Clinical Application of Fasting and Post-Prandial Lipid Profile in Patients of Chronic Kidney Disease

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ABSTRACT

BACKGROUND
Dyslipidemia is a traditional risk factor for cerebrovascular disease and cardiovascular disease (CVD). CKD is associated with dyslipidemia. Patients with CKD will be more prone to the CVD and cerebrovascular disease as compared to normal healthy individuals. Thus, it is important to cover the postprandial lipid profile for better assessment and treatment of dyslipidemia. We wanted to study the postprandial lipid profile in patients of CKD.

METHODS
This is a case control study conducted in Acharya Vinoba Bhave Rural Hospital (AVBRH) Sawangi (Meghe), Wardha, Maharashtra, between September 2016 and September 2018. In this study, we enrolled 150 cases and 75 controls.

RESULTS
Fasting lipid profile in CKD patients was higher as compared to controls and was found to have similar post-prandial lipid profile. When we compared the fasting and post-prandial lipid profile in patients with CKD, we found that a substantial difference existed. We found a considerable difference in the fasting and post-prandial lipid profiles even in the controls.

CONCLUSIONS
Patients with CKD and diabetes mellitus had a significant increase in the total cholesterol, triglycerides, low density lipoprotein and very low-density lipoprotein in the fasting and post-prandial state. In clinical practice, the implementation of standardized methodologies and biomarker profiles would allow for the early and reliable detection of those at risk.

KEY WORDS
CKD, Cholesterol, Dyslipidaemia, Triglycerides
BACKGROUND

Chronic Kidney Disease (CKD) is a major global health problem.\(^1\) CKD is a non-reversible renal function decline that typically progresses over the years. CKD and end-stage renal disease (ESRD) are related to increased morbidity and mortality, reduced quality of life and increased spending on health care. End-stage renal disease continues to increase in prevalence worldwide.\(^2\)

A decrease in estimated glomerular filtration rate (e-GFR) below 60 ml / min / 1.73 m\(^2\) and increased albuminuria are associated with increased cardiovascular disease (CVD) as well as general morbidity and mortality.\(^3,4,5\) CKD patients will develop end-stage renal disease (ESRD) but many patients will die of CVD before dialysis is required.

Dyslipidemia is one of the traditional risk factors of the CVD and Cerebrovascular disease. CKD is associated with dyslipidemia.\(^6,7\) A study conducted in non-diabetic CKD patients by Veeren Ganta suggests prevalence of dyslipidemia in CKD to be 65 %.\(^8,9\) So, patients with CKD will be more prone to the CVD and Cerebrovascular disease as compared to normal healthy individuals. Thus, it is important to check for lipid profile in patients of CKD.

Much of our knowledge about the relationship between lipid, lipoprotein metabolism, and the development of atherosclerosis and cardiovascular disease is based on measurements in the fasting state. Although such measurements remain the foundation of clinical assessment and an important basis for decisions regarding hypolipidemic interventions, it should be acknowledged that we spend a considerable amount of time in a non-fasting, postprandial state. Based on traditional western dietary habits, most people eat 3 or more foods a day, each containing 20 - 70 g of fat.\(^9\) A part from breakfast, each meal is most likely eaten prior to the return to the baseline of lipemic disease due to the previous consumption of plasma triacyl glycerols. Therefore, people spend most of their days in a postprandial (food) state and the degree of lipemia is continuously fluctuating throughout the day. Determination of the postprandial response is nuanced and, therefore, it is more difficult to determine cardiovascular risk associated with post-prandial lipemia, rather than under fasting conditions.\(^10\)

**Inclusion Criteria**
- Cases - Persons who have been diagnosed with CKD as per kidney disease improving global outcomes (KDIGO).
- Controls - Age and gender matched healthy individuals were enrolled by calculating odds ratio and 95 % confidence interval for each variable.
- Age - More than 18 years.

**Exclusion Criteria**
- Alcoholics
- Ischemic Heart Disease.
- Patients already on treatment for dyslipidaemia.
- Drugs causing dyslipidaemia
- Hydrochlorothiazide (≥ 25 mg / day)
- Chlorothalidone
- Orlstat
- Omega - 3 fatty acids, etc.

**Diagnosis of CKD**
1. Renal damage for 3 months, as identified by structural or functional renal abnormalities, with or without e GFR decreased, manifested by either: pathological abnormalities; or
2. Kidney damage marks, including blood or urine composition abnormalities, or imaging abnormalities.
3. E-GFR > 60 ml / min / 1.73 m\(^2\), with or without kidney injury, for a period of 3 months.

**Data Analysis**

Descriptive statistics were used to classify the population of the sample and identify the baseline parameters studied. The data were expressed in terms of frequencies (percentages) for category variables and average default (SD) for continuous variables. The statistical research was conducted with descriptive and inferential statistics using student-t, chi-square testing, z-testing, Pearson's correlation and multiple-regression testing.

Software used in the analysis was SPSS 22.0 version and graph-pad prism 6.0 version. P-value < 0.05 was considered as statistically significant.

**RESULTS**

Table 1 illustrates the baseline line characteristics of cases and controls. In this study we enrolled 150 cases and 75 controls. The mean age in CKD patients (cases) was 48.04 ± 14.46 years whereas in controls it was 47.13 ± 14.80 years. There were 94 (62.67 %) males and 56 (37.33 %) females in cases whereas there were 47 (62.67 %) males and 28 (37.33 %) females in control group. Risk factors like diabetes mellitus, systemic hypertension and smoking were considered in our study and are mentioned in the above table along with baseline characteristics.

Table 2 illustrates comparison of fasting and post-prandial lipid profile in cases. Total cholesterol (TC), triglycerides (TG), high density lipoproteins (HDL), very low-density lipoprotein (VLDL) and low-density lipoprotein (LDL) when compared in

**METHODS**

This is a case control study, conducted at Acharya Vinoba Bhave Rural Hospital (AVBHR) Sawangi (Meghe), Wardha, Maharashtra, from September 2016 to September 2018.
fasting and post-prandial state by students unpaired t-test was statistically significant.

Table 3. Comparison of Fasting Lipid Profile with Stages of CKD

<table>
<thead>
<tr>
<th>Lipid Profile</th>
<th>Fasting (n = 150) Mean ± SD</th>
<th>Post-Prandial (n = 150) Mean ± SD</th>
<th>Mean Difference Mean ± SD</th>
<th>T-Value</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>TC</td>
<td>171.50 ± 15.64</td>
<td>154.16 ± 10.22</td>
<td>17.34 ± 8.81</td>
<td>23.66 ± 7.99</td>
<td>110.31 ± 9.79</td>
</tr>
<tr>
<td>TG</td>
<td>172.33 ± 45.54</td>
<td>161.81 ± 23.66</td>
<td>10.52 ± 11.94</td>
<td>0.00015</td>
<td>0.37</td>
</tr>
<tr>
<td>HDL</td>
<td>39.88 ± 10.89</td>
<td>33.33 ± 10.79</td>
<td>6.55 ± 9.08</td>
<td>0.00015</td>
<td>0.37</td>
</tr>
<tr>
<td>LDL</td>
<td>121.49 ± 22.83</td>
<td>109.75 ± 21.02</td>
<td>11.74 ± 20.23</td>
<td>0.00015</td>
<td>0.37</td>
</tr>
</tbody>
</table>

Table 2. Comparison between Fasting and Post-Prandial Lipid Profile in Cases Unpaired Student's t-test

In our research, we compared the quick and post-prandial lipid profile with CKD with mellitus and found statistical significance for total cholesterol (TC), triglycerides (TG), very low lipoprotein density (VLDL), and low lipoprotein density (LDL). Lipoprotein of high density (HDL) was not statistically important. [Table 5]

Table 4. Comparison of Fasting Lipid Profile with Stages of CKD

The table 3 depicts comparison of fasting lipid profile with various stages of CKD. Fasting total cholesterol (FTC) had a mean of 186.90 with standard deviation of ± 22.91. FTC distribution between various stages was not statistically significant (p-value = 0.32). Fasting triglycerides (FTG) had a mean of 172.34 with standard deviation of ± 45.54. FTG distribution between various stages was statistically significant (p-value = 0.0001). Fasting high density lipoprotein (FHDL) had a mean of 39.88 with standard deviation of ± 10.89. FHDL distribution between various stages was statistically significant (p-value = 0.043). Fasting very low-density lipoprotein (VFLDL) had a mean of 34.52 with a standard deviation of ± 9.13. VFLDL distribution between various stages was statistically significant (p-value = 0.0001). Fasting low density lipoprotein (FLDL) had a mean of 121.49 with a standard deviation of ± 22.83. FLDL distribution between various stages was not statistically significant (p-value = 0.52).

Table 4 depicts comparison of post-prandial lipid profile according to stages of CKD. Post-prandial total cholesterol (PPTC) had a mean of 209.29 with standard deviation of ± 25.12. PPTC distribution between various stages was not statistically significant (p-value = 0.22). Post-prandial triglycerides (PPTG) had a mean of 219.62 with standard deviation of ± 49.55. PPTG distribution between various stages was statistically significant (p-value = 0.001). Post-prandial high density lipoprotein (PPHDL) had a mean of 36.67 with standard deviation of ± 10.91. PPHDL distribution between various stages was statistically significant (p-value = 0.012). Post-prandial very low density lipoprotein (PPVLDL) had a mean of 43.95 with a standard deviation of ± 9.91. PPVLDL distribution between various stages was statistically significant (p-value = 0.0001). Post-prandial low density lipoprotein (PPPLDL) had a mean of 128.66 with a standard deviation of ± 24.88. PPPLDL distribution between various stages was not statistically significant (p-value = 0.37). [Table 4]

Table 5. Comparison between Fasting and Post-Prandial Lipid Profile in Cases with Diabetes Mellitus

In our research, we compared the quick and post-prandial lipid profile with CKD with mellitus and found statistical significance for total cholesterol (TC), triglycerides (TG), very low lipoprotein density (VLDL) and low lipoprotein density (LDL). Lipoprotein of high density (HDL) was not statistically important. [Table 5]
the classification of kidney disease that enhanced global outcomes (KDIGO) and 75 years and sex had healthy individuals matched as controls.

We have discussed the findings in our study under the following headings:

1. Comparison of fasting and post-prandial individual parameter of lipid profile with stages of CKD.
2. Comparison of fasting lipid profile between cases and controls.
3. Comparison of post-prandial lipid profile between cases and controls.
4. Comparison of fasting and post-prandial lipid profile in cases with diabetes mellitus.

**Comparison of Fasting and Post-Prandial Lipid Profile in Cases**
In our study we observed that total cholesterol (TC), triglycerides (TG), high density lipoproteins (HDL), very low density lipoprotein (VLDL) and low density lipoprotein (LDL) when compared in fasting and post-prandial state in cases by students unpaired t test was statistically significant. Vinod Wali et al (2016)\(^2\) and Lokhande Suryabhan et al (2013)\(^1\) performed similar study but in patients with diabetes mellitus found similar findings as that of in our study.

**Comparison of Lipid Profile and Stages of CKD**
In our study we have compared lipid profile in fasting and post-prandial state with various stages of CKD. We have also compared fasting lipid profile with post-prandial lipid profile in total cholesterol (TC), triglycerides (TG), high density lipoprotein (HDL), very low density lipoprotein (VLDL) and low density lipoprotein (LDL) when compared fasting lipid profile with post prandial state. In clinical practice, the prandial total cholesterol (TC), triglycerides (TG), high density lipoprotein (HDL), very low density lipoprotein (VLDL) and low density lipoprotein (LDL) doesn’t have statistical significance when compared with various stages of CKD.

**Comparison of Fasting and Post-Prandial Individual Parameters of Lipid Profile with Stages of CKD**
We have compared total cholesterol (TC), triglycerides (TG), high density lipoprotein (HDL), very low-density lipoprotein (VLDL) and low-density lipoprotein (LDL) individually in fasting and post-prandial state with various stages of CKD. Fasting and post-prandial total cholesterol (TC) when compared with various stages of CKD was found to be statistically significant in all stages of CKD except stage III of CKD. Fasting and post-prandial triglycerides (TG) when compared with various stages of CKD was found to be only statistically significant in stage IV and V of CKD. Fasting and post-prandial very low density lipoprotein (VLDL) when compared with various stages of CKD was found to be statistically significant in stage IV and V of CKD. Fasting and post-prandial low density lipoprotein (LDL) when compared with various stages of CKD was found to be significant in stage IV and stage V.

**Comparison of Lipid Profile and Stages of CKD**
In our study we have compared lipid profile in fasting and post-prandial state with various stages of CKD. We have also compared fasting lipid profile with post-prandial lipid profile in total cholesterol (TC), triglycerides (TG), high density lipoprotein (HDL), very low density lipoprotein (VLDL) and low density lipoprotein (LDL).

Fasting total cholesterol (FTC) when compared with various stages of CKD was not statistically significant (p-value = 0.32). Similarly, post-prandial total cholesterol (PPTC) when compared with various stages of CKD was not statistically significant (p-value = 0.22). Fasting triglycerides (FTG) when compared with various stages of CKD was statistically significant (p-value = 0.0001). Similarly, post-prandial triglycerides (PPTG) when compared with various stages of CKD was statistically significant (p-value = 0.0001). Fasting high density lipoprotein (FHDL) when compared with various stages of CKD was statistically significant (p-value = 0.043). Similarly, post-prandial high density lipoprotein (PHDHL) when compared with various stages of CKD was statistically significant (p-value = 0.012). Fasting very low-density lipoprotein (FVLDL) when compared with various stages of CKD was statistically significant (p-value = 0.0001). Similarly, post-prandial very low-density lipoprotein (PVVLDL) when compared with various stages of CKD was statistically significant (p-value = 0.0001). Fasting low density lipoprotein (FLDL) when compared with various stages of CKD was not statistically significant (p-value = 0.52). Similarly, post-prandial low density lipoprotein (PPLDL) when compared with various stages of CKD was not statistically significant (p-value = 0.37).

So in our study we observed that fasting and post-prandial triglycerides (TG), high density lipoprotein (HDL), very low density lipoprotein (VLDL) have statistical significance when compared with various stages of CKD whereas total

**Comparison of Fasting Lipid Profile between Cases and Controls**
In our study we compared the fasting lipid profile in cases and controls. It was found statistically significant in FTC, FTG, FHDL, FVLDL and FLDL (p-value = 0.0001)

**Comparison of Post-Prandial Lipid Profile between Cases and Controls**
In our study we compared the post- prandial lipid profile in cases and controls. It was found statistically significant in PPTC, PPTG, PHDHL, PPVLDL and PPLDL (p-value = 0.0001)

**Comparison of Fasting and Post-Prandial Lipid Profile in Cases with Diabetes Mellitus**
In our study we compared the fasting and post-prandial lipid profile in cases with diabetes mellitus. We found that TC, TG, VLDL and LDL were statistically significant.

**CONCLUSIONS**
Dyslipidemia of CKD is characterized by raised triglycerides, very low-density lipoprotein and decreased high density lipoprotein. Fasting lipid profile in CKD patients was higher as compared to controls and was found to be similar with regard to post-prandial lipid profile. When we compared the fasting and post-prandial lipid profile in CKD patients, we found that there is a significant difference. Even in controls, we found a significant difference in the fasting and post-prandial lipid profile. Patients with CKD and diabetes mellitus had a significant increase in total cholesterol, triglycerides, low density lipoprotein and very low density lipoprotein in fasting and post-prandial state. In clinical practice, the
implementation of standardized methodologies and biomarker profiles would allow for the early and reliable detection of those at risk.

**Limitations**
In present study most of the patients were in advanced stages of CKD because of the unawareness in the rural population. Therefore, further study is required to evaluate the post-prandial lipid profile in early stages of CKD.
- There are no standard guidelines to check for post-prandial lipid profile.
- There was no restriction on the meal after which the post-prandial lipid profile was done.
- There is no standard reference range for post-prandial lipid profile and further studies are required for standardization of postprandial lipid profile levels.

**Recommendation**
In patients of CKD, inclusion of post-prandial lipid profile should be considered along with fasting lipid profile for better assessment and management of dyslipidemia.

Financial or Other Competing Interests: None.

**REFERENCES**


