

Salivary Urea as biomarker in renal failure

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ABSTRACT:

Urea and its metabolites are present in most body fluids. The current study evaluated the hypothesis that analyzing urea levels in patients with chronic kidney disease (CKD) undergoing dialysis can be used to monitor and assess the efficacy of dialysis. Salivary analysis of urea levels offers a simple and non-invasive alternative to blood sampling. The study observed that urea concentrations in blood and saliva were comparable, and the variations in both fluids closely reflected each other in pre- and post-dialysis samples. The reduction in urea levels after dialysis showed a similar pattern in both blood and saliva. The comparable drop in mean values before and after dialysis further supported this correlation. Therefore, the study demonstrated that salivary urea levels reliably reflect blood urea levels in CKD patients. In conclusion, salivary urea estimation provides an easy, safe, cost-effective, reliable, and less technically demanding non-invasive method for assessing renal function and dialysis efficacy.

Keywords: Salivary urea, Chronic kidney disease, Renal failure, Dialysis monitoring, Non-invasive biomarker, Serum urea

INTRODUCTION:

For over a century, research in the medical field on the composition and functions of saliva has highlighted its importance as a biological fluid worthy of scientific exploration. Metabolic products in the body are represented across multiple body fluids, including urine, sweat, saliva, and synovial fluid. Saliva may exhibit variations in odor and consistency depending on the metabolites secreted within it. The presence of hormones in saliva is well established, influencing taste, odor, and the activity of cognate receptors expressed in the oral cavity. These interactions can affect overall body metabolism through the activation of locally expressed receptors in the oral mucosa¹.

The secretion of the salivary glands includes a transudate derived from plasma, among other components. The composition of saliva is highly dynamic and influenced by various physiological factors such as flow rate,

circadian rhythm, gland type and size, duration and nature of stimulation, diet, age, gender, blood group, and general physiological status².

Over the past three decades, advances in knowledge and research on saliva and its homeostasis have led to the emergence of a new field known as *Salivaomics*. The presence of plasma proteins and metabolites in saliva provides a valuable source of biomarkers for various diseases, offering the advantage of a non-invasive method of sample collection for patients³—particularly in conditions where biochemical parameters are reflected in saliva.

Urea and other nitrogenous waste products present in the blood are also detectable in body secretions, including saliva. The presence of urea in saliva was first described in 1841 and has since been evaluated as an indicator of renal function⁴⁻⁶. The concentration of urea in saliva depends on several factors, including salivary flow rate, hydration status, kidney function, dietary intake, and the

use of chewable mouth fresheners before sample collection. Salivary urea levels can be assessed quantitatively or by bedside dipstick methods, making it a simple and non-invasive tool for patient evaluation⁷.

The present study was conducted in patients with chronic kidney disease (CKD) to assess the efficacy of salivary sampling in evaluating renal dysfunction and monitoring dialysis outcomes.

AIMS AND OBJECTIVES:

- To study the correlation between salivary urea levels and serum urea levels in patients with renal failure.
- To assess the significance of pre- and post-dialysis salivary urea levels in evaluating the efficacy of dialysis.

MATERIALS AND METHODS:

This study was conducted at the Academy of Medical Education, Pariyaram, Kerala, among patients undergoing maintenance dialysis. A total of 58 patients were included after obtaining informed consent. The study population

was randomized with respect to age, sex, and etiology of chronic kidney disease (CKD).

Patients with poor oral hygiene, dental caries, food intake within the previous hour, dehydration, sepsis, or salivary gland abnormalities were excluded from the study.

The study was designed as a hospital-based observational and descriptive study. No financial burden was placed on the participants, and the research was self-funded by the investigators.

OBSERVATIONS AND RESULTS:

Samples of blood and saliva were collected simultaneously from each patient before and after dialysis. The urea levels obtained from both fluids were compared and graphically analyzed.

The results demonstrated that urea levels in saliva followed a pattern similar to that in blood, with parallel fluctuations observed in both pre- and post-dialysis samples. Statistical analysis using Pearson's correlation coefficient revealed a significant positive correlation between salivary and serum urea levels, confirming that changes in blood urea were reliably reflected in salivary urea measurements.

Figure 1:

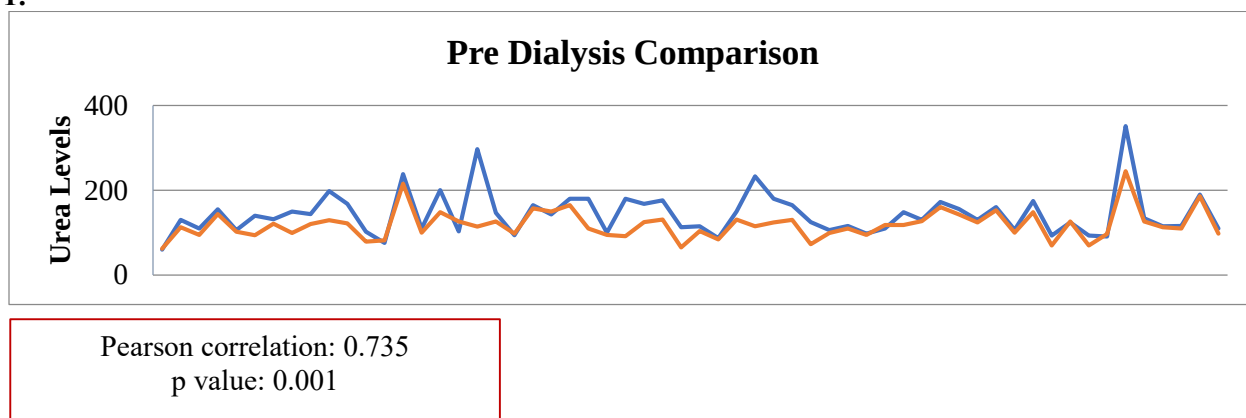
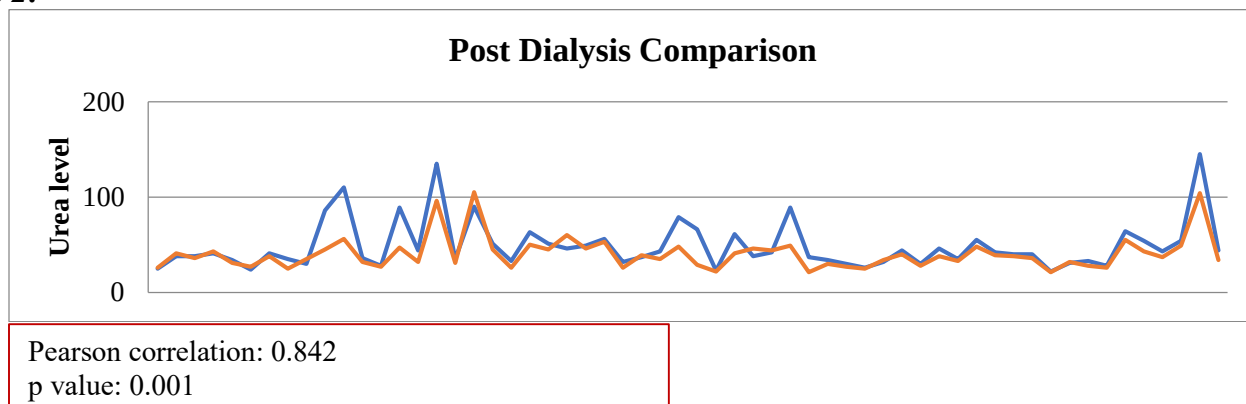


Figure 2:



The reduction in Blood Urea levels after dialysis is expected and was compared with the changes in the blood and saliva for pre and post dialysis values.

Figure 3:

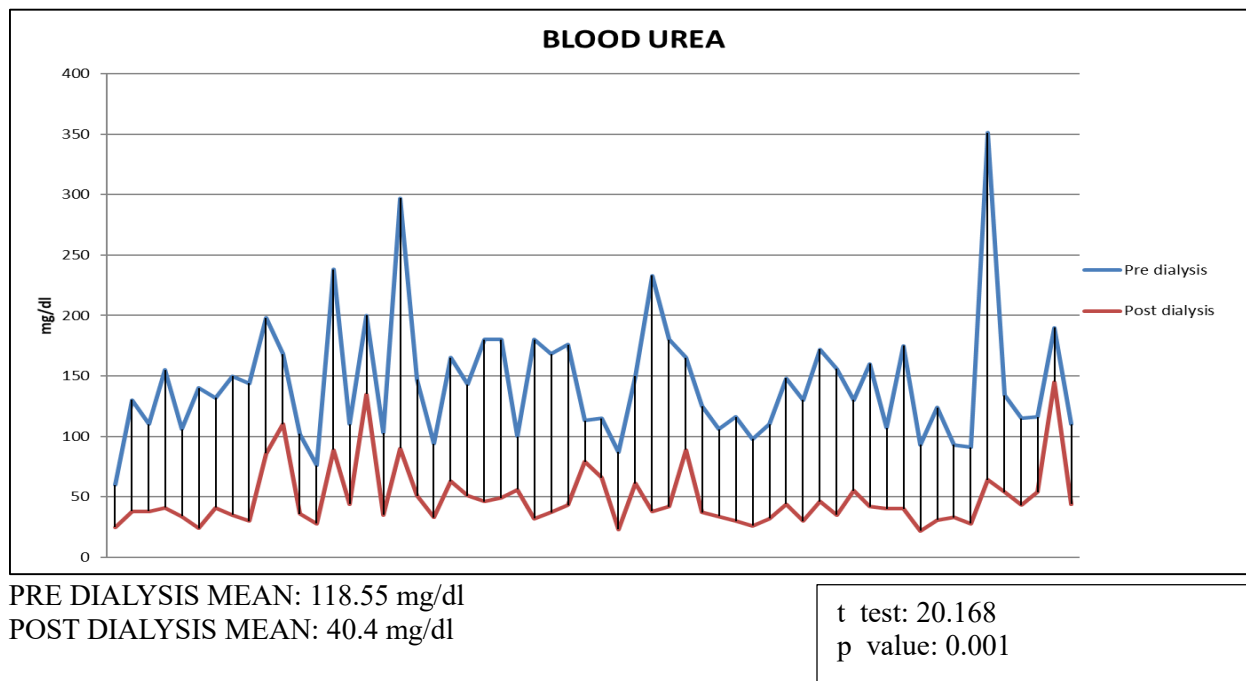


Figure 4:

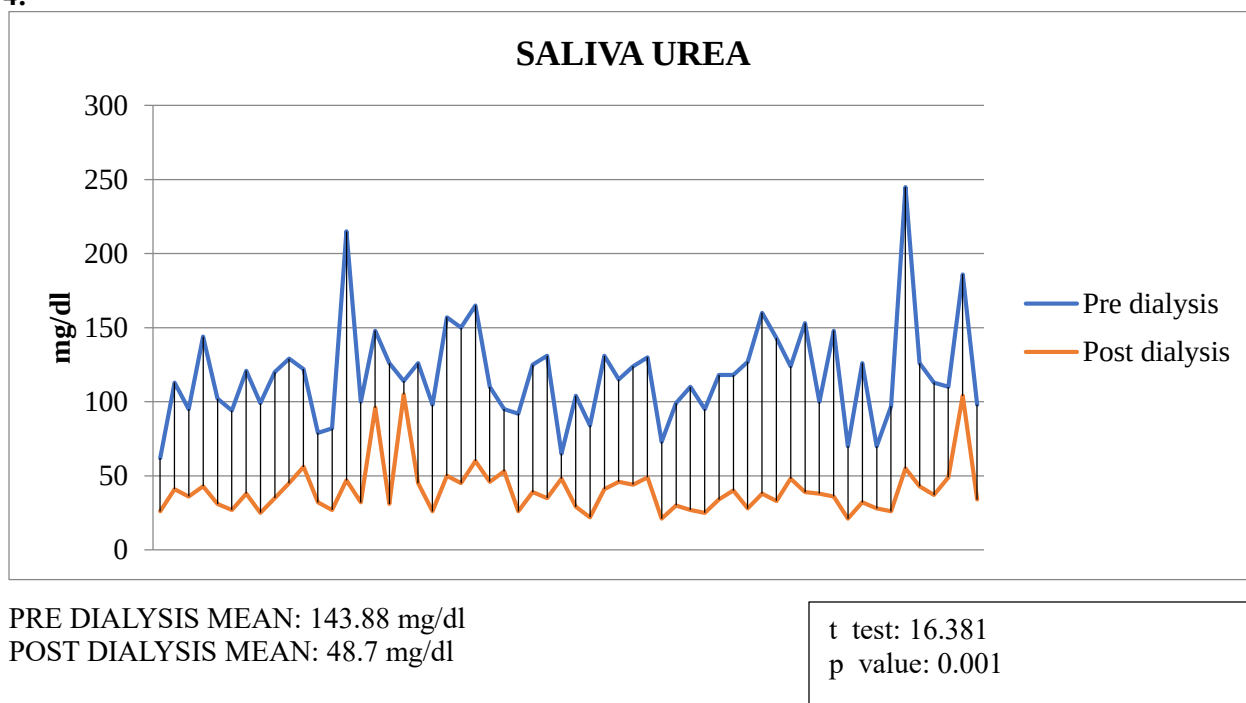
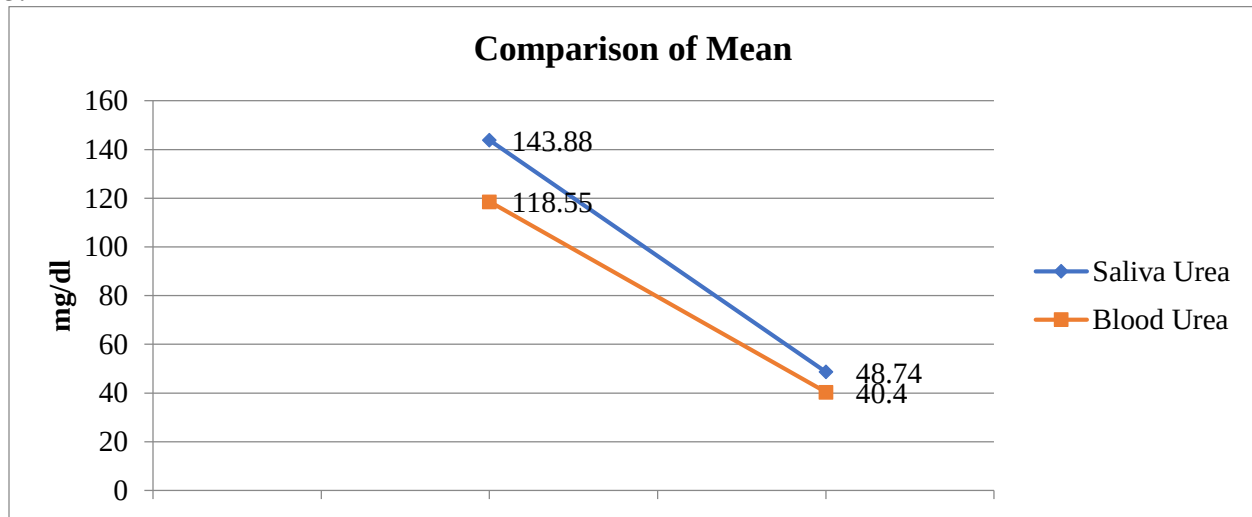


Figure 5:



p value: 0.001

DISCUSSION:

The blood and salivary urea levels were compared and analyzed across the study population to evaluate their clinical correlation, as represented in the graphs above. The graphical analysis demonstrated that both blood and saliva exhibited comparable trends, with a significant positive correlation as indicated by Pearson's correlation coefficient and corresponding *p* values.

As expected, urea levels showed a marked reduction in blood following dialysis, and this decline was clearly reflected in the plotted values. A similar reduction was observed in the salivary urea levels immediately after dialysis, suggesting that changes in salivary urea occur in close synchrony with those in blood. This immediate reflection indicates the potential utility of saliva as a non-invasive biofluid for monitoring renal function dynamics. The observed decrease in both blood and salivary urea levels pre- and post-dialysis was statistically significant, as confirmed by *t*-test analysis, with *p* values supporting the study hypothesis. The mean values of urea in both biological fluids showed a comparable and proportionate reduction following dialysis.

These findings highlight that salivary urea closely mirrors serum urea variations, particularly in response to dialysis. This observation opens possibilities for utilizing salivary urea estimation in acute kidney injury (AKI) cases, warranting further studies to determine the precise time lag (latency) between serum and salivary biochemical changes.

CONCLUSION:

The findings of this study support the hypothesis that saliva can serve as a simple, non-invasive, and reliable alternative to blood for assessing renal dysfunction. Salivary urea estimation may be used both in laboratory

settings and as a rapid bedside or dipstick test to aid in early diagnosis and treatment monitoring of renal disease. Future studies with larger sample sizes and inclusion of additional biochemical parameters of renal function are recommended to further validate and expand the clinical applicability of salivary diagnostics in nephrology.

Conflict of Interest:

The authors have declared that no conflict of interest exists.

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