin secretion, decreased glucose utilization, and increased glucose production (11).

Diabetes can be classified as Type 1, Type 2, Gestational, and other specific types of diabetes mellitus. Type 1 diabetes results from autoimmune beta-cell destruction, usually leading to absolute insulin deficiency while Type 2 occurs due to progressive loss of beta- cell insulin secretion frequently on the background of insulin resistance (12).

Chronic kidney disease in DM is mainly caused by true diabetic nephropathy, but can also be caused indirectly, e.g. due to polyneuropathic bladder dysfunction, increased incidence of relapsing urinary tract infections, or macro vascular angiopathy (13).

Complications of DM on CKD patients;diabetic nephropathy is kidney damage caused by diabetes. It develops slowly and is also referred to as kidney disease.

Some of the complications of Diabetic Nephropathy are:

- Fluid retention, which could lead to swelling in arms and legs, high blood pressure, or fluid in your lungs (pulmonary edema)

- A rise in potassium levels in blood (hyperkalemia)
- Heart and blood vessel disease (cardiovascular disease), which could lead to stroke
- Pregnancy complications that carry risks for the mother and the developing fetus
- Irreversible damage to kidneys (end-stage kidney disease), eventually needing either dialysis or a kidney transplant for survival (14).

Symptoms

There are often no symptoms with early diabetic nephropathy. As the kidney function worsens, symptoms may include: Swelling of the hands, feet, and face, Trouble sleeping, poor appetite, Nausea, Weakness (14).

Renal impairment can be detected by checking either the renal function indicators or kidney damage markers. Kidney damage is usually ascertained by markers like Persistent proteinuria (a principal marker of kidney damage), abnormalities in urine sediment, abnormalities in blood and urine chemistry measurements, and abnormal findings on imaging studies (15).

Like kidney damage markers, the functional status of the kidney are often detected by measuring the level of creatinine, blood urea nitrogen, serum electrolyte, glomerular filtration rate (GFR), and red blood cell profiles (16).But the glomerular filtration rate (GFR) is taken as the best available index of kidney function in health and disease (17).

Glomerular filtration is the physiological process of making an ultra-filtrate of blood as it flows through the glomerular capillaries. Glomerular filtration rate (GFR)

measures the speed at which substances are filtered from the blood into the urine (18). But GFR cannot be measured directly in humans. Rather, it has to be measured by clearance techniques involving endogenous (e.g., creatinine and urea) or exogenous (e.g., inulin, iohexol, and iothalam what ate) filtration markers, with the latter considered to be the gold-standard approach.

Estimated GFR (eGFR) is regarded as an honest laboratory tool to point out abnormality of kidney function which will be calculated from serum creatinine level (19). However, to the best of our knowledge there is no study conducted on the prevalence of CKD among diabetic patients at wolkite university specialized hospital. Therefore, this study aimed to be assessed the severity of renal function by eGFR (using CKD-EPI equation) for early detection of CKD among DM patients which is used for intervention of the problem attending at Wolkite University specialized Hospital.

1.2 statement of problem

Diabetes mellitus Diabetes has emerged as one of the most serious and common chronic diseases of our times, causing life threatening, disabling and costly complications, and reducing life expectancy (21). In 2021, the estimated global prevalence of diabetes among people 20–79 years of age was 11%, which is expected to increase to 12% by 2045 (22). In addition, depending on report Africa region's most populous countries have the highest numbers of people with diabetes, including Ethiopia (2.6 million), South Africa (1.8 million), Democratic Republic of Congo (1.7) million), and Nigeria (1.7 million). About 45.1% of all adults aged 20-79 years with diabetes in the region live in these four countries in 2017 (23). Ethiopia is the first ranked with 2.6 million from top 4 African countries. This is due to number of factors, such as lack of awareness, limitation in screening protocols, less propaganda for intervention programs, globalization, rapid adaptation to western lifestyle, unhealthy eating habits like skipping the breakfast (or) eating junk foods because of financial hardships, and poor accessibility to health care services (scarcity of specialists, practitioners, health facilities, less expenditure) on diabetes or pre diabetes in Ethiopia (24).

Diabetic nephropathy Diabetes is the leading cause of CKD in developed countries and rapidly is becoming the leading cause in developing countries as a consequence of the global increase in type 2 diabetes (25), and the rapidly increasing prevalence of diabetes worldwide virtually assures that the proportion of CKD attributable to diabetes will continue to rise. DM alone accounts for 44% of kidney failure (26). Diabetic nephropathy (DN) is thought to be more frequent among patients with diabetes in Africa as compared to those within the developed world (27).

Chronic kidney disease is a progressive condition that affects >10% of the general population worldwide, amounting to >800 million individuals. Chronic kidney disease is more prevalent in older individuals, women, racial minorities, and in people experiencing diabetes mellitus and hypertension. Chronic kidney disease represents an especially large burden in low- and middle-income countries, which are least equipped to deal with its consequences. Chronic kidney disease has emerged as one of the leading causes of mortality worldwide, and it is one of a small number of non-communicable diseases that have shown an increase in associated deaths over the past

2 decades (20).Globally, the prevalence and incidence of CKD varies due to different reasons such as estimation of GFR by using different formula, use of different methods to measure proteinuria, lack of symptoms until end stage renal failure, and lack of population based study on CKD especially in low and middle income countries (28).

According to 2016 meta-analysis, the global prevalence of CKD is estimated between 11 to 13% with the majority of stage 3 and the prevalence of all stages in different country is estimated between 7–12% , which is very high (29). The prevalence of CKD in high income countries are reported to be around 11% (28). According to global burden of disease 2012 report globally, CKD is 18th highest cause of death with rapid increasing rate between1990 and 2010 with high burden in low and middle income countries including sub Saharan countries (30). According to 2016 meta-analysis report, the foremost (80%) of CKD patients are live in low and middle income countries, which is estimated between 14.3% and 36.1% of prevalence with more than 500000 patient incidence rate of ESRD annually, resulting in premature death in most cases (31). By 2030 the majority (70%) of ESRD is estimated to be found in the developing countries (32). The average prevalence of CKD in Africa is 10.1% with highest proportion (16.5%) found in West/Central West Africa (33). According to 2014 report, the prevalence of CKD in Sub Saharan Africa countries is estimated to be 13.9% and for the next decade kidney disease will increase rapidly due to urbanization, epidemic of HIV, and increasing rates of non-communicable diseases, which are the risk factors for CKD (34). The worst aspect of CKD in sub-Saharan countries is, it affects mostly young productive adults and mortality rate is very high due to lack of early screening and treatment facility (35).

In Ethiopia, there is no meta-analysis published report on the incidence, prevalence, and life expectancy of CKD patients, but believed to be high because of lack of early screening, inability of cost affordability for dialysis, and shortage of facility center, since there is only one renal transplantation center. Apart to this, a study conducted at southern Ethiopia on the prevalence of CKD and associated factor among diabetes patient showed that, 23.8% and 18.2 % had CKD based on C-G and MDRD equations respectively (36)..

In addition, lot of researchers recommended screening for evidence of kidney disease in DM patients by using eGFR and albuminuria. Sudden hearing of kidney failure and death due to CKD and its complication become common. However, to the best of our knowledge there is no study conducted on the prevalence of CKD among diabetic patients at wolkite university specialized hospital. Therefore, this study aimed to be assessed the severity of renal function by eGFR (using CKD-EPI equation) for early detection of CKD among DM patients which is used for intervention of the problem attending at Wolkite University specialized Hospital..

1.3 Significance /rationale of the study

The global burden of kidney disease due to DM is high in morbidity and mortality. Different study revealed that the burden due to DM is higher among other chronic illness due to spending more money for treating and managing its complication. It is stated in the statement of the study diabetic nephropathy has become the major cause of end-stage renal disease (ESRD) in the western world and in the African continent. Therefore, in order to go through prevention, it is better if we first know about chronic kidney disease among diabetic patients for the development of nephropathy, this study also be significant for patients and society at large to create awareness on diabetic nephropathy and its impact on their health status and to bring better life expectation. Therefore, early detection of CKD among DM patient is very important to minimize the burden of the community from it. In addition, this study may provide health institution of the country to find ways to minimize DM related chronic kidney disease, it may also help health care workers to provide knowledge about the burden of diabetic nephropathy, to implement evidence-based practices for laboratory education and research in wolkite university and create an awareness about the burden of chronic disease in diabetic patient for physicians. In addition, the study provide data to researchers for further study at a larger scale in gurage zone.

In addition, the finding may be relevant to policymakers, healthcare providers and payers who have to allocate resources to manage the DM population, and support ongoing efforts to reduce the prevalence of CKD as well. Moreover, it may help as base line data for further researches in the future.

CHAPTER TWO

LITERATURE REVIEW

2.1 Global Overview of DM prevalence

Globally, diabetes (especially Type 2) has emerged as a public health problem. Pandemic proportions within the last century. In 2022 Cross-sectional study was carried out in 115 rural communities prevalence of DM was 9.8% (37).

According to a national survey, about 12% of the Japanese population had diabetes in 2016 (38).

Cross-sectional survey conducted in 2017–18 on a national sample of 12,000 households showed Prevalence of DM and impaired fasting blood glucose (IFG) in India was 9.3% and 24.5% respectively (39).

Study also reported that the overall prevalence of diabetes was still higher in the developed countries; $\approx$ 6% (compared to 3.3% for the developing countries), and would reach 7.6% by 2025. However, the rate of increase of diabetes prevalence in the developing countries was projected to reach 170% by 2025, compared to only about 42% increase for developed countries (40).

Other significant findings from that survey were that type 2 diabetes was twice as common in African Americans and Hispanics, compared to non-Hispanic whites, and that obesity and sedentary lifestyles were significant risk factors for diabetes in the US populations (41).

Furthermore, WHO Reports on prevalence of diabetes and IGT, reveal that the prevalence of Type 2 diabetes is increasing not only in affluent societies as previously Thought, but also among people of the newly industrialized and less developed regions of the world. For example, within Asia-Pacific Region, age-standardized prevalence rates of 40-50% have been reported from parts of Papua New Guinea and the Republic of Nauru, while Singapore and Hong Kong have about 15%. However, the reports show that these high percentage prevalence are not absolute. Thus, among traditional Chinese populations, a prevalence rate of 2% is still observed, and Malaysia has been reported to have a 5% annual incidence rate for diabetes (42).

2.2 Distribution in Africa

Although only a few epidemiological studies on diabetes and other major NCDs have been undertaken with respect to the Sub-Saharan African region, indications are that there is increasing prevalence and incidence of NCDs, especially diabetes and hypertension, among urban populations in recent times. In addition, the incidence of Type 2 diabetes among young adults in the region has also increased (43).

In 1997, a conducted survey on diabetes prevalence in Tanzania, and established an adult prevalence rate at 4-10% among the economically privileged population of Dares Salaam. Consistent with most studies on diabetes, it is also found no significant gender variation in the prevalence of diabetes in the population, although being female was a significant risk factor for IGT (44). Similarly on their study on urban South African Zulus, found that the prevalence of Type 2 diabetes and IGT were 8.0% and 7.0% respectively. They also found that urban residency, increasing age and obesity were significant, independent risk factors for diabetes in that population (45). Mauritius, a multi-ethnic island in Africa, has been reported to have a high prevalence rate of diabetes and IGT, and one of the highest diabetes mortality rates in the world. Researchers like Dowse GK et al who have conducted population-based studies in the country's adult population 25-74 years of age, have reported crude prevalence rates of 12% for diabetes and 20% for IGT, for all the ethnic groups combined, using the oral Glucose Tolerance Test (OGTT), and the WHO diagnostic criteria (46). A similar study among the Danagla Community of Southern Sudan revealed a prevalence rate of 8.3% and 7.9% for diabetes and IGT respectively. That study however reported no urban or rural difference in the prevalence (47)

2.3 Situation in Ethiopia

Very few studies on diabetes epidemiology have been undertaken in Ethiopian Populations in general or within the country as a whole. Furthermore, no such study has been conducted within the last ten to fifteen years. The only community-based study conducted over 20 years ago near Gonder reported an overall prevalence rate of 0.5% for diabetes and IGT. However, that study used glycosuria for screening and hyperglycemia for confirmatory purposes only. Furthermore, the findings were limited by the fact that 86% of those screened were less than 20 years of age (48).

The other study in Ethiopians was the institution-based study by Teklu in 1979, on chronic diseases prevalence among bank employees that used data from clinic registry only. In that study, the researcher found that, among the chronic diseases reported in the clinic statistics, diabetes had a prevalence rate of 1.7% (49). However, this may not have been representative of the prevalence among the entire bank employees, since hospital based statistics are difficult to relate to actual population prevalence. The study on 158 Ethiopian immigrants to Israel found prevalence rates of 8.9% for diabetes and 8.9% for IGT in the mostly young adult population, aged 30 years and below (50).

2.4 Prevalence of CKD in DM patients

Chronic kidney disease (CKD) affects ~50% of patients with type 2 DM (T2DM), and changes within the epidemiology of T2DM are driving changes in the epidemiology of T2DM-associated CKD. The greatest increase in T2 DM prevalence has occurred in low-to-middle income countries where risk of CKD is additionally high; these regions are least able to manage the disease burden (51).

The prevalence of chronic kidney disease (CKD) in people with type 2 diabetes is three times higher than in the non-diabetic population and in many parts of the world, and the bulk of individuals developing ESRD have type 2 DM (52

Diabetes mellitus is the commonest contributor to chronic kidney disease (CKD) within the USA and worldwide. Prior studies have estimated prevalence of CKD among adults with type 2 DM (T2DM) at 34.5–42.3%, with most CKD cases identified as early stage (stage 1or 2). A cross-sectional study conducted on type 2 DM patients in USA showed that prevalence of CKD was 39.7(53).

A cross-sectional study conducted in Brazil in 2013 on 146 subject indicates that the prevalence is 36.6 and 34.2% by using MDRD and CKD EPI formula respectively (54).

In similar way the prevalence of CKD among type 2 DM in Spain is 27.9% (55).
Another study in in Kerala (southwestern India), also revealed relatively an identical result which is 45.3% (56).
In a cross-sectional study on randomly recruited participants from adult population, it was investigated that the CKD prevalence (stages 3 to 5) in Southern Iran with overall prevalence of CKD stages 3 to 5 was 11.6%. Stages 1, 2, 3, 4, and 5 of CKD were found in 8.5%, 66.1%, 11.4%, 0.1%, and 0.1% of the participants, respectively (57).
In a cross-sectional study, 527 people from primary and secondary health care areas in the city of Kinshasa the prevalence of CKD in this study was 36%. 4% of patients had stage 1 CKD, 6% stage 2, 18% stage 3, 2% stage 4, and 6% had stage 5 (58)

A recent prospective study in Ghana on 2781 subjects show, the prevalence of CKD among DM patients is 16.1% (59).

On the opposite hand, in Tanzania (cross-sectional study done on 369 subjects) showed 24.7% have eGFR <60ml/min and 80% have significant albuminuria and the overall prevalence is 87% (59). A cross sectional study analysis conducted on sub-Saharan African countries showed the overall prevalence of CKD from the 21 medium-quality and high-quality studies was 13·9% (60).

A cross-sectional study conducted in southern region of Ethiopia in 2014 at Butajira Hospital with 214 subjects (using only eGFR) showed that the prevalence of CKD in DM patients is 23.8% and 18.2% according to the C-G and MDRD equations, respectively. From those with CKD the majorities were with in CKD stage 3 (17.3 and 22.9% by both the MDRD and CG, respectively) and only 0.9% have stage 4 CKD (61).

In another way a recent retrospective study conducted on 189 subjects at Asella teaching hospital using only eGFR(C-G) show that the overall prevalence of CKD is 65.1 % and of this 40.2% and 2.1 were CKD stage 2 and CKD stage 4 respectively (62).

Another cross-sectional study that was done in north western part of Ethiopia at Gonder tertiary hospital on 229 subjects by using both eGFR and proteinuria, the prevalence of CKD among DM was 21.8 which is more or less similar with that of the study which was done at Butajira Hospital. Of all study participants, 9(3.9%) had renal impairment (eGFR < 60 ml/min/ 1.73 m2) and 46 (20.1%) had albuminuria(63).

A descriptive institution based-retrospective study was conducted at DURH On 307 of type 2 DM patients who were admitted in medical ward of DURH in the previous four years (from 2015-2018), 18.24 % had CKD (64). However, to the best of our knowledge there is no study conducted on the prevalence of CKD among diabetic patients at wolkite university specialized hospital. Therefore, this study aimed to be assessed the severity of renal function by eGFR (using CKD-EPI equation) for early detection of CKD among DM patients which is used for intervention of the problem attending at Wolkite University specialized Hospital.

CHAPTER THREE

OBJECTIVES

3.1 General Objective

- ✓ To assess the prevalence of CKD among DM Patients over the last three years at Wolkite University specialized Hospital, Guragae ,SNNPR, Ethiopia,

3.2 Specific Objectives

- ✓ To determine the prevalence of CKD among DM patients
- ✓ To determine the KDIGO stage of CKD among DM patients
- ✓ To determine trends of CKD in each years

CHAPTER FOUR

MATERIALS AND METHODS

4.1 Study area

This study was conducted in Wolkite University Specialized Hospital, which is located in Gubre sub-city in wolkite town, Gurage, Southern Ethiopia. It is found at a distance of 172 km from Addis Ababa, the capital city of Ethiopia and 14 km along the road of ButaJira from wolkite town. The hospital is established in 2018 as a part of a teaching hospital for health science students to produce qualified health professionals by providing practical skills. The hospital delivers health services for Medical, Surgical, Gynecological/Obstetrics, and Pediatrics to 4 million catchment population living in Gurage zone and Yem special woreda both inpatient as well as an outpatient department (OPD).

4.2 Study period

The study was conducted from May 2 to June 20 2023.

4.3 Study design

Institutional based retrospective descriptive study design was used to be assessed the prevalence CKD among adult DM patient at WKUSH.

4. 4 Population

4.4.1 Source population

All adult DM patients who were visited Wolkite University Specialized Hospital from 2021 to 2023 G.C.

4.4.2 Study population

Study population were all adult DM patients who tested for serum creatinine and blood urea nitrogen and have had full recorded document in the clinical chemistry laboratory logbook at Wolkite University Specialized Hospital from 2021 to2023 G .C .

4.5 Eligibility Criteria

4.5.1 Inclusion criteria

- Data from (2021-2023) DM patient with complete results in the last three years was included.

4.5.2 Exclusion criteria

- Laboratory records which had repeated information
- DM patients who had incomplete data on the log book.

4.6 Sample size determination and Sampling technique

4.6.1 Sample size determination

- All adult DM patients from (2021 -2023 GC) examined and kidney function test done on DM patient in Wolkite University specialized hospital. Socio demographic data and laboratory data extracted from registration log book by checklist.

4.6.2 Sampling technique

- Convenience sampling technique was used.

4.7 Study Variables

4.7.1 Dependent variables

- Chronic kidney disease (CKD)

4.7.2 Independent variables

- Age
- Sex
- Place of Residence
- Year of diagnosis

4.8 Operational definition

- ★ **Random blood glucose**: blood glucose obtaining at any time.
- ★ **Chronic Kidney disease (CKD)** is defined as eGFR< 60 mL/min/1.73 m2 (by CKD EPI) and proteinuria.
- ★ **End stage renal failure** is defined as eGFR<15 mL/min/1.73 m2 by CKD-EPI equation
- ★ **Stage two kidney diseases** are defined as eGFR, 60-89 mL/min/1.73 m2 by CKD EPI equation.
- ★ **Glomerulus's filtration rate**: a measure of function of nephrons, particularly creatinine and urea filtration rate from glomerulus into Bowman's capsule per millimeters per minute.
- ★ **Diabetes** is defined as medical history of diabetes or on diabetic treatment during study period.
- ★ **Prevalence** is defined as number of cases of a disease existing in a given population at specific period of time or at a particular moment in time

4.9 Data collections

We had collected variables such as age, sex, kidney function test and random blood glucose results from Wolkite University specialized hospital from Clinical chemistry laboratory record book of the last three year by using a data collection checklist.

4.10 Laboratory method

The results of Renal function and blood glucose test from plasma/serum and whole blood (serum creatinine, blood urea nitrogen and blood glucose) respectively. Test results were collected from laboratory log books. The eGFR was calculated by 2009 CKD-EPI creatinine equation (65) Using mobile applications:

- for female with Scr ≤ 0.7 mg/dl: GFR = 166 x (Scr/0.7)−0.329 x (0.993) age
- for female with Scr> 0.7 mg/dl: GFR = 166 × (Scr /0.7)−1.209 x (0.993) age
- For male with Scr≤ 0.9 mg/dl: GFR = 163 x (Scr / 0.9)−0.411x (0.993)age
- For male with Scr> 0.9 mg/dl: GFR = 163 × (Scr / 0.9)−1.209 x (0.993)age

4.11 Data processing and analysis

Data was checked, sorted, categorized and coded manually. After coding, the data was entered to EPI info version 3.5.3 and then transferred to SPSS version 20 statistical

package for analysis. Data cleaning done before analysis. Descriptive statistics of like frequency distributions, percentage, summary and variability measurements pie chart and graphs used.

4.12 Quality Assurance

The collected data was checked for its completeness, accuracy, clarity and consistency before being entered into the system. When any ambiguity or incompleteness encountered, the problem was assessed and corrected immediately before proceeded to the next step

4.13 Ethical consideration

Wolkite university college of health and school of medical laboratory science gave us permission to be performed this research and official letters submitted to medical director of the hospital to be collected data and all collected data kept confidential.

4.14 Result Dissemination Plan

The result from the study will be submitted to the Wolkite University, College of Medicine and Health sciences, Department of Medical laboratory science in order to inform the prevalence of chronic kidney disease among DM patients. Oral presentation of the thesis will be made. The work will be published in peer reviewed journal.

CHAPTER FIVE

RESULTS

5.1 Socio-demographic Characteristics of the study participants

In this study about 238 participants were included. Out of these more than half, 172(72.3%) of the participants were less than or equal 50 year of age and the rest 66(27.7%) were greater than 50 year. Regarding to their sex, about 122(51.3 %) of the participants were males and the rest 116(48.7%) were females. Concerning to their residence around 130(54.6%) of the participants were came from urban, while the rest 108(45.4 %) came from rural areas. The foremost study participants 117(44.9%) were on 2022 followed by 2021 which was 95(39.9%) and the rest with minimum number of participants were on 2023 accounting 36(15.2%) from the total study participants.

Table 1: Socio-demographic Characteristics of the study participants (n = 238) at WKUSH, Guragea zone, SNNPR, Ethiopia, 2023.

Categories		frequency	(%)
Age (year)	≤50	172	72.3
	>50	66	27.7
Sex	Male	122	51.3
	Female	116	48.7
Residence	Urban	130	54.6
	Rural	108	45.4
Year of diagnosis	2013	95	39.9
	2014	117	49.2
	2015	26	10.9

%: Percent

5.2 Assesment of renal function and blood glucose tests of study participants

5.2.1 Mean and standard deviation of Renal function tests of study population

Kidney function tests were measured for all study participants. The mean ± standard deviation (SD) of serum creatinine was 1.032 ± 0.6 mg/ld. regarding to blood urea nitrogen (BUN) in the serum of the participants, the mean ± SD was 20.8± 10.3 mg/LD. The mean ± SD of estimated glomerular filtration rate using CKD-EPI equations was 94.07± 49.9mL/min/1.73m2. The finding also showed that the study participant had the mean ± SD of random blood sugar was 303.2.±101.8 mg/ld.

Table 2.1: Mean and standard deviation of renal function and blood glucose tests of study participants (n=238) at WKUSH, Guragae zone, SNNPR, Ethiopia, 2023.

Parameter	mean(±SD)
Scr(mg/dl)	1.032(±0.6)
BUN(mg/dl)	20.8(±10.3)
eGFR by CkD EPI	94.07((±49.9)
RBG	266.5(±61.8)

eGFR CKD-EPI: estimated Glomerular Filtration Rate using Chronic Kidney Disease-Epidemiological Collaboration; SD: Standard Deviation

5.2.2 Frequency distribution of renal function and blood glucose tests of study participants

Most of the studied population are in normal serum creatinine and BUN result range which were 173(72.7%) and 132(55.5%) respectively. Random blood glucose of the study participants showed 145(60%) mild DM while the rest 93 (44.5%) are on severe DM.

Table 2.2; Frequency distribution of renal function and blood glucose tests of study participants (n=238) at WKUSH, Guragae zone, SNNPR, Ethiopia, 2023.

Parameter		frequency (%)
Scr	≤1.2 mg/dl	173 (72.7%)
	>1.2 mg/dl	65 (27.3%)
BUN	≤20 mg/dl	132 (55.5%)
	>20 mg/dl	106 (44.5%)
RBG	<=300	145(60%)
	>300	93(40%)

RBG: Random blood glucose; Scr: Serum Creatinine

5.3 Distribution of eGFR categories of study participants

According to our study results from total of 238 of patients,109(45.8%) were stage one eGFR group followed by stage two which was 81(34%)and around one seventh of the study participants were stage three (a) 33(13.9%)and the rest 13(5.5%)and

2(0.8%) were stage three (b) and stage four respectively. No one was stage five. The study also showed that a total of 190 (79.8%) patients had normal renal function and slightly decreased eGFR which has no significant health problem (eGFR of ≥ 60 ml/min/1.73m2), and 48 (20.2%) patients had decreased renal function which includes stage 3 and stage 4 (eGFR of < 60 ml/min/1.73m2).

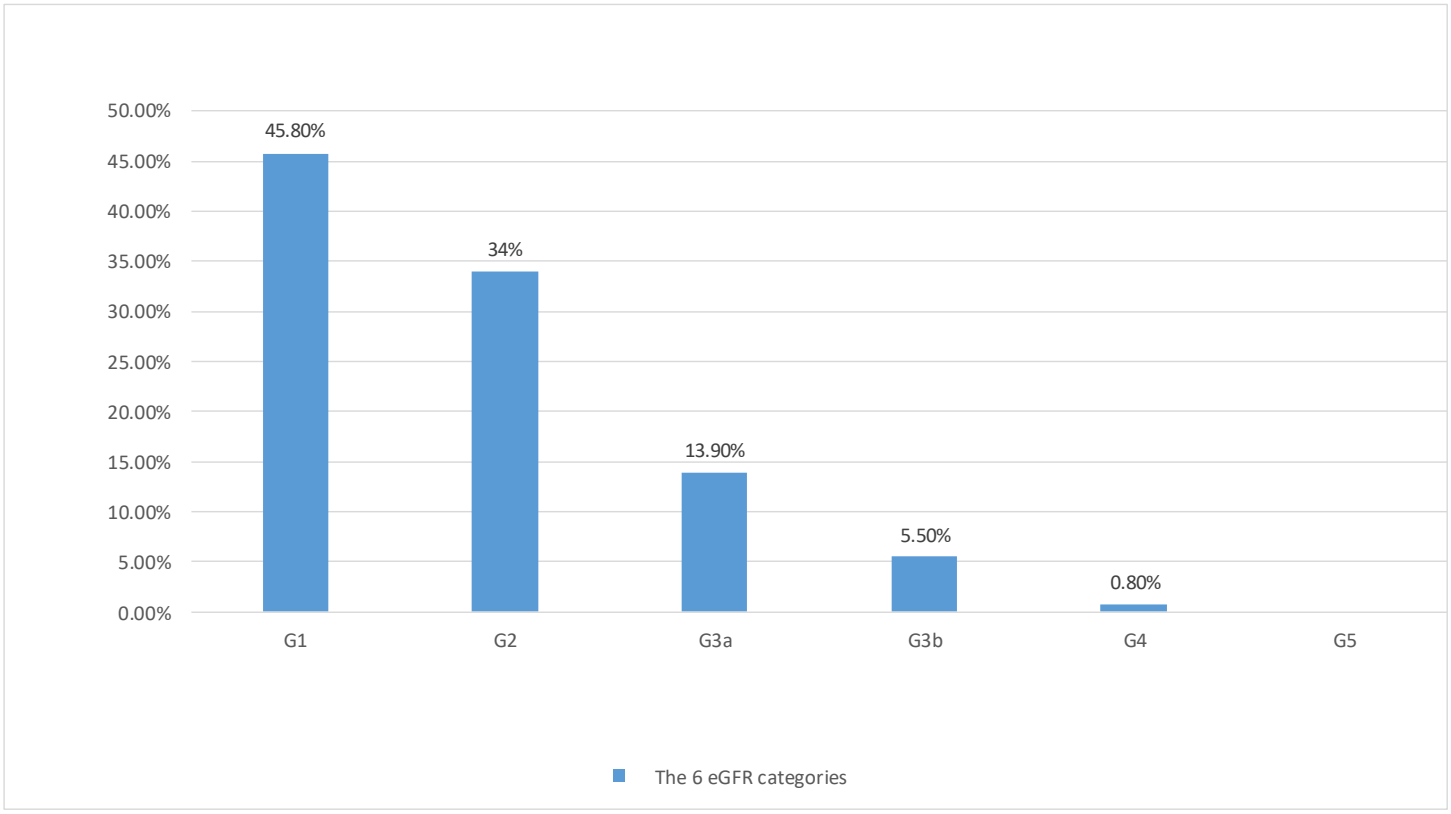

Figure 1: Distribution of eGFR catagories in (mL/min/1.73m2) of study participants (n=238) at WKUSH, Guragae zone, SNNPR, Ethiopia, 2023.

5.4 Assesment of eGFR categories of study participants by serum creatinine

According to our study results (Table 2.2), Out of the total study participants, 173 (72.7%) had normal Scr (≤ 1.2 mg/dl). When these populations were assessed by eGFR using the 2009 CKD -EPI creatinine equation, CKD was found in 16 (9.2%).

The majority of stage one study participants had normal serum creatinine which was 97(56.2% of the total normal serum creatinine population). In stage two study participants 60(34.9%) had normal serum creatinine. More than One third of stage three a study participants had normal serum creatinine which was 16(8.9%).

Table 3*:* Kidney function in DM patients with normal Scr assessed using 2009 CKD-EPI creatinine equation at WKUSH,guragae zone,SNNPR, Ethiopia

GFR category (ml/min/1.73m2)	**Description (ml/min/1.73m2**	**Scr** (≤ 1.2 mg/dl)	
		frequency [%]	
G1(>=90)	Normal or high GFR	97	(56.2)
G2 (61-89)	Mildly ↓GFR	60	(34.9)
G3a(46-60)	**Mildly to moderately ↓GFR**	**16**	**(8.9)**

GFR: Glomerular Filtration Rate; CKD-EPI: Chronic Kidney Disease-Epidemiological Collaboration; G: Group; N: Number; %: Percent

5.5 Prevalence of CKD

Among 238 subjects, 48 was suffering from CKD giving an overall estimated prevalence of CKD was 20.2%.From those 33{13.9%] were on stage 3 A which was covered the highest percent of the total CKD patients, Stage 3 B CKD patients were 13{5.5%] while the remaining were under stage four (G4) CKD which accounts 2 {0.8%] which was covered the least percent. There were no stage 5 CKD.

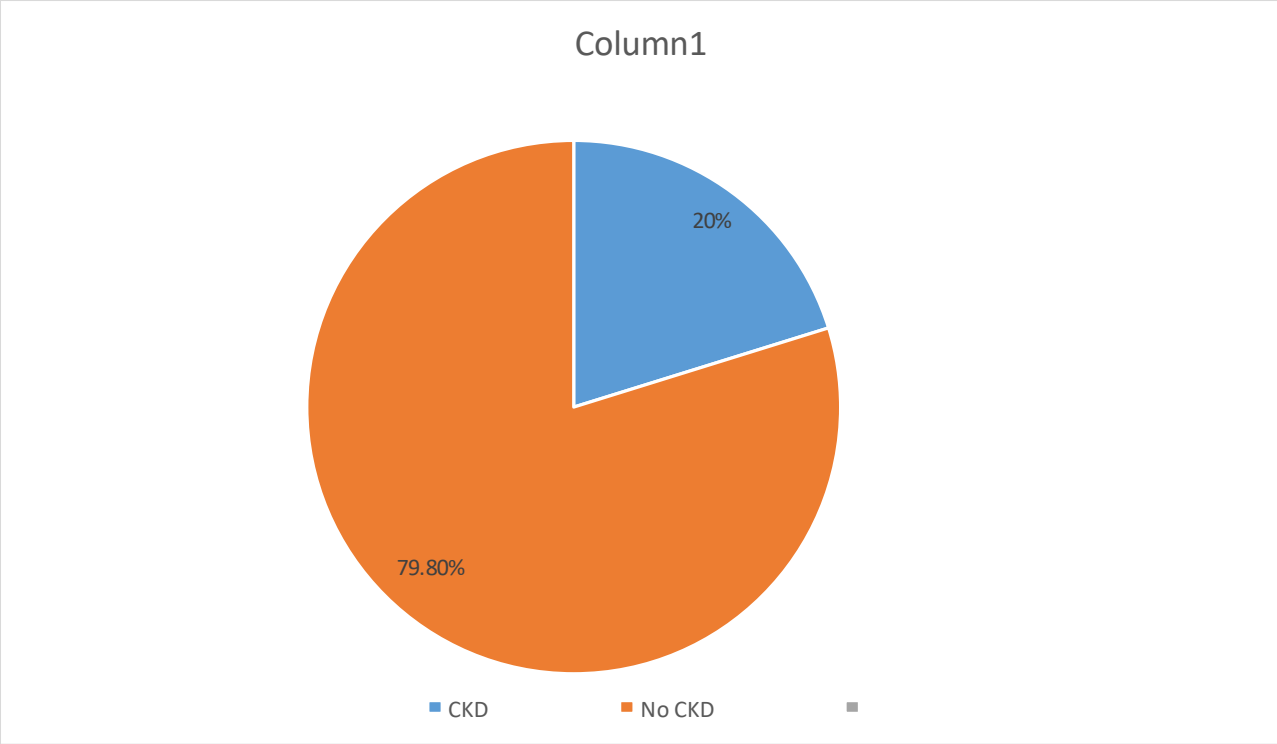

Figure 2: Pie chart to show prevalence of CKD by CKD- EPI equations of study participants (n=238) at WKUSH, Guragae zone, SNNPR, Ethiopia, 2023.

5.6 Socio-demographic factors related with CKD

From a total of 238 study participants 48 (20.2%) had developed chronic kidney disease, while the remaining 190 (79.8%) had not developed chronic kidney disease. More than half of CKD patients were in the age between 50-83 which was 25 (10.5%) while the remaining 23(9.6%)were the age between 18-50 and this difference was statistically significant (p=0. 001) less than 0.05. CKD with respect to sex majority of the patients were males which was 6(15.1%) while the remaining 22(5%) were females and the difference was statistically significant (p=0.001).Half of urban study participants had developed CKD which was 24(10.1%)while the rest 24(10.1 %) were rural and the difference was not statistically significant (p=0.472) greater than 0.05.

Table 4: Socio-demographic factors related with CKD among DM patients (n=238) at WKUSH, Guragae zone, SNNPR, Ethiopia, 2023**.**

Category	CKD				Total		P-value(A)
	Yes		NO				
	N	%	N	%	N	%	
AGE							
Age 18-50	23	9.6	149	62.6	172	72.2	
Age 51-83	25	10.5	41	17.3	66	27.8	0.001*
SEX							
Male	36	15.1	86	36.2	122	51.3	0.001*
Female	12	5	104	43.7	116	48.7	
RESIDENCE							
Urban	24	10.1	106	44.5	130	54.6	0.472
Rural	24	10.1	84	35.3	108	45.4	

eGFR: Estimated glomerular filtration rate, CKD: chronic kidney disease, N: Number, %: Percent.

5.7 Trends of chronic kidney disease

According to our results, it shows trend of CKD has been increased slightly from 2021 (CKD=22 or 9.2% of total 238 patients) to 2022 (CKD=24 or 10.1%) from those patients with severe CKD (eGFR<30) was reported on 2021 which was 2 (0.8%), but decrease in 2023 since it was assessed for only 3 months 2 (0.8%) were on CKD. The number of patients with elevated serum creatinine was decreased from 2021 to 2023 which was 36(15.1%), 27 (11.3%) and 2(0.8%) respectively. Severe elevation of random blood glucose in 2022 was 44(18%) which is increased from 2021 which was 36(15.1%). Even though gradually increased in the two consecutive

years, in 2023 was failed to 13(5.1%). In general the prevalence of CKD was fluctuating.

Table 5: Trends of chronic kidney disease among DM patients (n=238) at WKUSH, Gurage zone, SNNPR, Ethiopia, 2023

		Year of diagnosis						Total	
Category		2021		2022		2023			
		No	%	No	%	No	%	No	%
Serum Cr	<=1.2	59	24.8	90	37.8	24	10.1	173	72.7
	>1.2	36	15.1	27	11.3	2	0.9	65	27.3
eGFR	>=90	51	21.1	43	18.1	15	6.3	109	45.5
	60.1-89.9	22	10	50	12	9	3.8	81	25.8
	45.1-60	13	5	19	8	1	0.4	33	13.4
	30.1-45	7	2.9	5	2.1	1	0.4	13	5.4
	15.1-30	2	0.9	0	0	0	0	2	0.9
	<15	0	0	0	0	0	0	0	0
BUN	<=20	58	24.4	59	24.8	15	6.3	132	55.5
	>20	37	15.5	58	24.4	11	4.6	106	44.5
Rbscat	<=300	59	24.8	73	30.7	13	5	145	60.5
	>300	36	15.1	44	18	13	6.4	93	39.5
CKD	Developed	22	9.2	24	10.2	2	0.8	48	20.2
	Not developed	73	30.6	93	39.1	24	10.1	190	79.8

RFT: Renal function test, eGFR: Estimated glomerular filtration rate, CKD: chronic kidney disease, Scr: serum creatinine, RBG: Random blood glucose, BUN: Blood urea nitrogen, N: Number, %: Percent

CHAPTER SIX

DISCUSSIONS

Chronic kidney disease (CKD) is one of the common chronic NCDs that characterized by persistent reduction of kidney function with or without structural abnormality of the kidney for more than three months (66). Mild to moderate kidney function reduction is more prevalent than ESRD (67).

In this study the overall prevalence of CKD among DM patients over the 3 years was 48 (20.2 %).We also found that the prevalence of stage three a, b and four kidney diseases of the total study participants was 33%, 13%and 2% respectively which was comparable with a study done in Gondar(21.8%.%)(63).

Across-sectional study conducted in the USA also shows that the prevalence of CKD in patients with diabetes was found to be 39.7% (53) which is higher than the present study. The reason for the higher difference between the above studies and the present study might be genetic variation, variation of the sensitivity of the estimators used and the lifestyle.

Anaother study conducted in Brazil in 2013 on 146 subjects indicates that the prevalence is 36.6 and 34.2% by using MDRD and CKD EPI formula which was higher than the present study (54). This higher difference with the current study could be mainly because of genetic variation and used both eGFR and proteinuria, but in this study used only eGFR.

Another study done in Kinshasa (Democratic Republic of Congo) on selective risk groups, the prevalence of CKD found to be **36%** (56).which was much higher than the present study, the prevalence was 4%, 6%, 18%, 2%, and 6% for stage 1,2,3,4, and 5 CKD respectively by MDRD equation. This higher difference with the current study could be mainly because of selective study population groups used, the Kinshasa researcher emphases the prevalence of CKD diabetic, hypertensive, and obese patients.

our prevalence estimated of CKD was far lower than the study done in Asella that showed, the overall prevalence of CKD was (65.1%) by C-G equation {62}.The possible reasons for this difference might be the differences in there were more aged (>60 years) study subjects than in our study and used both eGFR and proteinuria but in this study used only eGFR.

In contrast, our finding was greater than study done in southern Iran which showed that, the overall prevalence of CKD (from stage 3 to 5) was 11.6% and the prevalence of stage1, 2, 3, 4, and 5 kidney disease was 8.5%, 66.1%, 11.4%, 0.1%, and 0.1% respectively by MDRD equation, but not reported by CKD-EPI equation (58). The difference between the above study and the present study might be genetic variationand variation of the sensitivity of the estimators used.

Our study result was also higher than that of sub-Saharan Africa country meta-analysis which revealed that the overall prevalence of CKD was 13.6% (60). The most difficult part to compare the present study with this meta-analysis was the difference of the estimators used. The meta-analysis done in sub-Saharan Africa country considers C-G equation and proteinuria in addition to MDRD and CKD-EPI equations to determine the prevalence of CKD.

The prevalence of CKD in this study was around 2 times higher than that of reported from Botswana (8.4%) {68}. The possible reasons for this difference might be sensitive of estimators.

This study found also CKD was significantly associated with older age (p = 0.001) similarly the study conducted in Botswana (p=0.001 and being male was independently associated with CKD (p = 0.001) unlikely study conducted in Botswana p{ = 0.595) (68)

Finally, the worst side of CKD is asymptomatic nature and diagnosis at end stage which is harsh and difficult to treat especially in developing counties. So early screening and detection of CKD in the population is the crucial step to reduce the morbidity and mortality rate of kidney failure and its complication

CHAPTER SEVEN

STRENGTHS AND LIMITATIONS OF THE STUDY

7.1 Strengths

- ✓ The study finding may be served as a base line data and has provided some data to inform decision-makers to improve current care and management of CKD persons.
- ✓ Had tried to assess renal function test by estimated Glomerular Filtration Rate using Chronic Kidney Disease-Epidemiological Collaboration equation.

7.2 Limitation

- ✓ The current study was based on retrospective review of monthly summary record at Wolkite university specialized hospital which limits the independent variables to only sex, age and residence.
- ✓ The influence of other medications and diet were also not taken into consideration during this study.
- ✓ All DM patients were assessed for CKD only by using eGFR and Scr alone.
- ✓ The study was restricted among wolkite university specialized hospital DM patients which did not give over all conclusions for Guragae zone population.
- ✓ We relied on CKD-EPI equations to determine the prevalence of CKD but there is no evidence for the validation of these equations among Ethiopian population

CHAPTER EIGHT

CONCLUSION AND RECOMMENDATIONS

8.1 Conclusion

In this retrospective study the overall prevalence of CKD was 48(20.1%), from those 33(13.9%), 13(5.5%) were stage three a and b retrospectively and the rest 2(0.8%) were stage four. The most prevalence stage was stage three which covers 46(19.3%).No of the study participants were under end stage renal failure or GFR<15ml /min/1.73m2. Therefore the prevalence of kidney disease was relatively high, early detection and screening of CKD should be practice in order to prevent and minimize end stage renal failure. The knowledge gained from this study could be a big input for health professionals, policy makers, and the community for minimization of end stage renal failure.

8.2 Recommendations

For further investigators, we would recommend:

- Further study should be conducted to determine the exact prevalence of CKD among DM patients using eGFR and Albumin creatinine ratio.
- The research area was restricted at wolkite university specialized hospital which did not explore the general population of guragea zone other than wolkite university specialized hospital. Therefore increasing the study areawill bring overall prevalence of chronic kidney disease in gurage zone population.
- During data collection period you should consider muscle disease such as gigantism, acromegaly and mysthesia gravis which increase serum creatinine.
- you should differentiate rapid decline of GFR from constant decline.

For regional, zonal and woreda health office:

- Clinicians in the diabetes outpatient clinics should have to be aware of the high prevalence of CKD and referral should be made to nephrologists as early as possible.
- Aged people should get special attention as they are more risky to CKD.

- It is recommended to screen for CKD in DM patients, soon after diagnosis of diabetes because CKD can occur independent of the duration of DM –post diagnosis.
- All DM patients should be screened for CKD using eGFR and proteinuria instead of Scr alone.

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Annex-I Sample collection format

Checklist for data collection about prevalence of chronic kidney disease among diabetes mellitus patients

NO	Patient MRN no	Sex	Age	RBS	Creatinine	eGFR	BUN	Year of diagnosis
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
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18								

Annex II: Declaration Form

We, the undersigned, hereby declare that this proposal paper is our original work and has not been presented for an award of a degree in Wolkite University or any other university.

Name of the students:

1. Name: _____ Signature: _____ Date: ___/____/_____

2. Name: _____ Signature: _____ Date: ___/____/_____

3. Name: _____ Signature: _____ Date: ___/____/_____

Approval of the advisors

This research proposal will be approved by the advisors:

1. Name: _____ Signature: _____ Date: ___/____/_____

2. Name: _____ Signature: _____ Date: ___/____/_____