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Original Research Article

EVALUATION OF SERUM ALKALINE PHOSPHATASE LEVEL IN NON-DIABETIC CHRONIC KIDNEY DISEASE PATIENTS IN INDIAN POPULATION

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ABSTRACT

Background: Chronic kidney disease (CKD) is a worldwide health problem, affecting millions of people. Causes of chronic kidney disease include diabetes, high blood pressure, glomerulonephritis, polycystic kidney disease, lupus, and other forms of cardiovascular diseases. Serum Alkaline Phosphatase (ALP) is mainly a marker of hepatobiliary disease and bone turnover but its level is also high in chronic renal disorder. Our study was aimed to assess and compare the status of serum Alkaline Phosphatase level in non-diabetic chronic kidney disease subjects and healthy controls. **Materials and Methods:** The present study is a case-control study, conducted on 100 non-diabetic CKD patients. Cases were selected from the Urology and Medical ward of Jawahar Lal Nehru Medical College and Associated Group of Hospitals, Ajmer. Age and sex-matched healthy controls (n = 50) were selected from MOPD. The present study is approved by Institutional Ethical Committee. All samples were collected under aspect conditions from the antecubital vein. **Results:** The mean activity of Serum ALP was significantly higher in non-diabetic CKD subjects as compared to healthy controls ($p < 0.0001$). The observations of this study also revealed that 84 out of 100 nondiabetic CKD patients have higher serum Alkaline Phosphatase levels more than (>100 U/L). **Conclusion:** Serum ALP can be used as a biomarker for the early detection of CKD in the general population to prevent the morbidity and mortality which are associated with CKD. If CKD is detected early and managed appropriately the deterioration in kidney functions can be slowed and the risk of cardiovascular diseases in renal patients can be reduced.

Keywords: Chronic kidney disease (CKD), Alkaline Phosphatase (ALP), End-stage renal disease (ESRD), Glomerular filtration rate (GFR), chronic renal failure (CRF)

INTRODUCTION

Chronic kidney disease (CKD) is affected millions of people and a worldwide health problem, affecting millions of people. **(1)** CKD represents a progressive, irreversible decline in glomerular filtration rate (GFR). **(2)**

CKD is a type of kidney disease in which there is a gradual loss of kidney function over a period of months or years. Causes of chronic kidney disease include diabetes, high blood pressure, glomerulonephritis, and polycystic kidney disease. Loss of renal function is common in renal failure, irrespective of the underlying cause of the kidney disease. Serum Alkaline Phosphatase is mainly a marker of hepatobiliary disease and bone turnover but its level is also high in chronic renal disorder. **(3,4,5,6)** Alkaline Phosphatase is mainly secreted by the liver and the bone **(7)** although a little amount is secreted by the intestine, kidneys, and leukocytes. It is also an indicator of bone turnover, particularly in patients with CKD. **(7, 8)** High level of serum Alkaline Phosphatase levels predicts mortality

independent of bone metabolism and liver function tests in CKD **(9)**, Chronic Hemodialysis patients **(10, 11, 12)** and contributes to the development and progression of vascular calcification **(13, 14)** like coronary artery calcifications. **(12, 15, 16)**

Serum Alkaline Phosphatase (ALP) levels returned to the normal range by treating the underlying lesions involving the kidney by nephrectomy, complete removal of stones, nephrostomy. **(17)** The serum Alkaline Phosphatase has prognostic importance in chronic renal disorder. Increasing levels signal a higher risk of ESRD mortality. **(18)**

BUN and serum creatinine are widely accepted and the most common parameters to assess renal functions. In India 8-10% of the adult population has some form of renal disorder. If CKD is detected early and managed appropriately the deterioration in kidney functions can be slowed and the risk of cardiovascular diseases in renal patients can be reduced. Our study was aimed to assess and compare the status of serum Alkaline Phosphatase in non-diabetic chronic kidney disease patients and healthy controls.

MATERIALS AND METHODOLOGY

The present study is a case-control study, conducted on 100 non-diabetic chronic kidney disease patients. Patients were diagnosed as chronic kidney disease on the basis of clinical history, physical examination & serum urea, and serum creatinine level. Cases were selected from the Urology and Medical ward of Jawahar Lal Nehru Medical College and Associated Group of Hospital, Ajmer. Age and sex-matched healthy controls (n=50) were selected from Medicine OPD of Jawahar Lal Nehru Medical College and Associated Group of Hospital, Ajmer. The results of patients were compared with healthy controls (n=50). The present study is approved by Institutional Ethical Committee.

Inclusion criteria for the study group: Established cases of chronic kidney disease were taken.

For the control group: Age and sex-matched healthy individuals were included.

Exclusion criteria: Patients having a history of diabetes. Patient admitted in ICU in state of shock & renal transplant patient. The cases of intra-abdominal pathologies arising from the stomach, bowel, and hepatobiliary tract, and the neoplastic disease were excluded.

Blood samples were collected after an overnight fast (12-14hrs) under aseptic conditions from all the study participants. All samples were centrifuged and analyzed for blood sugar, serum urea, and serum creatinine, and serum Alkaline Phosphatase. The blood sugar was measured by the Enzymatic GOD-POD endpoint method. Serum urea was measured by the enzymatic endpoint colorimetric method. Serum creatinine was measured by Jaffe's colorimetric kinetic method. Serum Alkaline Phosphatase was measured by colorimetric kinetic assay.

STATISTICAL ANALYSIS: All data were analyzed by SPSS-13 version. P< 0.01 was considered significant.

RESULTS

A total of 150 subjects were studied. The Table-1, Figure- 1 show Mean±SD of blood sugar (95.6 ±12.3V/S 83.8 ± 8.4) mg/dl, serum urea (189.9± 67.4 v/s 23.36±6.7) mg/dl, serum creatinine (6.4± 2.6 v/s 0.86±0.52) mg/dl in nondiabetic chronic kidney disease subjects compared to healthy controls were significantly (P<0.0001) raised.

The mean activity of serum Alkaline Phosphatase (49.23±21.5v/ s 169.12 ± 70.36) U/L in non-diabetic chronic kidney disease patients compared to healthy controls was significantly (P<0.0001) raised.

Results are shown in Tables 2 of the serum Alkaline Phosphatase level in non-diabetic chronic kidney disease subjects.

Table 1: Biochemical Parameters of Healthy Control Subjects v/s Non-Diabetic Chronic Kidney Disease Subjects

Biochemical Parameters	Healthy Control Subjects n =50 Mean ±SD	Non-Diabetic Chronic Kidney Disease Subjects n=100 Mean ±SD	P VALUE
Sugar (mg/dl)	**83.8 ± 8.4**	**95.6 ±12.3**	**<0.0001**
Urea (mg/dl)	**23.36 ± 6.7**	**189.9 ±67.74**	**<0.0001**
Creatinine (mg/dl)	**0.86 ± 0.52**	**6.4 ±2.6**	**<0.0001**
Serum Alkaline phosphatase (U/L)	**49.23**±21.5	**169.12**±70.36	**<0.0001**

Table -2: Serum Alkaline Phosphatase level in Non-Diabetic Chronic Kidney Disease Subjects

Serum Alkaline Phosphatase level	% Of Non-Diabetic Chronic Kidney Disease Subjects
<100	**16 %**
101-150	**27 %**
151-200	**28 %**
201-250	**17%**
251-300	**8%**
>300	**4 %**

Fig-1: Comparison of Biochemical Parameters of Healthy Control Subjects V/S Non-Diabetic Chronic Kidney Disease Subjects

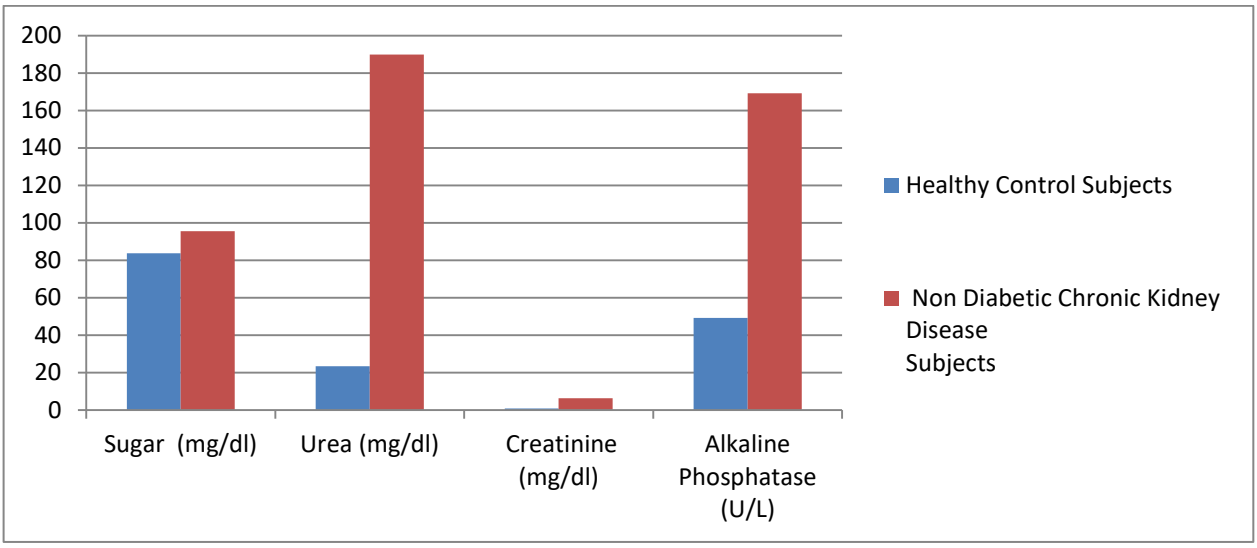
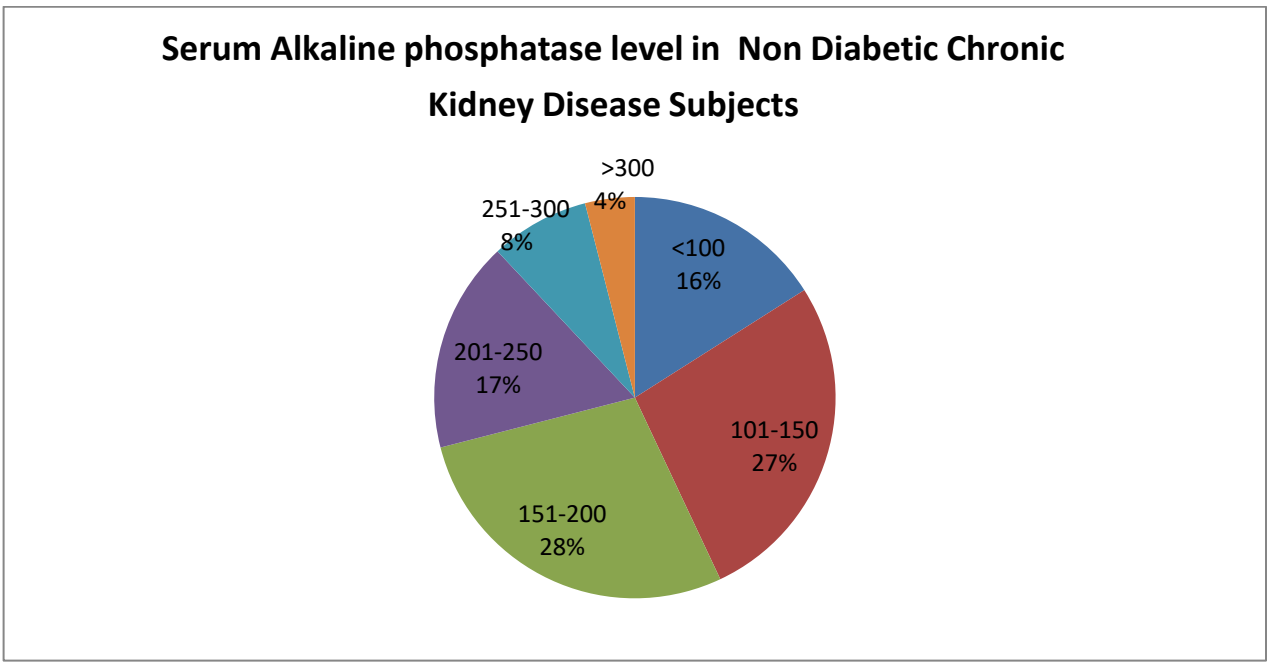


Fig-2: Serum Alkaline Phosphatase level in Non-Diabetic Chronic Kidney Disease Subjects



DISCUSSION:

Chronic kidney disease (CKD) is a worldwide health problem, affecting millions of people. **(1)** Causes of chronic kidney disease include diabetes, high blood pressure, glomerulonephritis, and polycystic kidney disease. **(4, 5)**

Other health conditions that may lead to CKD are obesity, high cholesterol, a family history of the disease, lupus, and other forms of cardiovascular diseases.

ALP is derived from various tissue origins such as liver, biliary ducts, bone, and placenta. Tissue with non-specific Alkaline Phosphatase inactivates pyrophosphate, an endogenous inhibitor of hydroxyapatite formation, resulting in medial arterial vascular calcification. **(19)**

In the present study, we observed that there was a significant increase in alkaline Phosphatase levels in non-diabetic chronic kidney disease patients as compared to the healthy subjects (controls).

Our findings are in agreement with Freethi et al. who also found that the mean activity of serum Alkaline phosphatase was significantly higher in chronic kidney disease patients compared to the Healthy subjects (controls) ($p<0.0001$). **(20)**

For conditions such as hypertension, aging, diabetes, and CKD, vascular cells undergo osteoblastic differentiation and express Alkaline Phosphatase. Subsequently, this leads to mineralization of the endothelium, arterial stiffening, and vascular calcification contributing to cardiovascular disease and mortality in CKD. **(21, 22)**

Secondary glomerular injury and nephrons loss is clinically characterized by proteinuria and hypertension, which leads to inflammation or scarring which causes kidney failure and ultimately a gradual elevation in the plasma creatinine concentration and a progressive decline in GFR **(23)** The excessive protein filtration, caused by glomerular hypertension, might per-se have toxic effects on the kidneys and increase the rate of progression. **(24)**

Renal arterial stiffness includes highly pulsatile blood pressure, flow to the low resistance renal vascular bed, defects in the filtration barrier leading to intraglomerular hypertension, hyperfiltration, and nephrosclerosis. Beddhu et al. noted higher urinary protein excretion levels in those with higher ALP levels thereby contributing to the progression of kidney disease. **(25)**

The increase in serum ALP activity may be derived from the injury to the brush border membrane of the renal tubular cells. Serum ALP may be a potential marker for the involvement of the pathological mechanism of kidneys and an indicator of treatment. **(17)**

Serum Alkaline Phosphatase can be used as a biomarker for the early detection of chronic kidney disease in the general population to prevent the morbidity and mortality which are associated with chronic kidney disease.

CONCLUSION

Serum total serum Alkaline Phosphatase was found to be elevated in non-diabetic chronic kidney disease patients.

Serum Alkaline Phosphatase can be used as a biomarker for the early detection of chronic kidney disease in the general population to prevent the morbidity and mortality which are associated with chronic kidney disease.

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