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STUDY OF BIOCHEMICAL PARAMETERS IN PATIENTS WITH CHRONIC RENAL FAILURE

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OMER MOHAMMED ABD ABD

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STUDY OF BIOCHEMICAL PARAMETERS IN PATIENTS WITH CHRONIC RENAL FAILURE

By Omer Mohammed Abd ABD

May 2022

We certify that we have read this thesis and that in our opinion it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Science

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Omer Mohammed Abd ABD

ABSTRACT

STUDY OF BIOCHEMICAL PARAMETERS IN PATIENTS WITH CHRONIC RENAL FAILURE

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Master of Science in Chemistry

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May 2022

The current study aimed to evaluation some biochemical parameters in patients with chronic renal failure. 85 patients, reported for infected with chronic renal failure in Azadi Teaching Hospital and Al-Jumhuri hospital from November 2021 to January 2022. Experimental work was carried out at private Laboratories in Kirkuk, Iraq. The results demonsterated sgnificant (P<0.05) elevated in param,eters in kidnyes function (urea, creatinine and uric acid). total cholesterol and triglyceride levels shows significant (P <0.05) elevated in CKD patients compared to healthy group. Total protrin and albumin demonsterated sgnificant (P<0.05) reduced in CKD pateins. Wihle CR protein demonsterated sgnificant (P<0.05) elevated in serum of CKD pateins. About the findings of trace elements, Phosphorus and Potassium levels shows significant (P <0.05) elevated in CKD patients compared with healthy group. While, calcium, sodium and magniesum levels shows significant (P <0.05) reduce in CKD patients compared to healthy group. Finally, vitamin D concentration shows significant (P <0.05) reduce in CKD patients compared to healthy group.

2022, 43 pages

Keywords: Chronic kidney disease, Lipid profile, Total protein, Magnesium, Sodium, Vitamin D.

ÖZET

KRONIK BÖBREK YETMEZLIĞI OLAN HASTALARDA BIYOKIMYASAL PARAMETRELERIN ÇALIŞMASI

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Mayis 2022

Bu çalışma, kronik böbrek yetmezliği olan hastalarda bazı biyokimyasal parametreleri değerlendirmeyi amaçlamıştır. Kasım 2021'den Ocak 2022'ye kadar Azadi Eğitim Hastanesi ve Al-Jumhuri hastanesinde kronik böbrek yetmezliği ile enfekte olduğu bildirilen 85 hasta ile deneysel çalışmalar Irak, Kerkük'teki özel Laboratuvarlarda gerçekleştirilmiştir. Sonuç olarak böbrek fonksiyonundaki (üre, kreatinin ve ürik asit) parametrelerde önemli bir artış ($P<0.05$) gösterdiği toplam kolesterol ve trigliserit seviyeleri, sağlıklı grupla karşılaştırıldığında KBH hastalarında anlamlı düzeyde ($P <0.05$) yükseldiği gözlemlenmiştir. Toplam protrin ve albümin, CKD pateinlerinde önemli ölçüde ($P<0.05$) düşüş göstermiştir. CR proteini, CKD pateinlerinin serumunda anlamlı düzeyde ($P<0.05$) yükselmiş olsa da. İz elementlerin bulguları hakkında, Fosfor ve Potasyum seviyeleri, sağlıklı grupla karşılaştırıldığında, KBH hastalarında anlamlı ($P <0.05$) artış gösteren sonuçlara ulaşılmıştır. Kalsiyum, sodyum ve magnezyum seviyeleri sağlıklı gruba göre KBH hastalarında anlamlı ($P<0.05$) azalma gösterirken, D vitamini konsantrasyonunun, sağlıklı gruba kıyasla KBH hastalarında anlamlı ($P <0.05$) düşüş gösterdiği görülmüştür.

2022, 43 sayfa

Anahtar Kelimeler: Kronik böbrek hastalığı, Lipid profili, Toplam protein, Magnezyum, Sodyum, D Vitamini.

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Omer Mohammed Abd ABD

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CONTENTS

LIST OF SYMBOLS

%	Percent
±	Plus-minus
°C	Degrees Celsius
µL	Microliter
dL	Deciliter
g	Gram
kg	Kilogram
L	Liter
m^2	Square meters
mg	Milligram
mL	Milliliters
mmol	Millimoles
nm	Nanometer

LIST OF ABBREVIATIONS

A	Absorbance
ADPKD	Autosomal dominant polycystic kidney disease
AKI	Acute kidney injury
BCS	Body condition score
CKD	Chronic kidney disease
CVD	Cardiovascular disease
EAT	Epicardial adipose tissue
ECS	Endcannabinoid system
EDTA	Ethylenediaminetetraacetic acid
ESRD	End-stage renal disease
ESRF	End stage renal failure
GFR	Glomerular filtration rate
HDL	High-density lipid
HTGL	Hepatic triglyceride lipase
IDF	International diabetes federation
IRIS	International renal ınterest society
LCAT	Lecithin-cholesterol acyltransferase
LDL	Low-density lipid
MDRD	Modification of diet in renal disease
NSAIDs	Non-steroidal anti-inflammatory drugs
RF	Risk factors
SCr	Serum creatinine concentration
SDMA	Symmetric dimethyl arginine
SST	Serum separator tubes
TC	Total cholesterol
TGs	Triglyceride
USRDS	United states renal data system
VLDL	Very low-density lipid

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1. INTRODUCTION

CKD is a common pathology in human, it tends to be progressive and irreversible (Polzin 2011). It can be induced by a wide range of illnesses, events, or circumstances, and the severity of the condition can be determined by a variety of clinical signs (Polzin 2011). Renal replacement therapy are not widely available in medicine. It is also well recognised that a late diagnosis of CKD is linked to a bad prognosis. These facts are sufficient justifications for focusing all efforts on early prognosis, favouring, together with therapeutic care, illness stability, slowing disease progression, and enhancing patient quality of life and survival time (Grauer 2005).

Because distinctive clinical indications are not common in early CKD stages, research is required to identify relevant RF utilizing information from individuals history and diagnosis of disease. The International Renal Interest Society (IRIS) (Perini-Perera *et al.* 2021) proposed that once individuals who have been exposed to RF have been identified, a set of tests should be performed to confirm CKD presence.

The presence of a persistent increase in GFR indicators serum concentration is consistent with the presence of the disease. The creatinine concentration (sCr) is measured as part of the routine evaluation of GFR. It does, however, have significant limits. As a result, novel GFR markers are being investigated, such as SDMA, that looks to be endogenous renal biomarker suited as a test for CKD diagnosis when used in conjunction with sCr investigation, but there is still much to learn about its properties (Sargent *et al.* 2021). After a diagnosis, staging and substaging the disease allows for a more precise prognosis and helps to guide therapeutic management decisions.

It is possible to distinguish between advancement RF, such as renal albuminuria and condition of hypertension, that are associated with a faster rate of disease progression (Reynolds and Lefebvre 2013), and renal failure, like hyperphosphatemia and BCS loss, that are related with a higher rate of morbidity and mortality (Reynolds and Lefebvre 2013, King *et al.* 1992, Geddes *et al.* 2013).

1.1 Study Objectives

- Elevated the concentration of total protein, albumin and CR protein.
- Determining the concentration of total cholesterol and triglyceride.
- Determining the concentration of creatinine, urea and uric acid.
- Determining the concentration of some electrolytes (calcium, sodium, potassium, phosphors and magnesium).

2. LITERATURE REVIEW

2.1 Chronic Kidney Disease

CKD is defined as disturbance remarkable by a loss the function of kidney that is progressive and irreversible, as well as persistent renal damage (Eckardt and Kasiske 2009). CKD has been identified as a worldwide public health issue. Evaluation data on widespread presence, and asosciated morbidity, corroborated the disease's substantial socioeconomic burden (Eckardt *et al.* 2013), especially in light of the disease's progression to ESRD and link to CVD. Different abnormalities of structure and functions inside the kidney will emerge along the disease course, lead to glomerular, nephron corpusles damage, regardless of the etiology of CKD (Schlondorff 2008). The disease's progression phase is marked by a continual state of inflammation and oxidative stress, all of which contribute to the formation of renal fibrosis (Figure 2.1) (Yamaguchi *et al.* 2015).

For CKD diagnosis and prognosis, GFR estimates (as important parameter) and albuminuria are commonly utilized in clinical practice. GFR estimation identifies the presence of renal impairment, whereas albuminuria identifies the degree of kidney dysfunction. These classic indicators, on the other hand, only rise when considerable amount of ability of filtration has been lost and renal damage has progressed (Zhang and Parikh 2019).

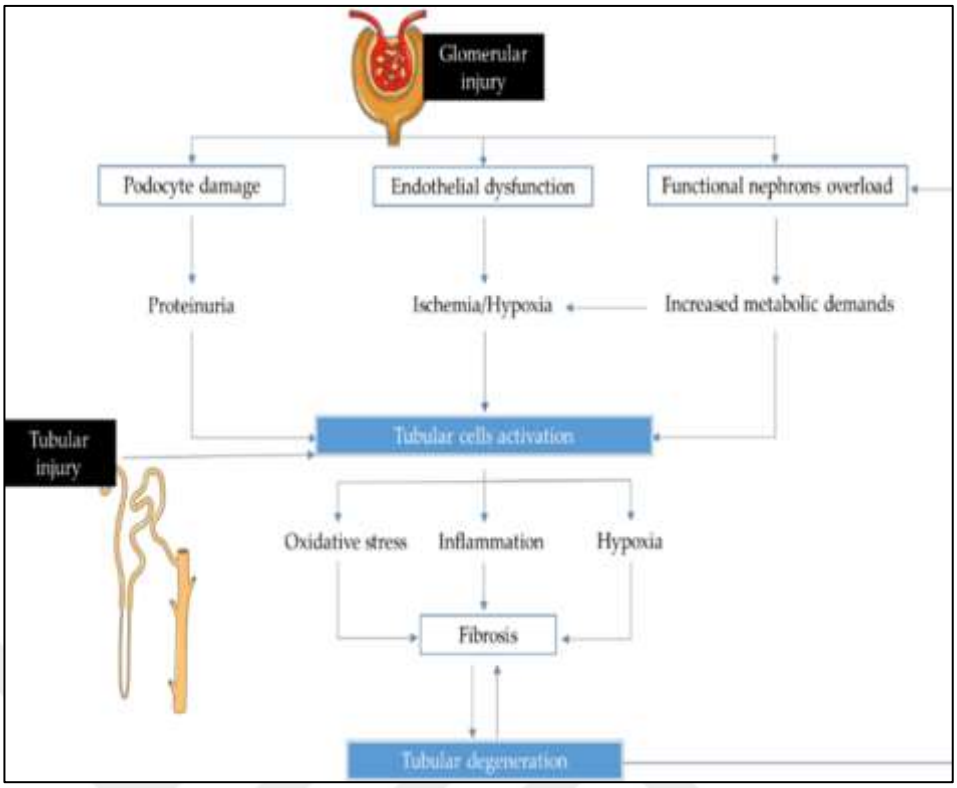

Figure 2.1 Mechanisms of tubular cell activation produced by tubular and glomerular lesions, as well as their consequences

As a result, when multiple damage to renal cells have already occurred, they increase (Levin *et al.* 2013, Levey and Coresh 2012). Early detection of CKD is a critical unmet medical need for not only predicting and preventing CKD progression, and also improving patient survival and reducing associated morbidities. To attain this goal, more sensitive and early biomarkers are required. The contrast between a normal and a sick kidney is depicted in Figure 2.2.

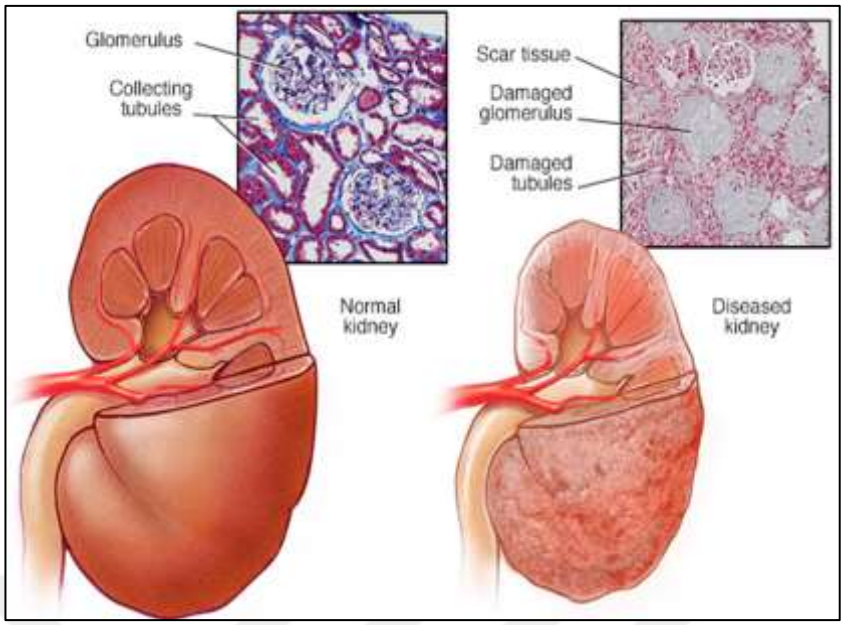

Figure 2.2 Structure of normal and diseased kidney

2.1.1 GFR

GFR, which is the most extensively used metric of the function of renal, is the amount of primary filtered of urine from blood via glomeruli. This translates to around 180 litres per day in a healthy person.

However, in natural conditions, about 99 percent of the primary pee is reabsorbed, leaving only a small portion to be evacuated. GFR is determined by the net filtration pressure across the glomeruli membrane, which is affected by afferent and efferent arterioles, and pressure. Amount of glomeruli and, as a result, the total filterable area influence GFR. GFR is measured in milliliters per minute per square meter and is usually adjusted for body size (relative GFR). The absolute GFR (the individual's true filtration rate) is frequently expressed in milliliters per minute (mL/min). The GFR is important for several things, including forecasting renal activity, monitoring kidney disease progression, drug dosing, and general hemodynamics. The GFR, on the other hand, is a rough estimate of renal filtering capacity rather than a comprehensive evaluation of kidney function. Furthermore, and perhaps most importantly, the GFR does not reveal the source or severity of renal disease. This is especially noticeable

because creatinine does not increase in concentration until after more than 24 hours in an acute renal strain, and so does not provide a straightforward explanation for the improvement in kidney function (Maisel 2012).

The "real" GFR, which is defined as the filtering of all nephrons in the kidneys at the same time, is a hypothetical event that cannot be determined. This is due to the difficulty of quantifying all one million nephrons that filter plasma at the same time, as well as the fact that primary urine changes its structure and volume as it passes through the tubuli and into the urinary bladder. However, if a marker is present in blood, and the marker is easily filterable and not expelled or reabsorbed by the tubule, It is possible to calculate the volume of filtered plasma. The amount of marker removed in urine per time unit equals plasma volume filtered by glomeruli over the same time interval if the plasma concentration is known.

GFR is defined as the amount of blood cleared of various molecules through nephrons in time unit, GFR equals the quantity of blood cleared of various molecules by nephrons in a unit of time. Young men have a normal value of 130 mL per minute per 1.73 m2 while young women have a normal value of 120 mL per minute per 1.73 m2. The actual rate is affected by age, race, size of whole body, the hydration, and a range of various factors such as medicines and disease. The mean GFR with age, with the highest levels of filtration reported in early adulthood and steadily decreasing GFR as one becomes older. However, the pace of degradation is debatable: starting in the fourth decade, it is expected to be in range of 10 mL/min per decade. Despite these drawbacks, GFR is typically considered to be the most reliable overall indication of renal function (Stevens *et al.* 2006, Levey *et al.* 2011).

2.1.2 CKD classification

The presence of kidney problems, shown by aberrant albumin excretion or impaired kidney function, assessed by observed or estimated GFR, that continues for more than 3 months is characterized as chronic kidney disease (CKD) (Levin *et al.* 2017). Although creatinine clearances can be computed using the Cockcroft-Gault MDRD Study

estimation equations and a 24-hour urine creatinine level, estimating GFR (estimated GFR or eGFR) using creatinine levels is a more practical way in the office. For both estimating equations, there are web-based tools accessible. Patients with severe CKD are more prone to develop problems and progress to end-stage renal disease, necessitating renal replacement treatment. Furthermore, early intervention is more likely to decrease serious CKD consequences and slow the course of the disease. The National Kidney Foundation created criteria to stratify CKD patients as part of its renal disease Outcomes Quality Initiative (NKF K/DOQI) to make CKD severity evaluation easier (Coresh *et al.* 2003):

- The stage 1: normal levels of eGFR about 90 mL/min per 1.73 m2 and persistent albuminuria
- The stage 2: levels of GFR about 60 to 89 mL/min per 1.73 m2
- The stage 3: levels of GFR about 30 to 59 mL/min per 1.73 m2
- The stage 4: levels of GFR about 15 to 29 mL/min per 1.73 m2
- The stage 5: levels of GFR about 15 mL/min per 1.73 m2 (Thomas *et al.* 2008).

2.1.3 Epidemiology

The rise in the number of people with ESRD is linked to a failure to recognize chronic kidney disease in its early stages. The incidence of ESRD treated with dialysis varies greatly according on the country's level of prosperity. Highly developed countries. There are about 1 million dialysis patients in the world, with a quarter-million new cases per year. Between 1988 and 1994 and 1999 to 2004, total widespread presence of CKD in the United States grew from 12% to 14%, but has stayed largely steady since 2004. Individuals with Third stage CKD have had the most growth, increasing from 4.5 percent to 6.0 percent since 1988. In USA, the incidence of CKD is rising at a faster rate in those aged 65 and up, which more than doubled between 2000 and 2008 (NIH 2012, NIH 2016).

The prevalence among those aged 20 to 64 is less than 0.5 percent. For African Americans, the rate of ESRD is more than three times higher than for Caucasians (NIH 2012). Diabetes and hypertension are resulting in causes of ESRD. USRDS numbers show a steady elevate in diabetics enrolling number in ESRF programs over the decades. Diabetics account for about 44% of all incident patients. As a cause of ESRD, glomerulonephritis and cystic kidney disease have remained rather stable. In both developing and developed countries, the diabetes condition is lead to induce ESRD. In Australia, ESRD incidence related to DM is over 25%, and according to the European Union registry, diabetics number enrolled in ESRF programs is between 15% and 33%, whereas the number enrolled due to glomerulonephritis is between 9% and 20% (McDonald 2015, Stel *et al.* 2009).

CKD is commonly related with age, diabetes, the obesity, and CVD in developed nations, glomerulosclerosis and the nephrosclerosis that caused by hypertension are the expected pathological findings, however, accurate diagnosis is sometimes challenging. Infections, medication and toxin, and glomerular and interstitial disorders are all significant causes of CKD in underdeveloped nations (Levey and Coresh 2012).

Sub-Saharan Africa is a big, diverse continent with over 900 million inhabitants and around 47 countries. End-stage renal illness affects over than 70% of individuals, such as those in Africa, are expected to live in low-income nations by 2030. In Sub-Saharan Africa, there are numerous probable causes of CKD, making renal disease particularly demanding. Communicable illnesses, like infectious glomerulonephritis, infection of human immunodeficiency virus, infection of leishmaniasis, are frequent and can lead to CKD. Because more than 22 million person in Africa have infection of HIV, the region faces a high risk of an epidemic of CKD (Stanifer *et al.* 2014).

CKD prevalence in Africa's general population has been observed to range from 2% to 41%. In the West/Central-West, the prevalence of CKD ranged from 12 percent to 17 percent, from 6 percent to 29 percent in the Southern region, from 7 percent to 15 percent in the Eastern region, and from 3 percent to 13 percent in the North region

(pooled estimate: 4 percent). The prevalence in Africa ranged from 2% to 14% (Abd ElHafeez *et al.* 2018).

2.1.4 CKD causes

CKD causes renal vascular disease, diabetic nephropathy, and hereditary kidney disorders and disease are primary causes of CKD prior to starting KRT, according to the CKD in Queensland registry research. trustworthy information on the etiology of CKD has mostly come from ESKD patient registries. Diabetic nephropathy, glomerulonephritis, and the hypertension conditin are the main causes of CKD development and progression in Australia (AIHW, 2009, ANZDATA, 2016). Diabetes mellitus, including type 1 and 2, causes CKD (Chen *et al.* 2011).

Diabetes affects 6.4 percent of the world's population, or 285 million person, and is expected to climb 7.7 percent (439 million person) by 2030 (Jha *et al.* 2013). It is predicted that about 40% of patients with diabetes will lead to CKD. Diabetes was responsible for 37% of all new indivduals of ESKD treated with dialysis in 2014. (ANZDATA Registry, 2016). Diabetes develops when the body generates insufficient or no insulin, or when the insulin produced is ineffective. Hyperglycemia is caused by high blood glucose levels, which damages the glomerular capillaries of the kidney (AIHW 2009).

Small amounts of protein flow via capillaries of glomerular and end up in the urine as a result of the glomerular injury. major protein amounts are excreted in the urine, causing water to enter bodily tissues and produce swelling, most commonly in the face, with upper and lower limbs. The kidney filters grow thin and blocked if not addressed, which can lead to renal failure (Thomas and Bryar 2013). The second most common cause of CKD is glomerulonephritis. Glomerulonephritis refers to a group of disorders in which the glomerulus becomes inflamed or damaged, impairing the kidney's ability to eliminate metabolic waste and excess fluid (Evans and Taal 2015, AIHW 2009). In Australia, it accounted for 20% of all dialysis patients starting in 2014 (ANZDATA 2016).

Hypertension is a common symptom of CKD and plays a significant role in its development and progression (Mobley 2009). Hypertension is main cause of ESKD all around the world. The hypertension contributed for 13% of all new patients with chronic kidney disease in 2014, Australia (ANZDATA 2016). The tiny blood arteries supplying the kidneys are damaged by hypertension (Nikolajenko 2013). The ability of the kidney to autoregulate blood flow and GFR is harmed as the blood artery walls thicken and narrow over time (Mobley 2009). Genetic illnesses, infections, blockage, medications, and urological issues are only a few of the other reasons of CKD. These other reasons account for roughly 30% of CKD cases when taken together (ANZDATA 2016).

2.1.5 Risk factors

According to (Kaur and Sharma 2017), there are numerous forms of booming in an individual's life in the twenty-first century due to wide range of changes occurring due to inherited disorders and lifestyles. Low HDL and high levels of triglyceride are linked to elevate risk of CKD and microalbuminuria, according to our findings. Obesity is linked to a decrease in renal activity, according to animal research. Our findings showed that abdominal obesity, defined as a waist circumference of 102 cm or more in males and 88 cm in female, was linked to a 2-fold eleavate in the risk of CKD. As well as to the diabetes condition and hypertension disease, that have been linked to CKD in previous studies, this evidence suggests which obesity may be a sgnificant modifiable risk factor for the disease (Chen *et al.* 2004).

Microalbuminuria and a quick reduction in renal function are unquestionably linked to traditional western diets and excessive salt and potassium absorption (Zhang *et al.* 2012). Diabetes and hypertension, often known as nephrosclerosis, are inherent risk factors in the body that contribute to CKD development (it is severe). The first symptom is a rise in albuminuria levels, and other symptom is diabetic glomerulosclerosis, symptoms include slowly deteriorating albuminuria, decreased GFR, hypertension flare-ups, and nephrotic syndrome.

Aetiologic factors, such as kidney poisoning due to nephrotoxicants, are probable extrinsic causes for CKD advancement, according to (Weaver *et al.* 2015), this type of CKD is known as CKDu. Chronic interstitial nephritis is the most well-known CKD linked to occupational, it has been linked to excessive exposure to lead ions, cadmium ions, other compunds as melamine, and diethylene glycol. Lead-induced CKDu is called glomerulonephritis. The kidneys become granular compacted in this kind of renal disease, lead is primarily exposed through lead paints. Itai-itai syndrome is caused by cadmium toxicity (ouch-ouch). Secondary fractures and intense pain are the most common symptoms of this disorder, Toxic grain produced in rice fields with contaminated water from industry causes these diseases. Aristolochic acid exposure causes urothelial carcinoma. It is primarily found in the Aristolochiaceae plant family. The schistosomiasis disease, glomerulonephritis, infection with HIV, and leishmania infections are examples of non-communicable and communicable disorders that cause CKD (Stanifer *et al.* 2014).

People with AKI are often in excruciating pain, therefore they turn to NSAIDs as their first line of defense. Sometimes what appears to be a simple medical procedure causes a major medical consequence, such as CKD (Foley *et al.* 2005). The researchers and the investigators studied and discussed the receptors, that are binding locations (exogenous) for both cannabinoids (synthetic and natural), that are exploited for diversion. They emphasized the presence of ECS in kidney, that has lately emerged as a key factor in diagnosis of diabetic nephropathy, medication nephrotoxicity, and progressive CKD. Experimental animals have shown that the ECS has renoprotective properties (due to pharmacological modulations), increasing hopes for its potential human application. Furthermore, there have been a number of AKI cases linked to utilize of synthetic cannabinoids, which appear to have a higher potency and incidence of toxicity compare with natural plant called cannabis, especially in mid age individuals, in recent years (Barutta *et al.* 2018).

AKI, hypertension, electrolyte abnormalities, necrosis of renal blood vessels, the uorthra infection, the urothelial malignancy, and CKD are all possible side effects of herbs. In cases of unexplained kidney disease, herbal reasons are considered,

particularly in a few places where herbal preparation intake is high. Balkan-endemic nephropathy is linked to persons who live along the Danube's tributaries, Aristolochic acid nephropathy is caused by the ingestion of aristolochic acid from flour obtained from wheat cultivated in polluted Aristolochia clematitis fields, where more cases of chronic interstitial fibrosis have been reported. Various problems that are directly or indirectly impacted by water can lead to kidney disease, for example, high temperatures regularly lead to water shortages in many tropical areas, resulting in dehydration of body and, ultimately, a severe effect on renal. Heavy industrial hazardous compounds leached from soil can pollute flowing water, and the grain present in the waterlogged fields can get polluted with damaging materials. Many water-borne infections can harm the kidneys, including leptospirosis condition, schistosomiasis disease, malaria infection, hantavirus, and finally the scrub typhus. Because of diarrhoeal infections, children are more vulnerable to AKI. In some parts of Sri Lanka and India, few cases of CKD of unknown etiology have been reported. Young male farmers make up the majority of those impacted. Although the clinical signs and symptoms are similar to interstitial nephritis, histology reveals interstitial fibrosis, mononuclear cell infiltration, and atrophy of tubule. The government of Sri Lankan decided a few years ago to prevent CKD by avoiding heavy metals, industrial chemicals, the various types of fertilizers, and different types of pesticides from contaminating water, food, or both. Strangely, no excess of heavy metals was identified in the water in a study financed by the International Society of Nephrology's Research and Prevention Committee and conducted in Srikakulam district (Andhra Pradesh) (Jha *et al.* 2013).

In autosomal dominant polycystic kidney disease, the overall kidney size and the rate of renal growth are related to advancement of CKD (ADPKD). ADPKD is a severe, life-threatening condition that typically affects adults and is caused by genetic mutations. Mutations in two genes, PKD1 and PKD2, are the most common causes for the dysfunction of kidney and lead to CKD. Kidney cysts in ADPKD are thought to start before birth and increase rapidly throughout life. During this time, cysts compress and severely harm nearby tissues such as the blood vessels and various tubules, resulting in interstitial fibrosis and condition of inflammation. The risk factors for CKD are shown below each stage (Foley *et al.* 2005).

2.1.6 Treatment of complications of CKD

After a quick sodium load, individuals with disease of CKD have a reduced ability to preseve the balance of body fluid, which becomes increasingly obvious in stages IV and V of CKD. Sodium restriction and a loop diuretic help these people. According to the 2012 KDIGO guidelines, all CKD patients should consume fewer than 2 grams of salt per day. In CKD, hyperkalemia can arise in oliguric patients and those whose aldosterone output is reduced. Hyperkalemia can be caused by dietary potassium intake, tissue breakdown, and hypoaldosteronism. Hyperkalemia can also be caused by drugs like ACE inhibitors and nonselective beta-blockers. Due to the elevated tendency of renal in advanced CKD to retain H, metabolic acidosis is a typical consequence (Aeddula *et al.* 2019).

In patients with CKD, chronic metabolic acidosis causes osteopenia, elevate the rate of protein catabolism, and the hyperparathyroidism. Bicarbonate supplementation should be given to these individuals in order to achieve a blood bicarbonate level of 23. CKD is an important risk factor of CVD, and the risk elevates as the severity of the disease worsens. There is substantial evidence that there is a link between the thickness of EAT and the occurrence of the CVD events in the CKD individuals. EAT assessment in CKD indivaduals could be a reliable indicator for assessing cardiovascular risk (Aeddula *et al.* 2019).

3. MATERIALS AND METHODS

3.1 Subjects

85 patients, reported for infected with chronic renal failure in Azadi Teaching Hospital and Al-Jumhuri hospital from November 2021 to January 2022. Experimental work was carried out at private Laboratories in Kirkuk, Iraq.

3.2 Groups of Study

Patients and healthy were divided into two groups:

- Group 1: It included 85 individuals (45 males and 40 females), their ages ranged from 20-70 years. All of them are suffering from chronic kidney disease.
- Group 2: This group was include 25 apparently healthy subjects as healthy group (15 males and 10 females), and their ages 25 to 60 years.

3.3 Kidney Function Parameters

3.3.1 Urea

1. Preincubate the working reagent, samples, and standard to 37 degrees Celsius.
2. Fill the photometer halfway with pure water and set the absorbance to zero.
3. Pipette the solution into a cuvette (Table 3.1).

Table 3.1 Urea procedure steps

WORKING REAGENT	SAMPLE OR STANDARD
1.0 mL	10 µL

Calculations: Urea concentration was calculated from the absorbance depending on the Equation (3.1).

$$\text{Results}=\frac{\text{A2-A1 (Sample)}}{\text{A2-A1 (Standard)}}*\text{CStandard}=\text{mg/dL} \quad (3.1)$$

3.3.2 Creatinine

1. Preincubate the working reagent, samples, and standard to 37 degrees Celsius.
2. Fill the photometer halfway with pure water and set the absorbance to zero.
3. Pipette the solution into a cuvette (Table 3.2).

Table 3.2 Creatinine procedure steps

WORKING REAGENT	SAMPLE OR STANDARD
1.0 mL	10 µL

Calculations: creatinine concentration was calculated from the absorbance depending on the Equation (3.2).

$$\text{Results}=\frac{\text{A2-A1 (Sample)}}{\text{A2-A1 (Standard)}}*\text{CStandard}=\text{mg/dL} \quad (3.2)$$

3.3.3 Uric acid

The reagent, specimens, and the standard were all kept at 37°C. Following that, the additions of raction were made in accordance with Table 3.3.

Table 3.3 Steps of uric acid procedure

SAMPLE	REAGENT R
25 µL	1000 µL
Mix, and after 5 min, Measure absorbance at 505 nm with a buffer blank. The color of reaction remains constant for several minutes.	

Calculation: uric acid levels is calculated according to the Equation (3.3).

$$\frac{\text{Sample}}{\text{Standard}} * \text{C Standard} \quad (3.3)$$

3.4 Lipid profile

3.4.1 Total cholesterol

The enzymatic method for measuring cholesterol in the blood was described by Allain as followING (by using BioLabo kit/ France/ spectrophotometer):

The total cholesterol concentration was calculated according to the Equatio (3.3).

$$\text{Conc. of Cholesterol} = \frac{\text{Abs(Test)}}{\text{Abs(Standard)}} * \text{Concentration of Standard (200mg/dL)} \quad (3.3)$$

3.4.2 Triglyceride

The enzymatic method for measuring triglyceride in the blood was described by Allain as following (BioLabo kit/ France/ spectrophotometer):

The triglyceride concentration was calculated according to the Equation (3.4).

$$\text{Conc. of Cholesterol} = \frac{\text{Abs(Test)}}{\text{Abs(Standard)}} * \text{Concentration of Standard (200mg/dL)} \quad (3.4)$$

3.5 Proteins

3.5.1 Total protein

The reagent, specimens, and the standard were all kept at 37°C. Following that, the additions of raction were made in accordance with Table 3.3.

Table 3.4 Steps of total protein procedure

WORKING REAGENT	SAMPLE OR STANDARD
1.0 mL	10 µL
The absorbance was read at the wavelength 540 nm 5 minutes. After mixing the serum with the assay agent	

Total protein levels are calculated according to the formula, as shown in Equation (3.5).

$$\text{Results} = \frac{\text{sample}}{\text{standard}} * \text{C Standard} = \text{mg/dL} \quad (3.5)$$

3.5.2 Albumin

The working reagent, samples, and standard were incubated at reaction temperature (37°C). Then the additions were made according to the Table 3.5.

Table 3.5 Steps of albumin procedure

WORKING REAGENT	SAMPLE OR STANDARD
1.0 mL	5 µL
The absorbance was read at the wavelength 630 nm 5 minutes. After mixing the serum with the assay agent	

Albumin levels are calculated according to the formula, as shown in Equation (3.6).

$$\text{Results} = \frac{\text{sample}}{\text{standard}} * \text{C Standard} = \text{mg/dL} \quad (3.6)$$

3.5.3 CR-protein

The CR-protein CT is designed for the quantitative measurement of CR-protein in human serum or plasma.

3.5.4 Protocol

- Dilute patient and healthy samples in 100-fold by adding 5 mL of sample or healthy group to 495 mL of sample diluted
- Distribute 10 mL of diluted and healthy standard samples into the appropriate pits
- Add 100 mL of enzyme conjugate to all pits.
- Incubation for 60 min at 18-26°C.
- Remove fluid from all pits.
- Wash the wells 3 times with 300 mL of semi-washing solution. Add 100 mL of substrate that called TMB to the all ELISA wells.
- Incubation at 37°C for 15 min.
- Add 50 mL of the solution called stop solution.
- Read the degree of absorbance on reader at wavelenght (450 nm) after 15 min from adding the solution called stop solution.

Results: The CRP concentration in each of the experiment samples is extracted by the standard curve specified by the kit manufacturer, as shown in Figure 3.1.

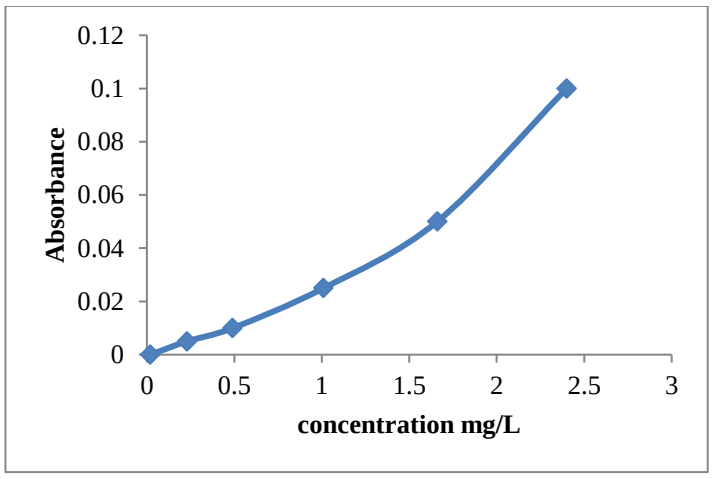

Figure 3.1 Standard curve for determination of CRP concentration

3.6 Vitamin D

- Fill each well with 10 mL of 25(OH) D Standards, healthys, and samples, as needed.
- Into the each ELISA well, dispense 200 mL of a 1x solution of biotinylated 25 (OH) D reagent.
- Utilizing a shaker at 200–400 rpm, carefully mix contents in all wells for 20 seconds. Remove the plate from the shaker and cover it with the adhesive plate seal, making sure each well is completely sealed.
- Incubate the sealed plate at 18–26 °C for 90 min.
- Remove the plate's seal with care and dump the contents of the wells.
- Fill each well with 300 mL of 1x Wash Buffer, then discard the contents of the wells. Repeat the process twice more for a total of three washes. On absorbent paper, tap the wells.
- In each well, pour 200 mL of Enzyme Conjugate (Streptavidin-HRP) and incubate at 18–26 °C for 30 min.
- Delete the contents of the wells.

Results: The Vitamin D concentration in each of the experiment samples is extracted by the standard curve specified by the kit manufacturer, as shown in Figure 3.2.

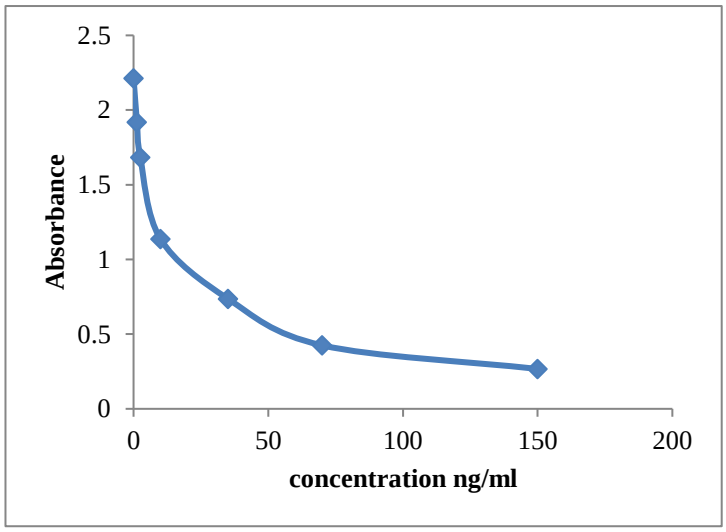

Figure 3.2 Standard curve for determination of Vitamin D concentration

3.7 Statistical Analysis

The computer programs SPSS version 21 and GraphPad prism version 8 were utilized for statistical analysis. MeanSE was used to express the results of statistical tests and bar graphs. An unpaired T-test (Man-Whitney U) was utilized for compare the parameter means between the patient and control groups

4. RESULTS AND DISCUSSION

4.1 Kidney Function

Table 4.1 shows significant (P <0.05) elevate in the concentration of urea in CKD patients compared to healthy group, as the concentration in the serum of patients was (114.21±17.1) mg/dL, while its concentration in the healthy group was (23.86±5.57) mg/dL (Figure 4.1). Creatinine levels shows significant (P <0.05) elevated in CKD patients (7.87±0.364) compared to healthy group (0.925±0.21) (Figure 4.2). Uric acid levels shows significant (P <0.05) elevated in CKD patients (8.45±0.164) compared to healthy group (7.16±0.12) (Figure 4.3).

Table 4.1 Kidney function parameters in studied groups

PARAMETERS	MEAN ± SD		P-VALUE
	Control N (25)	Patients N (85)	
Urea (mg/dL)	23.86 ± 5.57	114.21 ± 17.1*	0.037
Creatinine (mg/dL)	0.92 ± 0.21	7.87 ± 0.36*	0.003
Uric acid (mg/dL)	7.16 ± 0.12	8.45 ± 0.16*	0.024

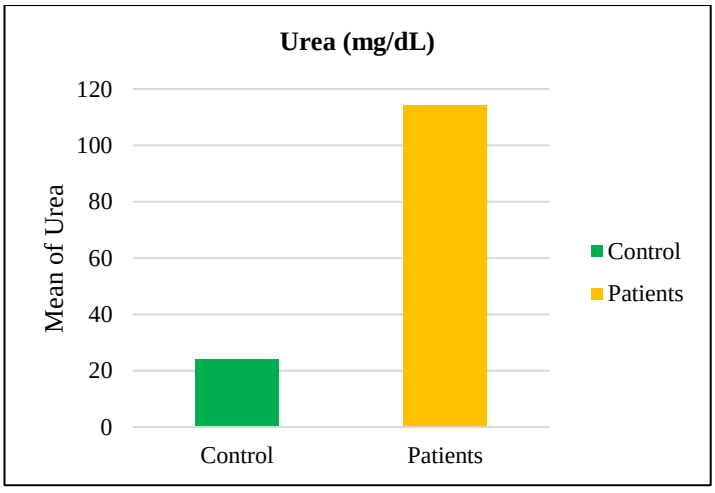

Figure 4.1 Urea levels in both groups

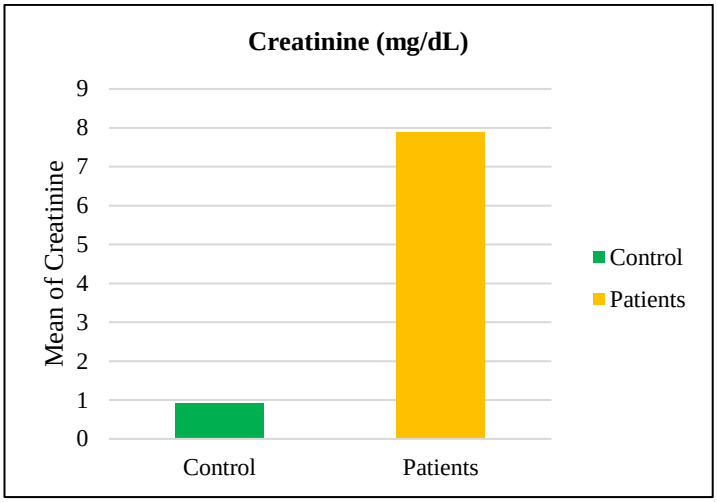

Figure 4.2 Creatinine levels in both groups

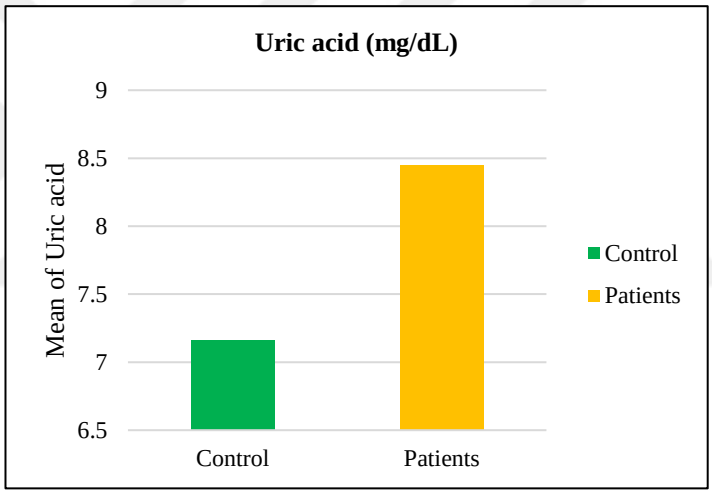

Figure 4.3 UA levels in both groups

The amount of creatinine in the patients' population was higher than in the control group, according to the conclusions of this investigation, and men were more affected than women. This finding is consistent with those of Al- Rawi et al (2014), who referred that there elevate in creatinine concentration in the serum of individuals with persistent renal disease (7.643.57 mg/dL) as compared to the control group's (0.880.07 mg/dL). The elevated concentration of creatinine in serum of individuals with chronic renal illness may be due to the fact that creatinine is one of the metabolic wastes that is ordinarily eliminated by diuresis. Levels of creatinine in serum is inversely proportional

to GFR, a small reduction in GFR causes a rise in the concentration of creatinine in the blood. (Zilva *et al.* 1988).

While the rate of renal function reduction appears to be slow (–1.64 mL/min/1.73m2/year), the average baseline eGFR was 22.5 mL/min/1.73m2. In the early stages of CKD, the same increases in serum creatinine (mg/dL) resulted in lower changes in eGFR. (Yuste *et al.* 2013).

Furthermore, in comparison to the healthy group, CKD individuals had slightly higher of urea and creatinine levels ($p < 0.01$) than the healthy group. The results of the additional experiments corroborated these conclusions (Souza *et al.* 2013). The kidneys eliminate important solutes such serum creatinine and blood urea, according to Skoreck and Porth, and urea was the first organic solvent detected in the blood of CKD patients. These pollutants build up as the kidneys lose their ability to clear nitrogenous wastes from the bloodstream, causing urea and creatinine levels to rise. (Porth 2007, Kadhim *et al.* 2020).

Blood urea levels rise when renal function diminishes to roughly 25-50 percent, making it a sensitive predictor of renal illness (Sharma *et al.* 2011) However, (Moses and Johnkennedy 2013) discovered that as a result of renal injury, creatinine levels increased marginally, resulting in a decrease in GFR due to kidney inflammation. Creatinine was frequently utilized to assess renal failure and the progression of CKD. Stevens and colleagues (Stevens *et al.* 2009).

4.2 Lipid Profile

Table 4.2 shows non-significant ($P < 0.05$) changes in cholesterol levels in CKD individuals compared to healthy group, as the concentration in the serum of patients was (186.9±23.5) mg/dL, while its concentration in the healthy group was (166.8±17.6) mg/dL (Figure 4.4). Triglyceride levels shows significant ($P < 0.05$) elevated in CKD patients (171.9±12.37) compared to healthy group (82.27±7.14) (Figure 4.5).

Table 4.2 Lipid profile in both groups

PARAMETERS	MEAN ± SD		P-VALUE
	Control N (25)	Patients N (85)	
T hc	166.8 ± 17.6	186.9 ± 23.5*	0.566
TG	82.27 ± 7.14	7.87 ± 12.37*	0.0245

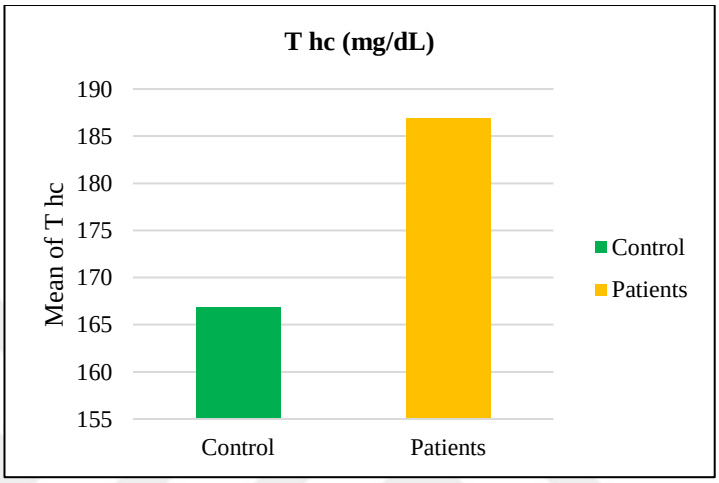

Figure 4.4 T hc levels in both groups

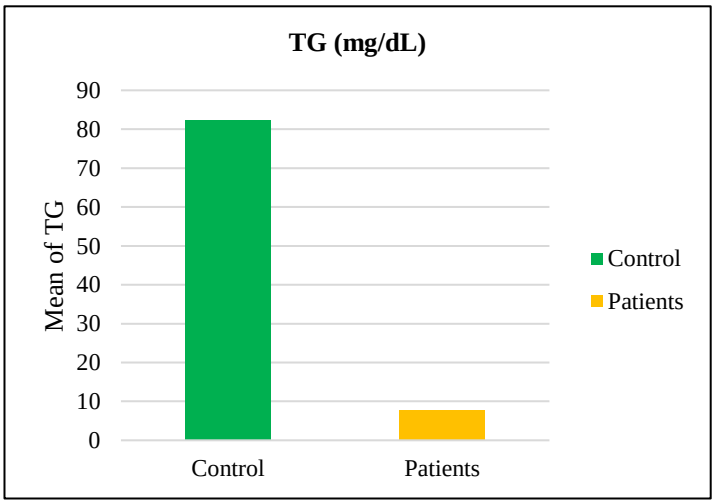

Figure 4.5 TG levels in both groups

The present study shows significant changes in lipid profile of ESRD patients when compared with that of healthy matched healthys. These findings were similar to those found in previous studies (e.g., Dyslipidemia is frequent among children with chronic

renal disease, according to research conducted by (Jeffrey *et al.* 2010, Ragab nd Ragab 2007). Patients with decreased renal function show considerable changes in lipoprotein metabolism, culminating in severe dyslipidemia, as is well recognized. Non-traditional risk factors in ESRD patients include inflammation, the oxidative stress, anemia, and vascular calcification (resulting in changes in calcium and phosphorus metabolism), and endothelial dysfunction, which have been proposed to play a central role in the development of severe dyslipidemia (Tsimihodimos *et al.* 2011).

These outcomesa are consistent with those of (Ali *et al.* 2010, Alaupovic and Attman 2000), and Ragab *et al.* in prior similar studies (Ragab and Ragab 2007). Low HDL-C level as well as their major apoprotien (A1and apoprotien A-2) are characterized of HDL, and these defects may lead to reduced cholesterol esterfication in HDL particles and a consequent inability to form mature HDL particles in end stage renal disease (Okubo *et al.* 2004).

other causes of reduction in HDL level may relate to reduce activity of LCAT, the hepatic lipase is define as an enzyme that lead to transforms free cholesterol compound to cholesteryl ester, which is then absorbed into the center of a lipoprotein particle, also known as hepatic triglyceride lipase (HTGL) enzyme. One of the principal functions of hepatic triglyceride lipase which converts intermediate-density lipoprotein (IDL) to LDL (Kwan *et al.* 2007).

4.3 Proteins

Table 4.3 shows a significant reduce in total protein levels in individuals compared to healthy group, as the concentration in the serum of patients was (5.992±0.339) mg/dL, while its concentration in the healthy group was (6.957±0.378) mg/dL (Figure 4.6). Albumin levels in serum of individuals was (2.54±0.09) mg/dL, while its concentration in the healthy group was (3.72±0.18) mg/dL (Figure 4.7). Concentration of CR-protein in the serum of patients was (8.48 ± 1.19) mg/dL, while its concentration in the healthy group was (0.78 ± 0.10) mg/dL (Figure 4.8)

Table 4.3 Total protein in studied groups

PARAMETERS	MEAN ± SD		P-VALUE
	Control N (25)	Patients N (85)	
Total protein (mg/dL)	6.95 ± 0.37	5.99 ± 0.33*	0.001
Albumin (mg/dL)	3.72 ± 0.18	2.54 ± 0.09*	0.001
CR-protein (mg/dL)	0.78 ± 0.10	8.48 ± 1.19*	0.023

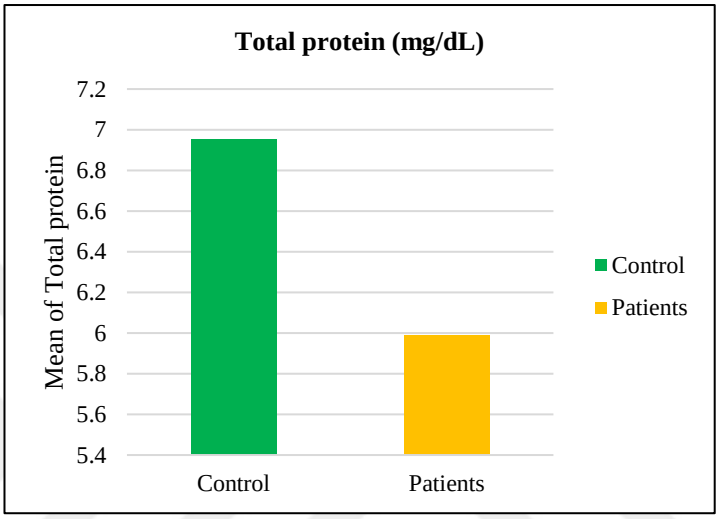

Figure 4.6 Total protein levels in both groups

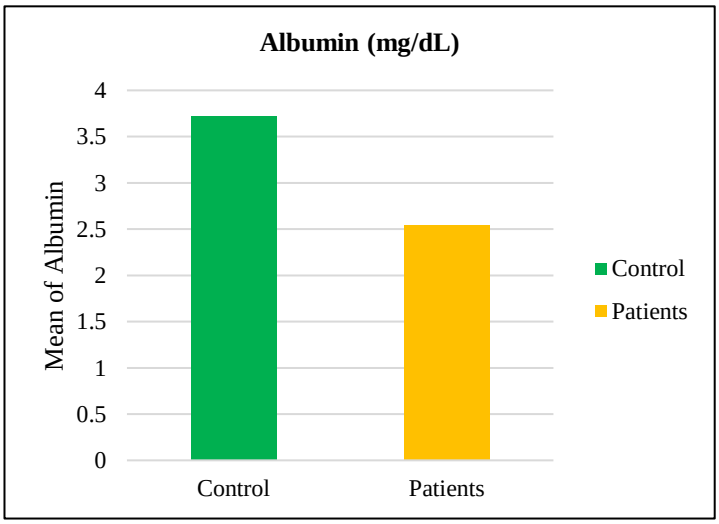

Figure 4.7 Albumin levels in both groups

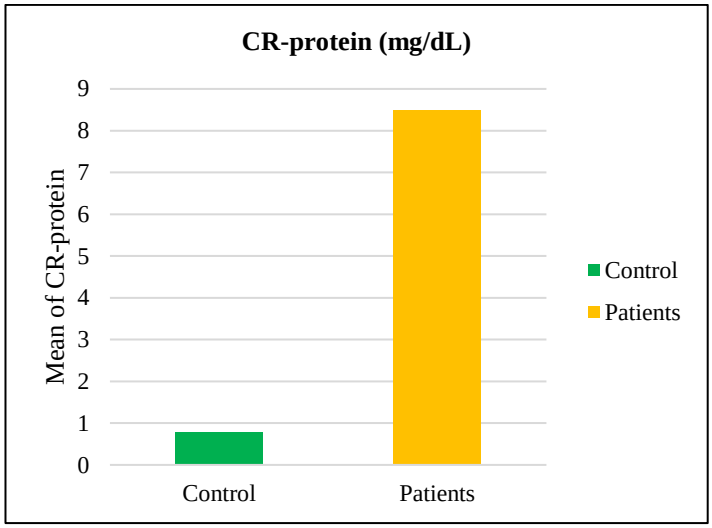

Figure 4.8 CR-protein levels in both groups

In the current study in serum was found markedly decrease in patients groups. Generally, it has been noted that variations in plasma protein levels can be caused by any of the following three changes: the averge of catabolism, the rate of anabolism, and the volume of distribution (Marshall *et al.* 2004).

Diabetics, on the other hand, experience a significant decline in total protein as a result of high glucose, that leads to the formation of developed glycosylated products, which causes hyperfiltration (a potential increase of 5% to 10% in GFR) and glomerular enlargement (Radbill *et al.* 2008). established that pathophysiologic components of diabetic nephropathy, which include glycosylation of circullating and intrarenal proteins, hypertension, and abnormal intrarenal hemodynamics, are not totally visible yet. The current study is agree with study carried out by Hasan and Abdulsattar 2015, A total of 109 patients with Diabetes disease, 72 with T1DM and 37 with type II (T2DM) 68 age and gender matched healthy individuals were the samples of the present study. Total protein measurements referred and revealed that individuals with both forms of illness had a highly significant reduce in the blood and a highly significant elevate in the saliva samples.

CRP is a well-known acute phase protein that is frequently employed as a diagnostic of inflammation in clinical settings. CRP is produced in the liver and is mostly caused by

interleukin-6. It's produced during an infection or other inflammatory episode's acute phase (Pepys and Hirschfield 2003). CRP promotes the production of adhesion molecules in human monocytes engaged in inflammation, according to an in vitro investigation (Gosset *et al.* 1999). CRP also aids in the scavenging of cell debris through the complement system's classical pathway (Volanakis 2001). Another possible reason for the higher CRP levels in this group of individuals could be chronic liver stimulation caused by high the levels of IL-6 in the serum, which has been estimated described in individuals with chronic renal failure (Herbelin *et al.* 1991, Nakahama *et al.* 1992).

4.4 Electrolytes

Table 4.4 shows significant (P <0.05) reduce in calcium levels in CKD individuals compared to healthy group, as the concentration in the serum of patients was (8.09±0.148) mg/dL, while its concentration in the healthy group was (12.61±0.89) mg/dL (Figure 4.9). Phosphorus levels shows significant (P <0.05) elevated in CKD individuals (5.62±0.273) compared to healthy group (3.38±0.194) (Figure 4.10). Sodium levels shows significant (P <0.05) reduce in CKD patients (139.2±2.08) compared to healthy group (150.9±1.59) (Figure 4.11). Potassium levels shows significant (P <0.05) elevated in CKD patients (6.68±0.17) compared to healthy group (5.13±0.15) (Figure 4.12). magniesum levels shows significant (P <0.05) reduced in CKD patients (1.38±0.144) compared to healthy group (2.29±0.115) (Figure 4.13).

Table 4.4 Some electrolyte in both groups

PARAMETERS	**MEAN ± SD**		**P-VALUE**
	Control N (25)	Patients N (85)	
S.Calcium (mg/dL)	12.61 ± 0.89	8.09 ± 0.14*	0.037
S.Phosphorus (mg/dL)	3.38 ± 0.19	5.62 ± 0.27*	0.021
S.Sodium (mg/dL)	150.9 ± 1.59	139.2 ± 2.08*	0.046
Potassium (mg/dL)	5.13 ± 0.15	6.68 ± 0.17*	0.02
Magnesium (mg/dL)	2.29 ± 0.11	1.38 ± 0.11*	0.024

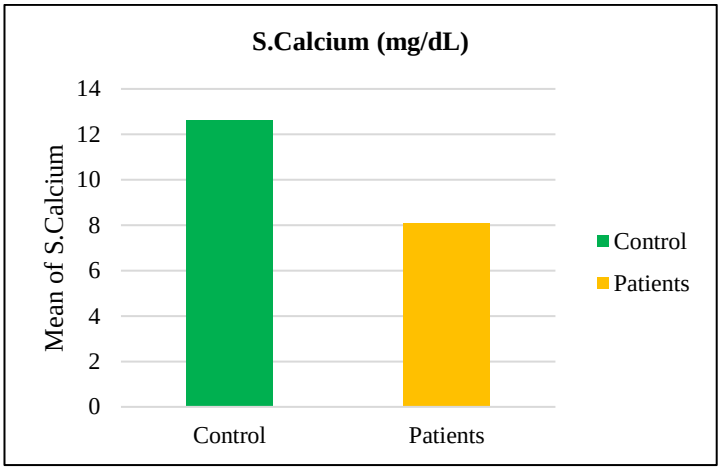

Figure 4.9 S.Calcium levels in both groups

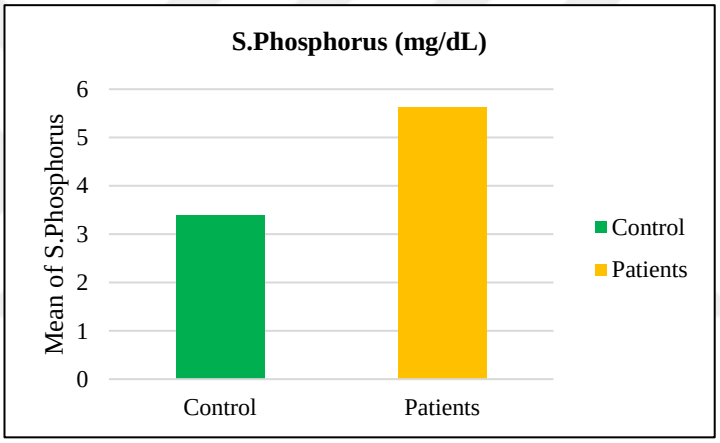

Figure 4.10 S.Phosphours levels in both groups

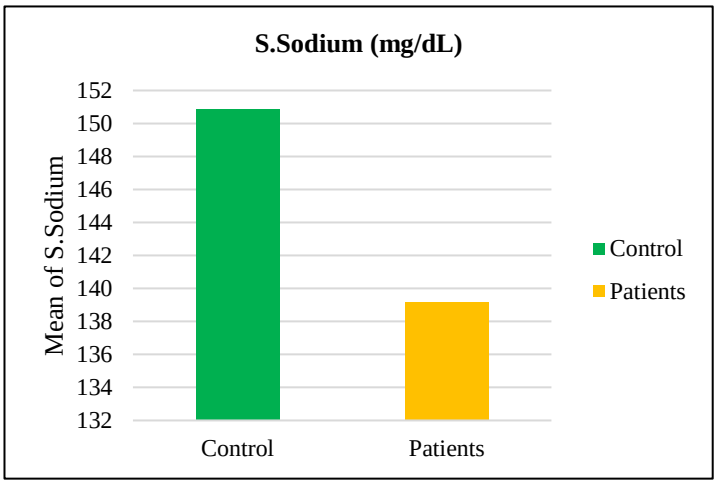

Figure 4.11 S.Sodium levels in both groups

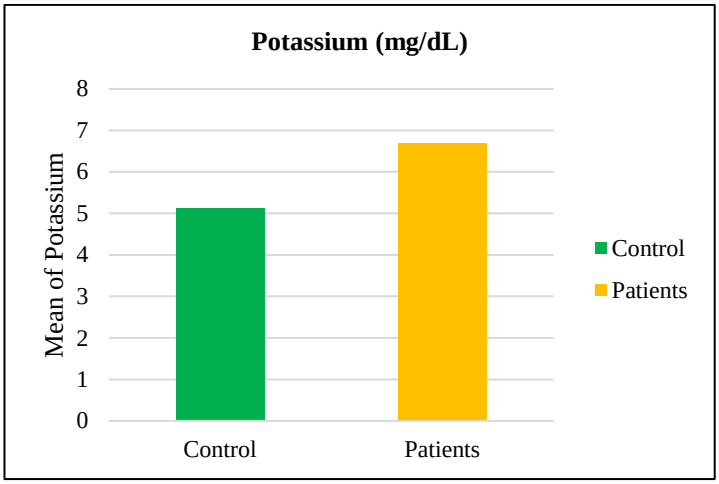

Figure 4.12 Potassium levels in both groups

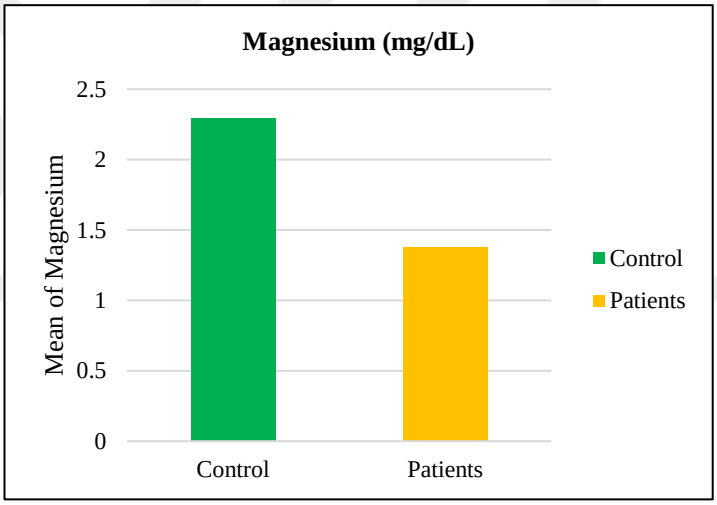

Figure 4.13 Magnesium levels in both groups

The result of current study indicates that the level of calcium was significant decreased patients group compared with healthy group, and men were affected more than female. This finding is in line with that of (Khalaf *et al.* 2019), who found that there is a reduce in the levels of calcium in an individuals with renal impairment, which they explain to an elevate in phosphorus levels. In individuals with chronic renal impairment, the decrease in calcium levels is due to a disturbance in vitamin D metabolism, as the kidneys are unable to form the vitamin D active form, which is required in the process of calcium absorption, so the disturbance in vitamin D function causes a decrease in calcium absorption from the intestine (Al-Rawi *et al.* 2014).

The current outcomes are in agree with those of (Al-Rawi *et al.* 2014), who found that the levels of calcium were lower in CKD group (7.730.81 mg/dL) compared to the healthy group (9.350.39 mg/dL). Reduced calcium levels can also be ascribed to a rise in phosphorous levels in the blood, which is inversely proportional to calcium (Spencer 1986), since both of them maintain the balance of their concentrations in the body, with an increase in one causing a drop in the other (Al-Rawi *et al.* 2014).

The current study's findings revealed considerable variances across the groups tested. Phosphate levels in patients were significantly higher ($P<0.05$) than in the healthy group. Phosphate loading or hyperphosphatemia has been found in numerous investigations to reduce the calcemic response to PTH (Somerville and Kaye 1982, Rodriguez *et al.* 1991). Phosphate is an independent marker of vascular illness in CKD (Mehta *et al.* 2015), and prior research have demonstrated the importance of reducing this marker (Perwad and Portale 2011).

PTH is the major sgnificant hormone which contributes to phosphate control in the kidney in this regard (Langman and Cannata-Andía 2010). In chronic renal illness, a greater level of serum phosphate adjusted for creatinine clearance has been linked to death (Eddington *et al.* 2010). Phosphate homeostasis is presved through hormonal control of its transit in the colon, bone, and renal (Oliveia *et al.* 2013). This mechanism explains why chronic renal disease patients have greater phosphate levels than healthy people.

Sodium is used to assess electrolyte balance and kidney function, as well as to control chronic or acute hypernatremia (high blood sodium) or hyponatremia (low blood sodium). Salt consumption may need to be restricted in patients with elevated blood pressure and chronic kidney disease (Armbruster *et al.* 2019).

According to this findings, the sodium levels in serum was lower in treated group than in control group. This finding is consistent with (Al-Rubae'i 2010), who found that the sodium levels in patients group (134.724.2 mmol/L) was lower than sodium levels in control group (142.532.5 mmol/L), and that this was due to sodium absorption absence

a second time after filtering as a result of tubule inflammation (Reynolds *et al.* 2006). This results show reduce in sodium exchange with hydrogen ions in the renal tubules, as well as a decrease in the activity of the N+-K+ ATPase enzyme (Pruden 1995).

As a result of this, potassium concentration in serum rise. The potassium builds up in the bloodstream in renal failure, resulting in a decrease in kidney activity. The kidneys were unable to clear the additional potassium that the body required, resulting in potassium levels that were too high. If you're looking for a unique (Yusuf *et al.* 2016).

The concentration of potassium in the serum samples of the treatment group was slightly higher at the level of chance ($P<0.05$) than that of the control group, according to the current findings. This finding is consistent with (Al-Rubae'i 2010), who showed that the potassium concentration in the patients group (5.9±1.19 mmol/L) was considerably greater than the potassium concentration in the control group (4.01±3.24 mmol/L). This is due to the kidneys' critical role in excreting nearly 90% of the potassium in the urine daily, and chronic renal dialysis illness has a weakness in controlling this mechanism, causing the process to become disordered (Rastergar and Soleimani 2001).

Chronic renal failure causes 95 percent of filtered sodium ions to be reabsorbed, according to a new study (Sterns *et al.* 2010). In some cases of chronic renal disease, the kidneys may be unable to remove excess potassium from the blood (NKDEP 2011). The mechanism of renal potassium ion excretion is compromised in individuals with CKD. It can rise in either case when renal function deteriorates. The increased potassium ion levels may have caused and lead to potassium ion excretion as a result (Hsieh *et al.* 2011).

4.5 Vitamin D

Table 4.5 shows a significant reduce in Vit. D levels in CKD individuals compared with the healthy group, as the concentration in the serum of individuals was (14.85±1.61)

mg/dL, while its concentration in the healthy group was (28.76±2.52) mg/dL (Figure 4.14).

Table 4.5 Vitamin D in studied groups

PARAMETERS	MEAN ± SD		P-VALUE
	Control N (25)	Patients N (85)	
Vitamin D	28.76 ± 2.52	14.85 ± 1.61*	0.043

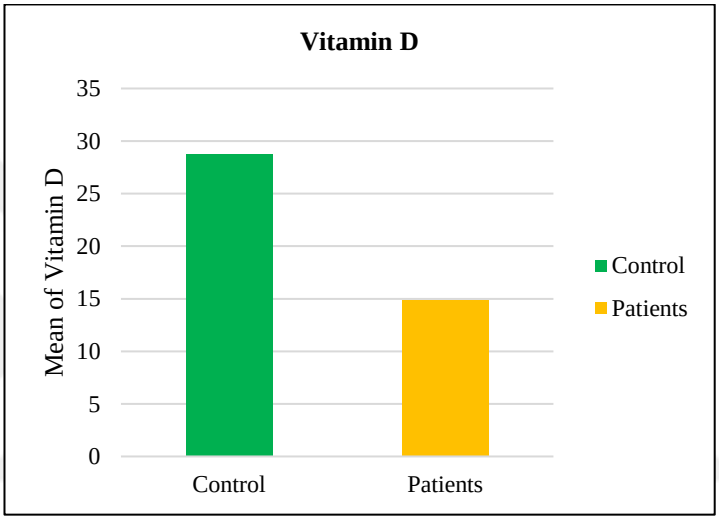

Figure 4.14 Vitamin D levels in both groups

Vitamin D metabolism in the bloodstream is dependent on the kidney. Kidney disease (CKD) is a condition in which kidney function deteriorates over time. Vitamin D metabolism issues may lead to induce of mineral and skeletal disorder and diseases, as well as increases in parathyroid hormone, hypertension condition, inflammation, and ultimately, damage of kidney structures. For the general population, the KDIGO clinical practice guidelines propose treating 25(OH)D deficit and insufficiencies (Urea-Torres 2018).

The causes of this severe vitamin D insufficiency in CKD are complex. The kidney's capacity to convert 25(OH)D to circulating calcitriol (the vitamin D hormone) and to sustain serum)25OH)D levels for non-renal calcitriol production can be gradually lost as

a result of CKD. The calcitriol and 25(OH)D deficit that results is linked to faster disease progression and death. Another intriguing idea is that vitamin D deficiency could be caused by urine loss of 25(OH)D-VDBP (the primary plasma carrier of vitamin D in circulation) coupled with proteinuria and impaired medaling-mediated absorption. Reduced 25(OH)D levels could also be the result of impaired endogenous previtamin D generation in the skin as a result of severe renal dysfunction or simply a lack of outside sunshine exposure owing to morbidity. Although not all observational studies have found a link between 25(OH)D insufficiency and decreased renal function, the majority of them have (Sprague *et al.* 2003, Mizobuchi and Ogata 2014).

5. CONCLUSIONS AND RECOMMENDATION

5.1 Conclusions

1. The current work demonstrated significant elevate in parameters (urea, creatinine and uric acid) of kidney function.
2. The current work demonstrated significant elevate in lipid profile (total cholesterol and triglyceride).
3. The current work demonstrated significant reduce in total protein and albumin.
4. The current work demonstrated significant elevate in CR protein levels.
5. The current work demonstrated significant ($P<0.05$) differences in levels of some electrolytes (Ca, Na, K, Mg and P).
6. The current work showed significant reduce in vitamin D levels.

5.2 Recommendation

1. Investigating the levels of other types of trace elements in serum of CKD individuals.
2. Investigating the levels of adipokines in serum of CKD individuals.
3. Investigating the levels of some interleukins in serum of CKD individuals.
4. Investigating the levels of Cluster of Differentiation (CD Markers) in serum of diabetes patients.

REFERENCES

Abd ElHafeez, S., Bolignano, D., D'Arrigo, G., Dounousi, E., Tripepi, G. and Zoccali, C. 2018. Prevalence and burden of chronic kidney disease among the general population and high-risk groups in Africa: a systematic review. BMJ open., 8: e015069.

Aeddula, N. R., Cheungpasitporn, W., Thongprayoon, C. and Pathireddy, S. 2019. Epicardial adipose tissue and renal disease. Journal of clinical medicine., 8: 299.

Alaupovic, P. and Attman, P. O. 2000. Lipid abnormalities in chronic renal insufficiency. Kidney Int., 15: 1029-34.

Ali, E. T. M., Ahmed, A. M. and Abdelraheem, M. B. 2010. Dyslipidemia among Sudanese Children Undergoing Maintenance Dialysis. Arab Journal of Nephrology and Transplantation., 3: 17-22.

Al-Rawi, K. F., Abd AL-Dulaimi, Z. H., AL-Neda, M. T. and Fayadh, M. A. 2014. Studying the Activity of Renin Enzyme and Some Biochemical Variables of Patients With Chronic Renal Failure at Ramadi Educational Hospital. Diyala Journal For Pure Science., 10.

Al-Rubae'i, S. H. 2010. Free Fatty Acids and Biochemical Changes in Iraqi patients. Baghdad Science Journal., 7: 1.

Armbruster, C. E., Forsyth, V. S., Johnson, A. O., Smith, S. N., White, A. N., Brauer, A. L. and Mobley, H. L. 2019. Twin arginine translocation, ammonia incorporation, and polyamine biosynthesis are crucial for Proteus mirabilis fitness during bloodstream infection. PLoS pathogens., 15: e1007653.

Barutta, F., Bruno, G., Mastrocola, R., Bellini, S. and Gruden, G. 2018. The role of cannabinoid signaling in acute and chronic kidney diseases. Kidney international., 94: 252-258.

Chen, J., Muntner, P., Hamm, L. L., Jones, D. W., Batuman, V., Fonseca, V. and He, J. 2004. The metabolic syndrome and chronic kidney disease in US adults. Annals of internal medicine., 140: 167-174.

Chen, S. H., Tsai, Y. F., Sun, C. Y., Wu, I. W., Lee, C. C. and Wu, M. S. 2011. The impact of self-management support on the progression of chronic kidney

disease—a prospective randomized controlled trial. Nephrology Dialysis Transplantation., 26: 3560-3566.

Coresh, J., Astor, B. C., Greene, T., Eknoyan, G. and Levey, A. S. 2003. Prevalence of chronic kidney disease and decreased kidney function in the adult US population: Third National Health and Nutrition Examination Survey. American journal of kidney diseases., 41: 1-12.

Eckardt, K. U., Coresh, J., Devuyst, O., Johnson, R. J., Köttgen, A., Levey, A. S. and Levin, A. 2013. Evolving importance of kidney disease: from subspecialty to global health burden. The Lancet., 382: 158-169.

Eckardt, K. U. and Kasiske, B. L. 2009. Kidney disease: improving global outcomes. Nature Reviews Nephrology., 5: 650-657.

Eddington, H., Hoefield, R., Sinha, S., Chrysochou, C., Lane, B., Foley, R. N. and Kalra, P. A. 2010. Serum phosphate and mortality in patients with chronic kidney disease. Clinical Journal of the American Society of Nephrology., 5: 2251-2257.

Evans, P. D. and Taal, M. W. 2015. Epidemiology and causes of chronic kidney disease. Medicine., 43: 450-453.

Foley, R. N., Murray, A. M., Li, S., Herzog, C. A., McBean, A. M., Eggers, P. W. and Collins, A. J. 2005. Chronic kidney disease and the risk for cardiovascular disease, renal replacement, and death in the United States Medicare population, 1998 to 1999. Journal of the American Society of Nephrology., 16: 489-495.

Geddes, R. F., Finch, N. C., Syme, H. M. and Elliott, J. 2013. The role of phosphorus in the pathophysiology of chronic kidney disease. Journal of Veterinary Emergency and Critical Care., 23: 122-133.

Gosset, P., Wallaert, B., Tonnel, A. B. and Fourneau, C. 1999. Thiol regulation of the production of TNF-alpha, IL-6 and IL-8 by human alveolar macrophages. European Respiratory Journal., 14: 98-105.

Grauer, G. F. 2005. Early detection of renal damage and disease in dogs and cats. Veterinary Clinics: Small Animal Practice., 35: 581-596.

Herbelin, A., Ureña, P., Nguyen, A. T., Zingraff, J. and Descamps-Latscha, B. 1991. Elevated circulating levels of interleukin-6 in patients with chronic renal failure. Kidney international., 39: 954-960.

Hsieh, M. F., Wu, I. W., Lee, C. C., Wang, S. Y. and Wu, M. S. 2011. Higher serum potassium level associated with late stage chronic kidney disease. Chang Gung Med J., 34: 418-425.

Jeffrey, M., Saland, C. B., Pierce, M. M., Mitsnefes, J. and Flynn, T. 2010. Dyslipidemia in Children with Chronic Kidney Disease.Kidney Int., 78:1154-63.

Jha, V., Garcia-Garcia, G., Iseki, K., Li, Z., Naicker, S., Plattner, B. and Yang, C. W. 2013. Chronic kidney disease: global dimension and perspectives. The Lancet., 382: 260-272.

Kadhim, H. M., Al-Ghanimi, H. H. and Al-Dedah, R. M. 2020. Haematological parameters and biochemical indices in patients with chronic kidney disease before haemodialysis Al-Furat Al-Awsat Governorates/Iraq. In AIP Conference Proceedings. AIP Publishing LLC., 2290: 020004.

Kaur, G. and Sharma, A. 2017. Predict chronic kidney disease using data mining algorithms in hadoop. In 2017 International Conference on Inventive Computing and Informatics (ICICI). IEEE., 973-979.

Khalaf, W. S., Hussein, W. N. and Ahmed, A. H. 2019. Evaluation the Iron status and some electrolytes balance in patients with chronic renal failure. Tikrit Journal of Pure Science., 24: 47-51.

King, L. G., Giger, U., Diserens, D. and Nagode, L. A. 1992. Anemia of chronic renal failure in dogs. Journal of Veterinary Internal Medicine., 6: 264-270.

Kwan, B. C., Kronenberg, F., Beddhu, S. and Cheung, A. K. 2007. Lipoprotein metabolism and lipid management in chronic kidney disease. Journal of the American Society of Nephrology., 18: 1246-1261.

Langman, C. B. and Cannata-Andía, J. B. 2010. Calcium in chronic kidney disease: Myths and realities. Clinical Journal of the American Society of Nephrology., 5: S1-S2.

Levey, A. S. and Coresh, J. 2012. Chronic kidney disease. The lancet., 379: 165-180.

Levey, A. S., De Jong, P. E., Coresh, J., Nahas, M. E., Astor, B. C., Matsushita, K. and Eckardt, K. U. 2011. The definition, classification, and prognosis of chronic kidney disease: a KDIGO Controversies Conference report. Kidney international., 80: 17-28.

Levin, A., Tonelli, M., Bonventre, J., Coresh, J., Donner, J. A., Fogo, A. B. and Yang, C. W. 2017. Global kidney health 2017 and beyond: a roadmap for closing gaps in care, research, and policy. The Lancet., 390: 1888-1917.

Levin, A., Stevens, P. E., Bilous, R. W., Coresh, J., De Francisco, A. L., De Jong, P. E. and Winearls, C. G. 2013. Kidney Disease: Improving Global Outcomes (KDIGO) CKD Work Group. KDIGO 2012 clinical practice guideline for the evaluation and management of chronic kidney disease. Kidney international supplements., 3: 1-150.

Maisel, A. S. 2012. Cardiac biomarkers: expert advice for clinicians. Jaypee Brothers Publishers.

McDonald, S. P. 2015. Australia and New Zealand dialysis and transplant registry. Kidney international supplements., 5: 39-44.

Mehta, R., Ying, G. S., Houston, S., Isakova, T., Nessel, L., Ojo, A. and Townsend, R. R. 2015. Phosphate, fibroblast growth factor 23 and retinopathy in chronic kidney disease: the Chronic Renal Insufficiency Cohort Study. Nephrology Dialysis Transplantation., 30: 1534-1541.

Mizobuchi, M. and Ogata, H. 2014. Clinical uses of 22-oxacalcitriol. Current Vascular Pharmacology., 12: 324-328.

Mobley, A. M. 2009. Slowing the Progression of Chronic Kidney Disease. The Journal for Nurse Practitioners., 5: 188-194.

Ragab, M. and Ragab, A. 2007. Assessment of lipid profile in Egyptian children with chronic kidney diseases on conservative therapy and those under regular hemodialysis. J Med Sci., 7: 825-9.

Moses, O. and Johnkennedy, N. 2013. Alteration of serum glucose, urea and creatinine level of malaria patients in Obowo, Local Government Area of Imo state Nigeria. Int J Adv Med., 1: 1-6.

Nakahama, H., Tanaka, Y., Shirai, D., Miyazaki, M., Imai, N., Yokokawa, T. and Kubori, S. 1992. Plasma lnterleukin-6 Levels in Continuous Ambulatory Peritoneal Dialysis and Hemodialysis Patients. Nephron., 61: 132-134.

Nikolajenko, L. 2013. Managing chronic kidney disease. Kai Tiaki Nursing New Zealand., 19: 15-17.

Okubo, K., Ikewaki, K., Sakai, S., Tada, N., Kawaguchi, Y. and Mochizuki, S. 2004. Abnormal HDL apolipoprotein AI and A-II kinetics in hemodialysis patients: a stable isotope study. Journal of the American Society of Nephrology., 15: 1008-1015.

Pepys, M. B. and Hirschfield, G. M. 2003. C-reactive protein: a critical update. The Journal of clinical investigation., 111: 1805-1812.

Perini-Perera, S., Del-Ángel-Caraza, J., Pérez-Sánchez, A. P., Quijano-Hernández, I. A. and Recillas-Morales, S. 2021. Evaluation of Chronic Kidney Disease Progression in Dogs With Therapeutic Management of Risk Factors. Frontiers in Veterinary Science., 8: 260.

Perwad, F. and Portale, A. A. 2011. Vitamin D metabolism in the kidney: regulation by phosphorus and fibroblast growth factor 23. Molecular and cellular endocrinology., 347: 17-24.

Polzin, D. J. 2011. Chronic kidney disease in small animals. Veterinary Clinics: Small Animal Practice., 41: 15-30.

Rastergar, A. and Soleimani, M. 2001. Hypokalaemia and hyperkalaemia. Postgraduate medical journal., 77: 759-764.

Reynolds, B. S. and Lefebvre, H. P. 2013. Feline CKD: Pathophysiology and risk factors—what do we know?. Journal of feline medicine and surgery., 15: 3-14.

Reynolds, R. M., Padfield, P. L. and Seckl, J. R. 2006. Disorders of sodium balance. Bmj., 332: 702-705.

Rodriguez, M., Martin-Malo, A., Martinez, M. E., Torres, A., Felsenfeld, A. J. and Llach, F. 1991. Calcemic response to parathyroid hormone in renal failure: Role of phosphorus and its effect on calcitriol. Kidney international., 40: 1055-1062.

Sargent, H. J., Elliott, J. and Jepson, R. E. 2021. The new age of renal biomarkers: does SDMA solve all of our problems?. Journal of Small Animal Practice., 62: 71-81.

Schlondorff, D. O. 2008. Overview of factors contributing to the pathophysiology of progressive renal disease. Kidney international., 74: 860-866.

Sharma, A., Hirulkar, N. B., Wadel, P. and Das, P. 2011. Influence of hyperglycemia on renal function parameters in patients with diabetes mellitus. IJPBA., 2: 734-9.

Somerville, P. J. and Kaye, M. 1982. Action of phosphorus on calcium release in isolated perfused rat tails. Kidney international., 22: 348-354.

Spencer, K. 1986. Analytical reviews in clinical biochemistry: the estimation of creatinine. Annals of clinical biochemistry., 23: 1-25.

Sprague, S. M., Llach, F., Amdahl, M., Taccetta, C. and Batlle, D. 2003. Paricalcitol versus calcitriol in the treatment of secondary hyperparathyroidism. Kidney international., 63: 1483-1490.

Stanifer, J. W., Jing, B., Tolan, S., Helmke, N., Mukerjee, R., Naicker, S. and Patel, U. 2014. The epidemiology of chronic kidney disease in sub-Saharan Africa: a systematic review and meta-analysis. The Lancet Global Health., 2: e174-e181.

Stel, V. S., Kramer, A., Zoccali, C. and Jager, K. J. 2009. The 2007 ERA-EDTA registry annual report—a precis. NDT plus., 2: 514-521.

Sterns, R. H., Rojas, M., Bernstein, P. and Chennupati, S. 2010. Ion-exchange resins for the treatment of hyperkalemia: are they safe and effective?. Journal of the American Society of Nephrology., 21: 733-735.

Stevens, L. A., Schmid, C. H., Greene, T., Li, L., Beck, G. J., Joffe, M. M. and Levey, A. S. 2009. Factors other than glomerular filtration rate affect serum cystatin C levels. Kidney international., 75: 652-660.

Stevens, L. A., Coresh, J., Greene, T. and Levey, A. S. 2006. Assessing kidney function—measured and estimated glomerular filtration rate. New England Journal of Medicine., 354: 2473-2483.

Thomas, N. and Bryar, R. 2013. An evaluation of a self-management package for people with diabetes at risk of chronic kidney disease. Primary Health Care Research and Development., 14: 270-280.

Thomas, R.., Abbas, K. and John, R. S. 2008. Chronic Kidney Disease and Its Complications. Prim Care Clin Office Pract., 35: 329–344.

Pruden, E. L. 1995. Clinical guide to laboratory tests. N. W. Tietz, and P. R. Finley (Eds.). Philadelphia: WB Saunders company., 624.

Tsimihodimos, V., Mitrogianni, Z. and Elisaf, M. 2011. Dyslipidemia associated with chronic kidney disease. The open cardiovascular medicine journal., 5: 41.

Volanakis, J. E. 2001. Human C-reactive protein: expression, structure, and function. Molecular immunology., 38: 189-197.

Weaver, V. M., Fadrowski, J. J. and Jaar, B. G. 2015. Global dimensions of chronic kidney disease of unknown etiology (CKDu): a modern era environmental and/or occupational nephropathy?. BMC nephrology., 16: 1-8.

Yamaguchi, J., Tanaka, T. and Nangaku, M. 2015. Recent advances in understanding of chronic kidney disease. F1000Research., 4.

Yusuf, A. A., Hu, Y., Singh, B., Menoyo, J. A. and Wetmore, J. B. 2016. Serum potassium levels and mortality in hemodialysis patients: a retrospective cohort study. American journal of nephrology., 44: 179-186.

Zhang, L., Wang, F., Wang, L., Wang, W., Liu, B., Liu, J. and Wang, H. 2012. Prevalence of chronic kidney disease in China: a cross-sectional survey. The lancet., 379: 815-822.

Zhang, W. R. and Parikh, C. R. 2019. Biomarkers of acute and chronic kidney disease. Annual review of physiology., 81: 309-333.

Zilva, J. F., Pannal, P. R. and Mayne, P. D. 1988. Clinical Chemistry in diagnosis and treatment. Loyd-Luke Publication, London., 173-177.

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