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Association Between Serum Calcium with Pancreatic Enzymes and Serum Albumin in Chronic Kidney Disease; A Case Control Study

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ABSTRACT

Background: CKD involves a gradual loss of kidney function over a period of three or more months with or without kidney damage. Diabetes and HTN are the leading causes of CKD.CKD patients may have malnutrition, anemia, pancreatic and mineral bone disorders that can affect the bones, heart and blood vessels of person with CKD. Estimation of SA, SL, calcium and albumin remains the main method of diagnosing these conditions.

Aims & Objectives: To find out the association between serum calcium with serum amylase, serum lipase and serum albumin in CKD and non-CKD patients.

Methodology: Case-Control Study, conducted in Department of Biochemistry, Index Medical College, Hospital & Research Centre Indore, Madhya Pradesh, during a period of 24 months. 100 patients of CKD as case and 100 age and sex matched persons included as control. Cases were selected as per inclusion and exclusion criteria. A pre-tested questionnaire based on semi-structured proforma was used to collect the data including basic profile of participants. chi-square Test, Pearson's coefficient was used to find the association between Pancreatic enzymes, Sr. Calcium and Sr. Albumin in patients of CK.

Result: Out of 100 cases and 100 controls ,55.5% were males and 44.5% were female. a positive correlation between SA and serum calcium in Case while negative correlation found between SA and serum calcium in Controls was found, although not significant. ($p>0.05$). A significant positive correlation between Sr. calcium and serum albumin in Case and Control was found. A significant but negative correlation between Sr. calcium and SL in Case while a significant positive correlation between Sr. calcium and SL in Control was found.

Conclusion: estimation of Serum calcium, serum amylase, lipase and albumin is important for treatment and progression of CKD.

Keyword: Association, pancreatic enzymes, albumin, serum calcium

INTRODUCTION

NKF define CKD as either kidney damage for more than three months or a glomerular filtration rate (GFR) of less than 60 ml per minute per 1.73 m^2 for three or more months with or without kidney damage [(1)]In addition to the reduction in eGFR, albuminuria is also considered in the risk categorization of CKD patients since it has been related to increasing cardiovascular events[(2)] Indeed, the use of antihypertensive medicaments can control

albuminuria and can slow CKD progression [3]. CKD involves a gradual loss of kidney function over a period of three or more months with or without kidney damage. Diabetes and HTN are the leading causes of CKD, as high blood sugar levels and high blood pressure can damage the blood vessels in your kidney. 1 in 3 peoples with diabetes has CKD and almost 1 in 5 adults with high blood pressure have CKD. High blood pressure is the second leading cause of CKD. [4]

The occurrence of acute pancreatitis among patients with end stage renal disease (ESRD) has been known for a long time, and it has been shown in studies that prevalence of acute pancreatitis is higher in patients who are on dialysis. [5] Patients on hemodialysis have increased levels of amylase and lipase due to the use of heparin which increases lipolysis. Abnormal exocrine pancreatic function has been found in 10-64% of patients with ESRD. Restricted intake of proteins in diet i.e. 0.6 g/kg of body weight /day for patients with non- proteinuric CKD as well as the loss via urine can contribute to malnutrition and diarrhea in the population. [6]

The impaired kidney function in CKD patients results in limited capacity to produce 1,25(OH)2D3 out of 25(OH)D3, due to the smaller amount of 1alpha hydroxylase. Decling of 25(OH)D3 and especially 1,25(OH)2D3 is an early feature of CKD, hypocalcaemia in CKD is generally considered to be a consequence of that. [7] The recently updated KDIGO guidelines on CKD-MBD management emphasize the need for optimal monitoring of serum calcium in CKD stages 3-5, based on the presence and magnitude of abnormalities. [8,9] CKD patients may have malnutrition, anemia, pancreatic and mineral bone disorders that can affect the bones, heart and blood vessels of person with CKD. Estimation of SA, SL, calcium and albumin remains the main method of diagnosing these conditions. Measurement of these parameters not only help in diagnosis but also help in assessing the treatment, monitoring the disease process and assessing the severity of the disease.

Aim & Objectives:

1. To investigate the levels of serum calcium, serum amylase, serum lipase and serum albumin in CKD and non-CKD patients.
2. To find out the association between serum calcium with serum amylase, serum lipase and serum albumin in CKD and non-CKD patients.

MATERIALS AND METHOD

This was a case-control study, conducted in the Department of Biochemistry, Index Medical College, Hospital & Research Centre Indore, Madhya Pradesh, during a period of 24 months from NOV 2023– NOV 2025. The study population included 200 subjects attending both outpatient and inpatient department of Index Medical College, Hospital &Research Centre.100 patients of CKD as case and 100 normal healthy age and sex matched persons included as control. Cases were selected as per inclusion and exclusion criteria. Subject of age more than 18 yrs of both sexes, known cases of Hypertension (HTN) and Diabetes Mellitus (DM)Type 1 and diagnosed case of CKD and CKD-ESRD included as case. Similar characteristics were followed for control but not diagnosed with CKD. Ethical Clearance was taken as per the Institutional Medical Ethical Committee conducted at Index Medical College, Hospital & Research Centre Indore. A pre-tested questionnaire based on semi- structured proforma was used to collect the data including basic profile of participants. All the parameters of two groups were analyzed for mean and standard deviation. The results were expressed as Mean ± Standard deviation. Data was analyzed by statistical software SPSS Trial Version 25.0. Comparison among two groups was done by using t-Test, chi-square Test, Pearson's coefficient to find the association between Pancreatic enzymes (sr. Amylase and sr. Lipase), Sr. Calcium and Sr. Albumin in patients of CKD.A verbal or

written consent in their own native language will be obtained from the participants before the sample collection.5 ml of blood sample was collected from antecubital vein under aseptic conditions into a plain vial for estimation of serum amylase, lipase, calcium and albumin after explaining the procedure to the study subject. Blood sample was allowed to clot at room temperature for 15 minutes and serum was obtained by centrifugation at 3000 rmp (rotation per minute) for 15 minutes in the biochemistry laboratory and stored at -20degree Celsius until assayed. The supernatant serum will be used for the analysis of serum amylase, lipase, calcium and albumin.

METHODS USED FOR TESTING:
CNP-G3 Kinetic Method for s. amylase, Advanced Homogenous Micelle Technology. Enzymatic color test for s. lipase and Arsenazo III Method, End Point for s. calcium and BCG Dye Method, End Point for s. albumin.

RESULT

The present study included 100 CKD patients as case and 100 non-CKD as control.

TABLE 1; Age and sex wise distribution of study subjects (case and control)

SUBJECTS		MALE		FEMALE		TOTAL (200)	Chi square test, degree of freedom, p value
		N	%	N	%		
AGE (Years)	31-40	22	22%	28	28%	50	X2=6.4791, df=4, p=0.16661 (p>0.05)
	41-50	24	24%	20	20%	44	
	51-60	35	35%	27	27%	62	
	61-70	19	19%	11	11%	30	
	Above 71	11	11%	03	03%	14	

Table 1; shows that the age wise distribution in which total 200 subjects of study were divided into five groups, predominantly male population which comprises 55.5% male population and 44.5% female population. Out of total 44.5% females, maximum 28% were in the age group of 31-40 years and from 55.5% males, maximum 35% were in the age group of 51-60 years. The relationship of gender with age was not found significant. (p>0.05)

Table 2; Comparison between SA and sr. calcium in case and control

Lab. Variables	Sr. Calcium	N	Pearsons's "r" value	"P" value
SA	Case	100	0.131	0.193
	Control	100	-0.084	0.409

Table 2 shows a positive correlation between SA and serum calcium in Case (r = 0.131 and p = 0.193) while negative correlation found between SA and serum calcium in Controls (r = -0.084 and p = 0.409) although not significant. (p>0.05)

Graph 2: Scatter plot showing correlation between SA and Serum calcium in case and control

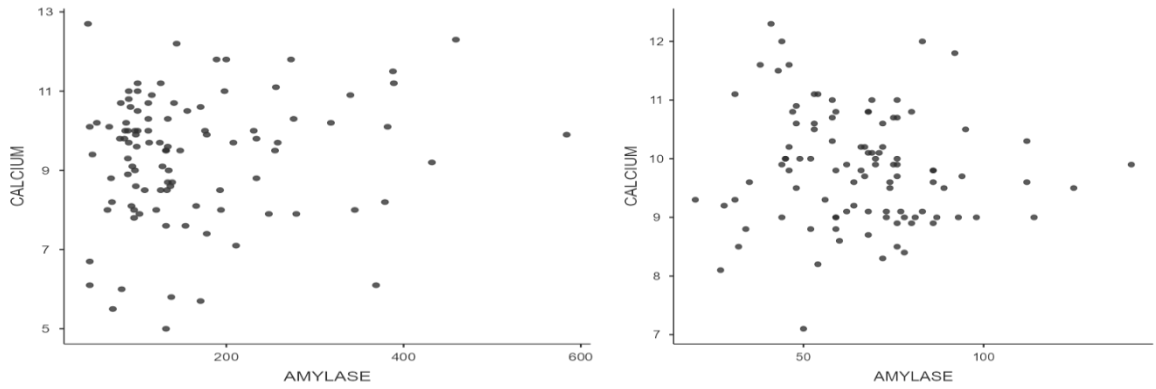


Table3; comparison between Sr. Calcium and Sr. Albumin in case and control

Lab. Variables	Sr. Albumin	N	Pearsons's "r" value	"P" value
Sr. Calcium	Case	100	0.617	<.001
	Control	100	0.186	0.065

Table3; evident a significant positive correlation between Sr. calcium and serum albumin in Case (r = 0.617 and p= <.001) while a evident a significant positive correlation between Sr. calcium and serum albumin in Control (r = 0.186 and p= 0.065)

Graph 3: Scatter Plot showing correlation of Sr. Calcium and Sr. Albumin in case

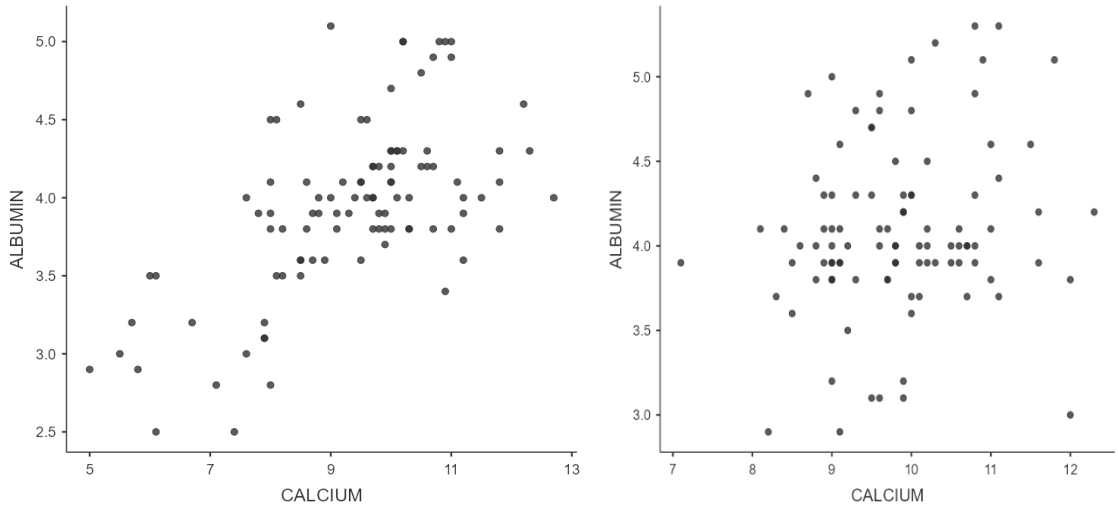
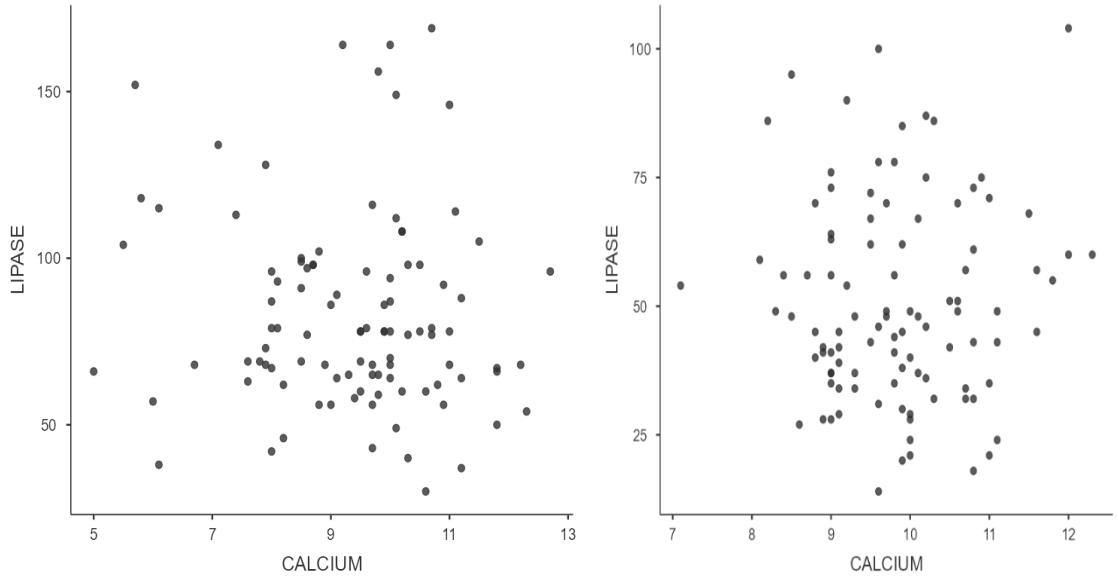


Table 4; comparison between Sr. Calcium and SL in case and control

Lab. Variables	SL	N	Pearsons's "r" value	"P" value
Sr. Calcium	Case	100	-0.094	0.350
	Control	100	0.022	0.828

Table 4; show a significant negative correlation between Sr. calcium and SL in Case (r = -0.094 and p=0.350) while evident a significant positive correlation between Sr. calcium and SL in Control (r = 0.022 and p=0.828)

Graph 4: Scatter Plot showing correlation of Sr. Calcium and SL in case and control



DISCUSSION

Renal insufficiency is one of the common causes of such nonspecific elevation. As the kidney functions declines, there is progressive deterioration in mineral homeostasis manifesting as disruption of serum and tissue concentration of phosphorus and calcium. Serum calcium concentration is maintained within a very narrow range. Approximately 45% of the body's calcium is bound to plasma protein, notably albumin. ([10] Patients with moderate chronic kidney disease (CKD) are frequently found to have reduced serum albumin levels. [11] Although the development of hypoalbuminemia in patients with CKD is often multifactorial, the proximate cause is an albumin synthesis rate that is outpaced by catabolic loss. [12] Increased levels of SA and SL are indicators of acute pancreatitis, but these two enzymes are elevated in many non-pancreatic conditions also.

Our study was planned to find out the association of serum calcium with serum amylase, lipase and albumin in CKD and non-CKD patients. Out of 200 subjects (100 cases and 100 controls), among which 55.5% were males and 44.5% were female. Out of total 44.5% females, maximum 28% were in the age group of 31-40 years and from 55.5% males, maximum 35% were in the age group of 51-60 years. Regarding association of serum calcium, a positive correlation between SA and serum calcium in Case ($r = 0.131$ and $p = 0.193$) while negative correlation found between SA and serum calcium in Controls ($r = -0.084$ and $p = 0.409$) was found, although not significant. ($p>0.05$). A significant positive correlation between Sr. calcium and serum albumin in Case ($r = 0.617$ and $p= <.001$) while positive correlation between Sr. calcium and serum albumin in Control was found but not significant. ($r = 0.186$ and $p= 0.065$). A significant but negative correlation between Sr. calcium and SL in Case ($r = -0.094$ and $p=0.350$) while a significant positive correlation between Sr. calcium and SL in Control was found. ($r = 0.022$ and $p=0.828$).

It is observed in our study that CKD patients having elevated pancreatic enzymes shows a positive correlation with serum calcium and sr. albumin. Our findings are consistent with the figures mentioned in national as well as in the international literatures of authors Royse et al. [13], Masoero et al. [14], Berk et al. [15], Liamis et al. [16], Zachee et al. [17], who reported a positive correlation. Lower serum calcium levels, was associated with a subsequent faster kidney function decline in individuals with CKD stages 3,4 and 5 not requiring dialysis. Lower calcium levels may be indicative of vitamin D deficiency. The association between lower serum calcium and CKD progression is observed in our study.

CONCLUSION

Serum calcium is important element in CKD patients to be monitored as its association with serum amylase, lipase and albumin for treatment and progression of disease.

Declaration by Authors

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Conflict of Interest: No conflicts of interest declared.

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