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# Evaluation of Cholesterol, Triglyceride, Calcium and Glucose Levels in Sudanese Patients with Chronic Kidney Disease.

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**Abstract:**

**Background.** Chronic kidney disease is a slow and progressive decline of kidney function. It is usually a result of a complication from another serious medical condition and it is now one of the major health problems all over the world. The Aim of this study was designed to investigate the association of the serum cholesterol, triglyceride, calcium and glucose in patients with chronic kidney disease.

**Methods.** This study was conducted at Ahmed Gasim Hospital and Sudanese kidney Transplanted Association Hospital during the period from February to April 2015. In this study 150 blood samples were collected and analyzed colorimetrically, 100 samples (69 males and 31 females) from patients with chronic kidney disease and 50 samples from healthy individuals as control were taken.

**Results.** The mean serum levels of cholesterol in patients versus control were (184.76 versus 168.68) mg/dl, triglyceride level was (149.18 versus 96.8) mg/dl, calcium level was (7.958 versus 8.770) mg/dl and Glucose level was (124.42 versus 91.48) mg/dl in both male and female with chronic kidney disease; with p-value levels of (0.13, 0.00, 0.00 and 0.00) respectively.

**Conclusion.** the study concluded that the patient with chronic kidney disease has insignificant increase in cholesterol level, significant increase in triglyceride and glucose levels and significant decrease in calcium level, in both male and female, compared to the normal individuals.

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**Introduction:**

Chronic renal failure is a slow and progressive decline of kidney function; usually a result of a complication from another serious medical condition and it is now one of the major health problems all over the world (Elkes*et al., 2003*).

The mortality rates in patients with chronic renal failure are high, both before and after the start of renal replacement therapy. So the early screening is vital to prevent the development of end-stage of renal failure. This study was designed to evaluate the proportion of Sudanese adults suffering from chronic kidney disease (CKD) as well as to have a preliminary idea about the determinants of this disorder, and to evaluate the effects of chronic renal failure on calcium homeostasis, cholesterol, Triglyceride, (TG), and glucose. Previously, it has been reported that, (23.5%) of 1,052 patients with chronic renal failure show high mean total cholesterol (Elkes *et al., 2003*). Cholesterol is the common risk factor for developing cardiovascular disease. Chronic renal failure is also associated with deficiency of 1, 25-dihydroxyvitamin D, because the final hydroxylations step of 25-hydroxyvitamin D to1,25-dihydroxyvitaminD mediated by the kidney 1-alpha-hydroxylase. Deficiency of 1,25-dihydroxyvitaminD causes decreases of plasma calcium level and enhances the production of parathyroid hormone ( Levin *et al*., 2006). Because calcium is an essential nutrient that plays a vital role in neuromuscular function, many enzyme-mediated processes, blood clotting and provides skeletal rigidity. So deficiency of calcium has been known for many years to jeopardize the skeleton in the long term. CKD characterized by an accumulation of partly metabolized triglyceride-rich particles (Carl *et al*., 2008). The consequences of hyperphosphatemia include the development and progression of secondary hyperparathyroidism and a predisposition to metastatic calcification when the product of serum calcium and phosphorus are elevated. Both of these conditions may contribute to the substantial morbidity and mortality seen in patients with end-stage renal disease (ESRD) (Block *et al*., 1998). A prominent risk factor known to increase the incidence of atherosclerotic vascular disease are the various disorders of lipoprotein metabolism, including high serum lipoprotein (A), possibly homocysteine, and disorder of homeostatic system. The main metabolic abnormality of the lipoproteins profile is delayed catabolism of TG rich

apolipoprotein (B) containing lipoproteins caused by decreased activity of lipolytic enzymes, hypertriglyceridemia, and a decrease in high density lipoprotein cholesterol (HDL-C apoA -1), apoA – (1,2) (Josef *et al*.,1999). Plasma total cholesterol is frequently low to normal and only occasionally elevated in Chronic Renal Failure, (CRF), patients. In addition, HMG CoA reductase, the rate-limiting step in cholesterol biosynthesis, and cholesterol 7a-hydroxylase, the rate-limiting step in cholesterol catabolism, are unaffected by CRF. Moreover, LDL receptor and scavenger receptor BI, the primary pathways of hepatic cholesterol uptake, are normal in CRF. However, HDL maturation is impaired. The plasma HDL cholesterol to-total cholesterol ratio is markedly reduced, and pre-βHDL, which is a lipid-poor HDL species, is elevated in CRF (Vaziri *et al*., 2001).

About 11.5% of the surveyed people told that they were diabetic, although after measuring the RBS, it was found that 8.5% of the people were hyperglycemic (Kaniz Fatema *et al.,* 2013). Studies in humans have demonstrated that both insulin resistance and impaired insulin secretion contribute to the pathogenesis of the carbohydrate intolerance (De Fronzo *et al*., 1978).

**Materials and Methods:**

The study comprised a total of 150 individuals of which100 individuals with evidence of CKD were included on the basis of clinical signs and symptoms of kidney disease and who were (cases) under hemodialysis treatment. Other 50 healthy individuals were used as a control group, whose age and sex matched healthy.

Subjects who were suffering from hypertension, diabetes mellitus, cardiovascular disease and kidney–transplanted patients were excluded from the study. Informed consent was taken from the patients and subjects who participated in the present study, and after agreement of general managers of hospital and private centers. Ethical committee approval has also been obtained from Omdurman Islamic university.

In both groups serum cholesterol, serum triglyceride, serum calcium, and plasma glucose concentrations were estimated. The serum cholesterol was estimated by cholesterol oxidase, serum triglyceride was analyzed using glycerol kinase method, serum calcium was estimated by orthocresolphthalin complexon, and plasma glucose assessment was carried out by glucose oxidase-peroxidase method.

Statistical data: All the data are expressed in Mean and Standard deviation.

For the statistical significance, T test was performed using SPSS software.

**Results:**

The study revealed that among the100 individuals with chronic kidney disease, who participated, (69% men and 31% women), the mean serum levels of cholesterol were 184.76 ± 81.978 mg/dl, triglyceride level was 149.18 ± 71.570 mg/dl, calcium was 7.958 ± 1.2006 mg/dl and glucose was 124.42 ± 32.409 in both male and female.

According to the chronic kidney disease group, the mean level of triglyceride and glucose showed significant increase in the results and calcium level showed significant decrease, yet cholesterol levels showed insignificant increase in result compared with normal individuals as shown in table (3-1).

Table (3-1) Shows mean of parameters level in study group classified as chronic kidney disease patients and normal individuals.

| Variables | Case | Control | P. value |
|---|---|---|---|
| Cholesterol(mg/dl) | 184.76 ± 81.978 | 168.68 ±47.050 | 0.13 |
| Triglyceride(mg/dl) | 149.18 ± 71.570 | 96.8 ± 42.132 | 0.00 |
| Calcium (mg/dl) | 7.958 ± 1.2006 | 8.770 ±.5027 | 0.00 |
| Glucose (mg/dl) | 124.42 ± 32.409 | 91.48 ± 17.404 | 0.00 |

According to gender the result showed insignificant values in both male and female with cholesterol, triglyceride, calcium and glucose levels as shown in table (3-2).

Table (3-2): shows the effect of gender (male and female) on levels of cholesterol, triglyceride, calcium and glucose.

| Variables | Male | Female | P. value |
|---|---|---|---|
| Cholesterol (mg/dl) | 181.06±70.824 | 193.00±103.471 | 0.503 |
| Triglyceride(mg/dl) | 149.86±.79.231 | 147.68±51.681 | 0.889 |
| Calcium (mg/dl) | 8.043±1.2833 | 7.768±.9847 | 0.290 |
| Glucose (mg/dl) | 120.90± 30.904 | 132.26±34.777 | 0.105 |

According to age of patients the result show slightly insignificant low cholesterol level and slightly insignificant high levels of triglyceride, calcium and glucose in patients more than 40 years compared with less than 40 years old patients as show in table (3-3).

Table (3-3): show the effect of age of patients on cholesterol, triglyceride, calcium and glucose levels.

| Variables | Less than 40years | More than 40 years | p. value |
|---|---|---|---|
| Cholesterol (mg/dl) | 191.94 ± 95.718 | 176.66 ± 63.088 | 0.355 |
| Triglyceride (mg/dl) | 146.04 ± 82.105 | 150.60 ± 56.794 | 0.751 |
| Calcium (mg/dl) | 7.908 ±1.2536 | 8.015 ± 1.1487 | 0.658 |
| Glucose (mg/dl) | 121.04 ± 33.074 | 127.70 ± 32.248 | 0.311 |

The prevalence of calcium in chronic kidney disease show insignificant increase in patients who intake calcium supplement compare with non calcium supplement intake patients as shown in table (3-4).

Table (3-4): shows levels of calcium in patients who take in calcium supplement against non-calcium supplement intake patients.

| Variable | $Ca^{++}$ supplement | Non $Ca^{++}$supplement | p. value |
|---|---|---|---|
| Calcium(mg/dl) | 8.019± 1.21 | 7.71± 0.97 | 0.438 |

The correlations between the duration of disease and cholesterol, triglyceride, calcium and glucose levels

showed insignificant negative correlation as shown in table (3-5).

Table (3-5): show the correlations between duration of disease and cholesterol, triglyceride, calcium and glucose levels.

| Variables | Correlation | p.value |
|---|---|---|
| Cholesterol | -0.055 | 0.110 |
| Triglyceride | -0.029 | 0.369 |
| Calcium | -0.091 | 0.773 |
| Glucose | -0.161 | 0.589 |

**Discussion:-**

End-stage renal disease (ESRD) patients under hemodialysis (HD) have a high mortality rate. Inflammation, dyslipidemia, disturbances in erythropoiesis, iron metabolism, endothelial function, and nutritional status was reported in these patients (Maria *et al*., 2013).

In this study, 100 patients with chronic kidney disease under haemodialysis therapy were studied to evaluate serum cholesterol, triglyceride, calcium and glucose in order to identify parameters that could be associated with mortality and, therefore to provide a biomarker of risk. The results showed that the patients with chronic renal failure had insignificant increase in serum cholesterol and significant increase of triglyceride compared with controls with p-value (0.13), (0.00) respectively. This study agreed with (Elkes*et al., 2003*) and (Raju*et al*., 2013) who mentioned that there was no significant change in serum cholesterol level in CKD patients. The mechanism was attributed to hypercholesterolemia due to the heavy proteinuria in CKD which involved altered gene expression of HMG-COA reductase, 7 alpha hydroxylase and hepatic LDL receptor (Raju*et al*., 2013). Also (Trevisan*et al*., 2010) mentioned that proteinuria with the resultant hypoalbuminemia lead to an up regulation of 3-hydroxy-3-methylglutaryl CoA reductase with a consequent hypercholesterolemia.

Hypertriglycerdemia due to impaired activity lipoprotein lipase (LPL) and direct inhibitory effect of various

uremic ‘toxins’ on the enzymes were involved in lipid metabolism (Rao*et al*., 2010).

Also the results showed highly significant low level of calcium in patients compared to normal control with p.value (0.00) as shown in table (3-1) which agreed with (Alevin *et al*., 2006). Reduction in calcium absorption caused by decreased $1,25(OH)_2D$ secretion led to a fall in serum calcium and a rise in PTH (Peacock *et al*., 2010) or due to hyperphosphatemia included the development and progression of secondary hyperparathyroidism and a predisposition to metastatic calcification when the product of serum calcium and phosphorus that are elevated. Both of these conditions might contribute to the substantial morbidity and mortality seen in patients with ESRD (Block *et al*., 1998).

Glucose result showed highly significant increased level with p. value (0.00) compared with normal control as shown in table (3-1) which agreed with (Fatema*et al.,* 2013) hat this result might be due to impaired carbohydrate metabolism (Westervelt and Schreiner, 1962). This might be due to insulin resistant and impaired insulin secretion (DeFronzo*et al*., 1981) who also had suggested that urea might have played an important role in glucose tolerance by interfering directly with carbohydrate metabolism. It is known that high concentrations of urea can affect enzyme systems in vitro (Neurath*et al*., 1956), and Perkoff and co-workers were able to show a decrease in the glucose tolerance of normal patients given a urea load (Constantine *et al*., 1966).

The results showed insignificant increase in calcium in patients who take in calcium supplement compared with non-calcium supplement patients with p.value (0.438) as shown in table (3-4). This insignificant result might refer to the less number of patients who could not take in calcium supplement and the inaccuracies due to the inabilities of patients to confirm if were taking in calcium supplement or not.

In this study depending on age the results showed insignificant increase of serum cholesterol and insignificant decrease in triglyceride, calcium and glucose in patients less than 40 years of p.values (0.355, 0.751, 0.658, and 0.311) respectively, compared with over 40 years as in table (3-3). So the age had no significant effects on this parameter, what agreed with (Elkes*et al., 2003*), (Levin *et al*., 2006), and (Fatema *et al.,* 2013). Also according to gender males, had insignificant increase levels of cholesterol and glucose of p.values (0.503, 0.105) respectively and an

insignificant decrease level of triglyceride and calcium of p.values (0.889, 0.290) compared to females and that agreed with those suggested by the same former study.

Finally this result showed negative insignificant correlations between durations of the disease and cholesterol, triglyceride, calcium and glucose levels with p.values of (0.110, 0.369, 0.773, 0.589) respectively. That entailed that when the duration of disease was increased the levels magnitude was insignificantly decreased.

**Conclusion:**

During the study dyslipidemia was observed in chronic kidney disease patients characterized by a statistically significant increase of serum triglyceride and insignificant increase in cholesterol level. Significant increase in glucose levels and significant decrease in calcium level, both in male and female, compared with normal individuals were also evident.

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