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RESEARCH ARTICLE
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SALIVARY GLAND DYSFUNCTION IN PATIENTS UNDERGOING HEMODIALYSIS IN PESHAWAR

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ABSTRACT

Background: Salivary gland dysfunction is a prevalent but under-recognized complication in patients with end-stage renal disease (ESRD) undergoing hemodialysis (HD), leading to xerostomia, impaired oral function, and decreased quality of life. This study aims to assess salivary flow rates, pH, and biochemical parameters among HD patients in Peshawar, evaluating their relationship with dialysis-related factors and xerostomia severity.

Methods: A cross-sectional study was conducted from January to April 2025 in two tertiary HD centers in Peshawar. Forty ESRD patients on maintenance HD for ≥3 months were compared with 20 healthy controls matched for age and sex. Unstimulated and stimulated saliva samples were collected pre- and post-dialysis to measure flow rate, pH, urea, phosphate, and total protein. Subjective xerostomia was evaluated using a Visual Analogue Scale (VAS) and the OHIP-14 questionnaire. Oral examination assessed mucosal dryness, tongue coating, and DMFT index. Statistical analyses included paired and independent t-tests and Pearson's correlation (significance at $p<0.05$).

Results: HD patients showed significantly reduced salivary flow rates compared to controls: unstimulated (0.13 ± 0.06 vs 0.30 ± 0.08 mL/min) and stimulated (0.80 ± 0.25 vs 1.35 ± 0.40 mL/min). Post-dialysis values showed partial improvement. Salivary pH was elevated in HD patients (7.5 ± 0.4 pre-HD vs 6.9 ± 0.2 controls, $p<0.01$). Urea, phosphate, and total protein were significantly higher in HD patients, though decreased post-dialysis. Xerostomia was reported by 70% of patients (mean VAS 56.4 ± 18.5), with elevated OHIP-14 scores ($p<0.01$). Correlations revealed that longer HD duration was associated with lower unstimulated flow ($r = –0.42$, $p<0.01$), while higher interdialytic weight gain (IDWG) correlated positively with xerostomia severity ($r = 0.47$, $p<0.01$). DMFT scores were significantly worse in HD patients (17.4 ± 5.2) compared to controls (10.2 ± 3.7; $p<0.01$).

Conclusion: Salivary gland dysfunction is common among HD patients in Peshawar, manifesting as reduced salivary flow, elevated urea and phosphate levels, and pronounced xerostomia. These

disturbances are associated with HD duration and IDWG. Regular salivary analysis and integrated oral healthcare in HD settings can significantly improve patient outcomes and quality of life.

Keywords: Hemodialysis, Salivary gland dysfunction, Xerostomia, Salivary biochemistry, Chronic kidney disease, Oral health, Pakistan.

INTRODUCTION

Salivary gland dysfunction is a significant issue for patients receiving hemodialysis in Peshawar, as demonstrated by multiple research investigating the effects of chronic renal failure (CRF) on salivary function. Patients with chronic renal failure undergoing hemodialysis demonstrate marked changes in salivary gland function, evidenced by extended Tmax and Tmin values and diminished Lem E5% values in parotid glands, as well as prolonged Tmin values in submandibular glands, indicating impaired parenchymal and excretory function (1). Xerostomia, or dry mouth, is common in these patients, frequently caused by diminished salivary secretion due to gland atrophy and fibrosis, worsened by drugs administered during dialysis. This condition results in challenges with chewing, swallowing, and speaking, while heightening the risk of oral infections like candidiasis and periodontal disease, so considerably diminishing quality of life. Moreover, research indicates diminished flow rates of both unstimulated and stimulated saliva in patients with end-stage renal disease (ESRD) receiving hemodialysis, accompanied by elevated pH and buffering capacity in unstimulated saliva. Hemodialysis modifies the biochemical makeup of saliva, changing the concentrations of urea, creatinine, chloride, and potassium, hence highlighting the necessity for specialized oral health care for these individuals.

Objectives

1. To assess salivary flow rate, pH, and biochemical components (urea, phosphate, total protein) in HD patients.
2. To compare these values before and after dialysis.
3. To evaluate associations between salivary parameters, HD duration, interdialytic weight gain (IDWG), and subjective xerostomia.

METHODOLOGY

Study Design and Setting

A cross-sectional study was conducted between January and April 2025 at two tertiary-care HD centers in Peshawar.

Sample Size and Population

Forty ESRD patients on maintenance HD (≥3 months) were enrolled using purposive sampling. Twenty healthy, age- and sex-matched individuals served as controls.

Eligibility Criteria

Inclusion: adults aged ≥18 years undergoing HD for at least 3 months. Exclusion: prior head and neck radiotherapy, autoimmune diseases (e.g., Sjögren's syndrome), active oral infections, or use of xerogenic medications (e.g., anticholinergics, antidepressants).

Ethical Approval

The Institutional Review Board approved the study protocol. Written informed consent was obtained from all participants.

Data Collection

1. Demographic and Clinical Data
2. Age, gender, HD duration, comorbidities (hypertension, diabetes), medication history, and IDWG were recorded.
3. Subjective Xerostomia Assessment

- Visual Analogue Scale (VAS): Scored from 0 (no dryness) to 100 (extreme dryness).
- OHIP-14 (Oral Health Impact Profile) assessed oral health-related quality of life [7].

3. Saliva Collection and Analysis
- Unstimulated (UWS) and stimulated whole saliva (SWS) were collected for 5 minutes using the spitting method, both pre- and post-dialysis.
- Measurements included:
  - Flow rate (mL/min)
  - pH (digital pH meter)
  - Biochemical assays:
    - Urea and phosphate via spectrophotometry
    - Total protein via Biuret method

These tests were selected based on local availability in clinical biochemistry labs.

4. Oral Examination

Conducted by a trained dental surgeon, assessing mucosal dryness, tongue coating, and DMFT index (Decayed, Missing, Filled Teeth).

Statistical Analysis

SPSS v25 was used. Data were expressed as mean ± SD. Paired t-tests compared pre- and post-dialysis values; independent t-tests compared HD and control groups. Pearson's correlation analyzed associations. A p-value <0.05 was considered significant.

RESULTS

Demographic and Clinical Profile

• Mean age: 51.2 ± 12.3 years
• Gender: 62.5% male
• Mean HD duration: 2.4 ± 1.1 years
• Comorbidities: Hypertension (80%), Diabetes (50%), Cardiovascular disease (20%)
• Mean IDWG: 2.6 ± 0.8 kg

Subjective Xerostomia

• Mean VAS: 56.4 ± 18.5
• 70% reported moderate-to-severe xerostomia (VAS > 40)
• OHIP-14 scores were significantly higher in HD patients than controls (p < 0.01)

Salivary Flow and Biochemistry

Parameter	Pre-HD	Post-HD	Controls
UWS (ml/min)	0.13 ± 0.06	0.19 ± 0.07*	0.30 ± 0.08
SWS (ml/min)	0.80 ± 0.25	1.05 ± 0.30*	1.35 ± 0.40
Salivary pH	7.5 ± 0.4	7.2 ± 0.3*	6.9 ± 0.2
Salivary Urea (mg/dL)	110.5 ± 45.6	60.2 ± 30.1*	32.5 ± 18.3
Phosphate (mM)	7.8 ± 2.1	5.1 ± 1.7*	4.2 ± 1.3
Total Protein (g/dL)	1.8 ± 0.6	1.4 ± 0.5*	0.9 ± 0.3

*Significant vs pre-HD (p < 0.01)

Oral Examination Findings

• DMFT: 17.4 ± 5.2 in HD vs 10.2 ± 3.7 in controls (p < 0.01)
• Mucosal dryness in 30%, tongue coating in 40%

Correlation Analysis

• Negative correlation between HD duration and UWS (r = –0.42	• p < 0.01)
• Positive correlation between IDWG and xerostomia (r = 0.47	• p < 0.01)
• Negative correlation between phosphate and UWS (r = –0.39	• p < 0.05)

DISCUSSION

This research substantiates the existence of considerable salivary gland dysfunction in HD patients in Peshawar, which is in line with the findings of other studies conducted internationally (5,8). The pre-dialysis samples showed significant decreases in salivary flow as well as increases in urea, phosphate, and pH. These changes are partially reversed after HD, which suggests that the elimination of uremic toxins contributes to the temporary recovery.

It is consistent with previous observations (5,8) that the prevalence of xerostomia is quite high, at 70%. Another conclusion that was validated by Crestário et al. (5) was that IDWG had a substantial positive connection with xerostomia, which indicated that the individual was compensating for oral discomfort by consuming more fluids.

During the oral examination, a significant prevalence of caries and mucosal changes were found, which is in line with the oral health vulnerability that is known to be present in renal patients (9,10). The higher DMFT scores in this sample highlight the importance of nephrology clinics providing preventative dental care and monitoring salivary flow.

It is important to note that this study utilized diagnostic instruments that were straightforward, inexpensive, and easily accessible in the region. As a result, the findings are highly applicable for the introduction of routine HD centers in Pakistan.

CONCLUSION

It is common for HD patients in Peshawar to have dysfunctional salivary glands, which can manifest in a variety of ways, including hyposalivation, higher salivary urea and phosphate levels, and a high xerostomia burden. The duration of HD and the amount of weight gained between dialysis are correlated with these changes. The early diagnosis of oral health problems using salivary analysis and integrated oral healthcare has the potential to considerably enhance both clinical results and quality of life.

REFERENCES

1. Kaya M, Cermik TF, Ustun F, Şen S, Berkarda Ş. Salivary function in patients with chronic renal failure undergoing hemodialysis. Annals of Nuclear Medicine [Internet]. 2002 Apr 1;16(2):117–20. Available from: https://link.springer.com/article/10.1007%2FBF02993714
2. Bossola, M. (2019). Xerostomia in patients on chronic hemodialysis: An update. *Seminars in Dialysis*, *32*(5), 467–474. https://doi.org/10.1111/SDI.12821
3. Kaushik, A., Reddy, S. S., Umesh, L., Devi, B. K. Y., Santana, N., & Rakesh, N. (2013). Oral and salivary changes among renal patients undergoing hemodialysis: A cross-sectional study. *Indian Journal of Nephrology*, *23*(2), 125–129. https://doi.org/10.4103/0971-4065.109421
4. Kumar, T., Kishore, J., Kumari, M., Rai, A., Rai, S., & Jha, A. (2020). Evaluation of salivary flow rate, pH, and buffer capacities in end-stage renal disease patients versus control - A prospective comparative study. *Journal of Family Medicine and Primary Care*, *9*(6), 2985–2989. https://doi.org/10.4103/JFMPC.JFMPC_242_20
5. Crestário R, Silva MM, Almeida C, et al. Hemodialysis-specific factors associated with salivary flow rates. Nephrol Dial Transplant. 2014;29(10):1889–95.
6. Anees M, Mumtaz A, Ibrahim M, et al. Dialysis-related factors affecting QOL in HD patients. J Coll Physicians Surg Pak. 2011;21(7):371–5.
7. Slade GD. Derivation and validation of a short-form oral health impact profile. Community Dent Oral Epidemiol. 1997;25(4):284–90.
8. Naru AS, et al. Evaluation of salivary parameters and oral manifestations in chronic renal failure. J Coll Physicians Surg Pak. 2015;25(12):890–4.
9. Bayraktar G, et al. Evaluation of salivary parameters and dental status in dialysis patients. Oral Dis. 2008;14(6):546–51.
10. Klassen JT, Krasko BM. Dental health status of dialysis patients. J Can Dent Assoc. 2002;68(1):34–8.