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Correlation of salivary and serum urea, creatinine and ph in end-stage renal disease patients undergoing hemodialysis in pre and post-dialysis state

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Abstract
Introduction: Chronic renal failure is defined as the progressive and irreversible decline of the glomerular filtration rate (GFR), and gradual loss of kidney function over time, causing to an increase of serum creatinine and blood urea nitrogen levels leading to end-stage renal disease.
Aims and Objectives: The aim of the study was to estimate and compare the salivary and serum urea, creatinine, and PH in pre-dialysis and post-dialysis state in end-stage renal disease patients.
Materials and Methods: The sample comprised of patients with renal failure, who were undergoing hemodialysis at Government hospital in Nizamabad. The venous blood and saliva samples were collected from the patients during pre and post dialysis stages. Collected samples were immediately sent to the laboratory for biochemical examination of creatinine, urea, and Ph.
Results: Statistical analysis was done for the comparison of serum and salivary samples of all the three parameters in pre and post dialysis states using paired t-test in which gave a significant p-value of 0.0001.
Conclusion: Patients who are under hemodialysis show apparent oral and salivary changes. In our study, a significant correlation was obtained between salivary creatinine levels when compared to urea and PH thus salivary creatinine levels will help in diagnosing of patients with ESRD.

Keywords: GFR, hypertension, hemodialysis

Introduction
There is a gradual uprise in patients being affected with chronic renal disease (CRD) globally and this increase is placing a substantial burden over the health care resources [1, 2]. Chronic renal disease is manifested as elevated levels of blood creatinine and serum urea, along with hematological, endocrine, electrolyte and skeletal disorders which are attributed to the accumulation of metabolic waste products and thereby leading to multiorgan involvement [3, 4].
Chronic renal disease is one among several systemic diseases which are known to alter the contents of the saliva. Most importantly, saliva can indicate any alterations in urea and creatinine levels which are the parameters usually assessed through hematological examination in chronic renal failure patients. Thus saliva may play an important role as a diagnostic tool in assessing patients with chronic renal disease [5-8].
Many systemic diseases have been reported to produce identifiable alterations in salivary secretions. Chronic renal disease is one among them that can affect the contents of salivary secretions. Hence non-invasive procedure like salivary estimation would become novel marker in the identification of kidney failure of earliest. Novel diagnostic methods are being introduced in today's research one among which is by the assessment of molecular components of the saliva [9].

Aims and objectives
The aim of the study was to compare the salivary and serum urea, creatine and pH in pre and post dialysis state in end-stage renal disease patients.
1. To estimate the serum urea, creatinine, PH levels in pre-dialysis and post-dialysis state in end-stage renal disease patients.
2. To estimate the salivary urea, creatinine, pH levels in pre-dialysis and post-dialysis state in end-stage renal disease patients.

3. To compare the serum and salivary urea, creatinine and pH levels in pre-dialysis and post dialysis state in end-stage renal disease patients.

Materials and Methods

The sample comprised of 30 renal failure patients, above 20 years of age who were undergoing hemodialysis above one-year duration at Government hospital in Nizamabad. Systemic illness other than renal failure with the cause of diabetes and hypertension were not included in the study. The venous blood was collected from the patient before and after dialysis procedures and at the same time, unstimulated whole saliva of about 5ml was collected before and after dialysis procedure in a sterile container by spitting method. Both Collected samples were immediately sent to the laboratory for biochemical examination of creatinine, urea, and Ph. And statistically analyzed using paired t-test analysis.

Results

30 subjects those who are under hemodialysis were enrolled in the study with above age of 20yrs.we have collected blood and saliva from these 30 patients at pre and post dialysis states.

Table 1 shows the mean values of blood urea, blood creatinine and blood pH in, pre-dialysis group and post-dialysis group. Following results were obtained.

Blood urea levels: The blood urea values in a pre-dialysis group were significantly higher (p-value 0.05). The blood urea level in a post-dialysis group was significantly lower.

Serum creatinine: Serum creatinine values in a pre-dialysis group were significantly higher in comparison with the post-dialysis group (p-value 0.05).

Blood ph: Blood pH was significantly higher mean value where as Ph is acidic in pre-dialysis when compared to the post-dialysis group.

The mean values of salivary urea, creatinine, and ph in, pre and post-dialysis groups were obtained similar to the blood where pre-dialysis values were significantly higher and post dialysis there was a significant decrease in the levels of salivary urea, creatinine and ph as shown in table 2.

In the present study, we noticed a decrease in the blood and salivary urea, creatinine levels, decrease in ph where as basic in post-dialysis patients when compared to pre-dialysis patients, but a significant decrease with a p-value less than 0.05 was obtained in creatinine levels only as shown in table 3. There was no significant decrease in urea levels and ph, as they are influenced by various local and systemic factors within the body like ph levels can alter with food consumed before and during the dialysis procedure, urea levels also can be altered due to dehydration unlike creatinine which is not influenced by other factors as much as urea.

Discussion

One of the progressive diseases causing irreversible fall in the glomerular filtration [1] rate further resulting in an elevation in values of serum creatinine and blood urea nitrogen values in the chronic renal failure [7]. It is irreversible in nature and progresses to further severe form with time, with a decline of glomerular filtration rate to 5 to 10 percent with high levels of uremia [8]. These biochemical changes of the blood reflect the sign and symptoms of the disease. By measuring the serum levels of these compounds excreted by the kidneys, assessment of the renal excretory functions can be done and therefore serum levels of electrolytes and saliva in the body can also be used as a diagnostic tool in the assessment of renal diseases [9, 10]. Hence; we evaluated the pre-dialysis and post-dialysis mean values of serum renal biochemical markers in CRF patients undergoing dialysis to elucidate the effect of dialysis on CRF patients. We noticed that in the present analysis, a pre-dialysis group showed an increase in the levels of the blood urea and serum creatinine which were statistically significant (p-value 0.05) (Figure 1, Table 1). This is due to the fall in the GFR in CRF patients. As the GFR falls, plasma levels of creatinine and urea rise as they are eliminated by glomerular filtration and tubular secretion. Blood urea and serum creatinine levels in the post-dialysis group showed a significant fall in comparison with the pre-dialysis group. Similar results were obtained in the salivary component also [9]. These results are in accordance with a study conducted by Seethalakshmi *et al*. who compared the salivary urea levels and levels of other serum biochemical parameters in patients with end-stage renal disease at pre and post- dialysis stage [9].

Cheng *et al*. explored the changes occurring in the salivary urea, creatinine, and uric acid before and after hemodialysis in patients with end-stage renal disease [11]. They observed that in renal disease patients highly correlation exists in dialysis patients regarding various biochemical parameters. From the results, they concluded that similar clearing effect of salivary and serum Urea, Cr, and UA levels are observed in renal disease patients [11]. The findings of the present study are also in accordance with a study conducted by Dhal berg [12].

It will, therefore, be possible to substitute unstimulated whole saliva samples in place of serum samples for these parameters whenever the clinical situation demands this, e.g. in situations where due to anemia, small blood volume, difficulties in access for sampling, preservation of major vein for future arteriovenous shunts, it may be deemed desirable to reduce the frequency of venipuncture and or blood samplings, which was also stated in a study conducted by Estela ML Cardoso *et al*. [13]

Our results are in correlation with the study conducted by Rahime Renda *et al*. were there was a significant decrease in salivary creatinine levels in patients with ESRD in post Dialysis state [14].

Conclusion

Under the light of the above results, we conclude that saliva could be an alternative to blood for diagnosis and monitoring individuals with CKD. A noninvasive method of collecting saliva can reduce the anxiety and discomfort those are associated with blood collection, this noninvasive method can be taken to allow frequent monitoring of these patients general health and to diagnose morbidities in the early stages. The present study reveals the most important finding is that saliva can play important role in estimating the serum creatinine and urea levels in individuals with CKD. Further larger scale controlled studies are required to understand the role of saliva analysis in the diagnosis and treatment.

Table 1: Shows the mean values of blood urea, blood creatinine and blood ph in a pre-dialysis group and post-dialysis group.

Variables	Dialysis	Min	Max	Mean	SD	Difference Mean±SD	P value
Blood urea	Pre-dialysis	56.00	136.00	102.90	24.21	38.80±3.52	<0.001 Significant
	Post-dialysis	38.00	118.00	64.10	20.69		
Blood Creatinine	Pre-dialysis	2.70	12.00	5.11	2.48	1.96±0.62	<0.001 Significant
	Post-dialysis	1.40	9.20	3.15	1.86		
Blood PH	Pre-dialysis	5.90	7.10	6.47	0.43	0.21±0.03	<0.001 Significant
	Post-dialysis	6.10	7.30	6.68	0.40		

Table 2: Shows the mean comparison between Pre-dialysis and Post dialysis in salivary urea, Salivary Creatinine, and Salivary PH

Variables	Dialysis	Min	Max	Mean	SD	Difference Mean±SD	P value
Salivary urea	Pre-dialysis	36.00	68.00	49.25	8.28	17.05±0.24	<0.001 Significant
	Post-dialysis	19.00	46.00	32.20	8.04		
Salivary creatinine	Pre-dialysis	1.50	3.90	2.90	0.73	1.16±0.09	<0.001 Significant
	Post-dialysis	0.60	3.00	1.74	0.64		
Salivary PH	Pre-dialysis	5.60	6.90	6.18	0.38	0.30±0.00	<0.001 Significant
	Post-dialysis	5.80	7.10	6.48	0.38		

Table 3: Correlation Analysis between the variables.

Correlation between	The Correlation coefficient (r)	P value
Blood urea and Salivary urea	0.267	0.254 NS
Blood Creatinine and Salivary Creatinine	0.449	0.047 S
Blood PH and Salivary PH	0.171	0.470 NS

Statistical Analysis: Karl Pearson's correlation.
Statistically significant if $P<0.05$

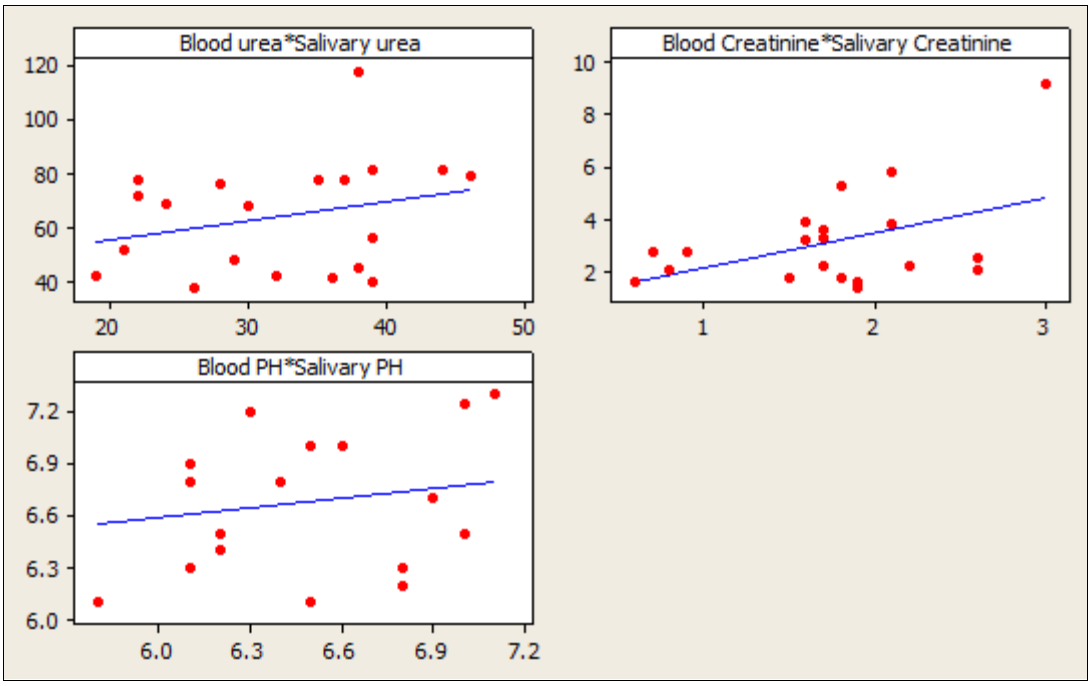

Fig 1: Scatter plot between the variables

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