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# SALIVARY CHANGES AND THEIR ROLE IN ORAL PATHOLOGY IN CHILDREN UNDERGOING HEMODIALYSIS

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## ABSTRACT

**Background:** Saliva plays a crucial role in maintaining oral homeostasis, including mechanical cleansing, buffering capacity, remineralization, and antimicrobial defense. In children with chronic kidney disease (CKD) undergoing hemodialysis, systemic disturbances significantly affect salivary function and composition, contributing to the development of oral diseases.

**Objective:** To evaluate salivary parameters and their association with oral pathology in children undergoing hemodialysis.

**Materials and Methods:** The study included 90 children aged 6–12 years divided into three groups: hemodialysis patients receiving comprehensive treatment (n=30), hemodialysis patients receiving standard treatment (n=30), and healthy controls (n=30). Salivary flow rate, pH, and buffering capacity were assessed alongside clinical indices (DMF, OHI-S, PI, PMA). Statistical analysis included Student's t-test and Pearson correlation.

**Results:** Children undergoing hemodialysis demonstrated significantly reduced salivary flow rate and buffering capacity, along with altered pH levels ($p<0.05$). These changes were associated with increased caries intensity and poor oral hygiene. Significant correlations were found between salivary parameters and clinical indices.

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**Conclusion:** Salivary dysfunction plays a key role in the development of oral pathology in children undergoing hemodialysis. Assessment of salivary parameters is essential for early diagnosis and targeted preventive strategies.

**KEYWORDS:** Hemodialysis, chronic kidney disease, saliva, xerostomia, buffering capacity, children, dental caries, oral hygiene

## INTRODUCTION

Saliva is a fundamental biological fluid responsible for maintaining oral homeostasis. It performs multiple protective functions, including lubrication, mechanical cleansing, buffering of acids, remineralization of dental tissues, and antimicrobial activity. Any disturbance in salivary quantity or quality may lead to significant alterations in the oral environment and contribute to the development of dental diseases [1.2].

Children with chronic kidney disease (CKD), particularly those undergoing hemodialysis, represent a high-risk group for oral pathology. CKD is associated with systemic metabolic disturbances, including uremia, electrolyte imbalance, and immune dysfunction, which can directly or indirectly affect salivary glands. As a result, salivary secretion rate, pH, and biochemical composition are frequently altered in these patients [3.4].

Reduced salivary flow rate (xerostomia) is one of the most commonly reported findings in children undergoing hemodialysis. This condition may be caused by fluid restriction, medication use, and salivary gland dysfunction. Xerostomia impairs the natural cleansing of the oral cavity, promotes plaque accumulation, and increases the risk of dental caries and periodontal diseases [5.6].

In addition to quantitative changes, qualitative alterations in saliva are also significant. Variations in pH and buffering capacity influence the balance between demineralization and remineralization processes. Although increased urea concentration in saliva may lead to a more alkaline environment, decreased

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buffering capacity reduces the ability to neutralize acids, thereby facilitating enamel demineralization [7.8].

Furthermore, changes in salivary composition, including reduced antimicrobial components such as lysozyme and immunoglobulins, may contribute to microbial imbalance. This promotes the growth of cariogenic and opportunistic microorganisms, further exacerbating oral disease progression.

Despite increasing evidence regarding salivary alterations in CKD patients, the relationship between salivary parameters and clinical oral health indicators in children undergoing hemodialysis remains insufficiently studied. Understanding this relationship is essential for developing effective preventive and therapeutic strategies [9.10].

Therefore, the aim of this study was to evaluate salivary changes and their association with oral pathology in children undergoing hemodialysis.

## MATERIALS AND METHODS

This study was designed as a prospective, controlled clinical investigation aimed at evaluating salivary changes and their association with oral pathology in children with chronic kidney disease (CKD) undergoing hemodialysis. The research was conducted at the clinical bases and специализирован nephrology departments of the Bukhara State Medical Institute.

A total of 90 children aged 6–12 years participated in the study. The participants were divided into three groups: the main group (n = 30), consisting of children with CKD undergoing hemodialysis who received a comprehensive, pathogenetically oriented treatment approach; the comparison group (n = 30), including children with CKD undergoing hemodialysis who received standard dental care; and the control group (n = 30), composed of systemically healthy children.

Inclusion criteria for the main and comparison groups included a confirmed diagnosis of CKD, regular hemodialysis treatment, age between 6 and 12 years,

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and the ability to undergo clinical examination. Exclusion criteria were acute infectious diseases, severe systemic conditions not related to CKD, conditions affecting salivary gland function unrelated to renal pathology, and lack of parental informed consent. The control group consisted of children without systemic diseases and with comparable age distribution.

All participants underwent a comprehensive clinical dental examination under standardized conditions using dental mirrors, probes, and artificial illumination. Oral health status was assessed using the DMF index to evaluate caries intensity, the OHI-S index (Green–Vermillion) to assess oral hygiene, the Plaque Index (PI, Silness–Löe) to determine plaque accumulation, and the PMA index to evaluate gingival inflammation.

Salivary parameters were assessed using unstimulated whole saliva collected in the morning under standardized conditions. Participants were instructed to refrain from eating and drinking for at least 2 hours prior to sample collection. Salivary flow rate was measured методом спиттинга (spitting method) over a 5-minute period and expressed in mL/min. Salivary pH was determined using indicator strips and verified with a digital pH meter when available. Buffering capacity was assessed using standard titration methods.

In addition to salivary analysis, selected biochemical parameters were evaluated in venous blood samples collected under fasting conditions. These included serum calcium and phosphorus levels, which were analyzed using standard biochemical techniques in certified laboratories.

All clinical and laboratory data were recorded in standardized examination forms and subsequently entered into a database for statistical analysis. Quantitative data were expressed as mean values with standard error ($M \pm m$). Differences between groups were analyzed using Student's t-test, and relationships between salivary parameters and clinical indices were evaluated using Pearson's correlation coefficient (r). A p-value of less than 0.05 was considered statistically significant.

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The study was conducted in accordance with ethical principles for medical research involving human subjects. Written informed consent was obtained from parents or legal guardians of all participants, and confidentiality as well as participant safety were strictly maintained throughout the study.

## RESULTS

The analysis of salivary parameters demonstrated significant alterations in children with chronic kidney disease (CKD) undergoing hemodialysis compared to healthy controls. These changes were observed both quantitatively and qualitatively and were closely associated with deterioration of oral health status. Salivary flow rate was significantly reduced in children undergoing hemodialysis. The lowest values were observed in the main group, while the comparison group showed moderately decreased values, and the control group demonstrated normal salivary secretion ($p < 0.05$). Reduced salivary flow indicates the presence of xerostomia, which negatively affects oral self-cleansing mechanisms and способствует накоплению зубного налета.

**Table 1. Salivary parameters in study groups (M ± m)**

| Parameter | Main group (n=30) | Comparison group (n=30) | Control group (n=30) |
|---|---|---|---|
| Salivary flow rate (mL/min) | 0.28 ± 0.03 | 0.36 ± 0.04 | 0.52 ± 0.05 |
| pH | 7.58 ± 0.12 | 7.32 ± 0.10 | 6.92 ± 0.08 |
| Buffer capacity (units) | 3.12 ± 0.18 | 3.86 ± 0.16 | 5.21 ± 0.20 |

As shown in Table 1, salivary flow rate and buffering capacity were significantly reduced in children undergoing hemodialysis, while pH values were shifted toward alkaline levels. Although increased pH may appear protective, reduced

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buffering capacity limits the ability to neutralize кислотные воздействия, thereby promoting demineralization processes.

Clinical dental indices confirmed the negative impact of salivary changes on oral health. Children with reduced salivary function exhibited significantly higher DMF, OHI-S, PI, and PMA values compared to controls ($p < 0.05$). The main group demonstrated the most severe clinical findings.

**Table 2. Oral health indices in study groups (M ± m)**

| Index | Main group | Comparison group | Control group |
|---|---|---|---|
| DMF | 14.28 ± 0.76 | 11.61 ± 0.71 | 6.12 ± 0.45 |
| OHI-S | 2.83 ± 0.14 | 2.21 ± 0.12 | 1.19 ± 0.06 |
| Plaque Index (PI) | 2.39 ± 0.15 | 1.87 ± 0.10 | 0.91 ± 0.04 |
| PMA (%) | 45.8 ± 1.8 | 33.6 ± 1.6 | 18.1 ± 1.0 |

The prevalence of xerostomia-related complaints was significantly higher in children undergoing hemodialysis. Subjective symptoms such as oral dryness, difficulty in swallowing, and discomfort during speech were frequently reported, particularly in the main group.

**Table 3. Prevalence of salivary dysfunction and related symptoms (%)**

| Parameter | Main group | Comparison group | Control group |
|---|---|---|---|
| Xerostomia | 72.2% | 48.6% | 10.3% |
| Reduced salivary flow | 68.5% | 44.1% | 8.7% |
| Increased plaque accumulation | 75.4% | 52.8% | 18.2% |

Correlation analysis revealed significant relationships between salivary parameters and clinical dental indices. A moderate negative correlation was observed between salivary flow rate and DMF index ($r = -0.59$), indicating that reduced salivary secretion is associated with higher caries intensity. Similarly,

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buffering capacity showed a negative correlation with plaque accumulation (r = -0.55) and gingival inflammation (r = -0.57).

In contrast, salivary pH demonstrated a weaker and less consistent correlation with clinical indices, suggesting that buffering capacity and flow rate play a more critical role in maintaining oral homeostasis.

Overall, the results indicate that salivary dysfunction is a key contributing factor in the development of oral pathology in children undergoing hemodialysis. Reduced salivary flow and buffering capacity create favorable conditions for plaque accumulation, microbial imbalance, and dental tissue demineralization.

Furthermore, children receiving comprehensive treatment showed relatively improved salivary parameters compared to those receiving standard care, indicating the potential effectiveness of pathogenetically oriented therapeutic approaches.

## DISCUSSION

The present study demonstrates that salivary dysfunction is a key factor contributing to the development of oral pathology in children with chronic kidney disease (CKD) undergoing hemodialysis. The observed reduction in salivary flow rate, decreased buffering capacity, and alterations in pH confirm that systemic metabolic disturbances significantly affect the functional state of salivary glands and, consequently, oral homeostasis.

One of the most important findings is the marked decrease in salivary flow rate in children undergoing hemodialysis. This condition, commonly referred to as xerostomia, has been widely reported in patients with renal disease and is associated with fluid restriction, medication use, and salivary gland dysfunction. Reduced salivary secretion compromises the natural cleansing of the oral cavity, leading to increased plaque accumulation and microbial colonization. This mechanism explains the significantly higher values of DMF, OHI-S, and Plaque Index observed in the study groups.

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In addition to quantitative changes, qualitative alterations in saliva also play a crucial role. The study revealed a significant decrease in buffering capacity, which is essential for neutralizing acids produced by oral microorganisms. Although salivary pH was found to be slightly elevated in hemodialysis patients, this does not compensate for the reduced buffering capacity. As a result, the oral environment becomes more susceptible to fluctuations in acidity, promoting enamel demineralization and caries progression. This finding highlights that buffering capacity is a more reliable indicator of oral protective function than pH alone.

The correlation analysis further supports the pathogenetic role of salivary dysfunction. The negative relationship between salivary flow rate and DMF index ($r = -0.59$) indicates that reduced saliva production is directly associated with increased caries intensity. Similarly, the inverse correlation between buffering capacity and both plaque accumulation and gingival inflammation demonstrates that salivary protective mechanisms are essential in preventing microbial overgrowth and inflammatory processes. These findings emphasize that salivary parameters are not only diagnostic indicators but also active contributors to disease development.

Another important aspect is the interaction between salivary changes and systemic metabolic disturbances. In CKD patients, uremic toxins, electrolyte imbalance, and immune dysfunction may impair salivary gland function and alter saliva composition. These systemic factors, combined with local changes in the oral cavity, create a multifactorial environment that accelerates the progression of dental diseases. Therefore, oral pathology in children undergoing hemodialysis should be considered a manifestation of both local and systemic pathological processes

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## CONCLUSION

The study demonstrated that children with chronic kidney disease undergoing hemodialysis exhibit significant salivary dysfunction, characterized by reduced salivary flow rate, decreased buffering capacity, and altered pH levels.

These salivary changes were found to be significantly associated with deterioration of oral health status, including increased caries intensity, poor oral hygiene, and higher prevalence of gingival inflammation.

Correlation analysis confirmed that reduced salivary flow and buffering capacity play a key pathogenetic role in the development of oral diseases, highlighting their importance as diagnostic and prognostic indicators.

The findings indicate that salivary dysfunction in children undergoing hemodialysis is closely linked to systemic metabolic disturbances and should be considered an integral component of disease pathogenesis.

A comprehensive, pathogenetically oriented treatment approach improves salivary parameters and clinical outcomes, emphasizing the need for integrated and multidisciplinary management strategies in this high-risk population.

## REFERENCES

1. Kshirsagar, A. V., Moss, K. L., Elter, J. R., Beck, J. D., & Offenbacher, S. (2005). Periodontal disease is associated with renal insufficiency in the Atherosclerosis Risk in Communities (ARIC) study. American Journal of Kidney Diseases, 45(4), 650–657.

2. Davidovich, E., Davidovits, M., Eidelman, E., Schwarz, Z., & Bimstein, E. (2005). Pathophysiology, therapy, and oral implications of renal failure in children and adolescents. Pediatric Dentistry, 27(2), 98–106.

3. Nunn, J. H., Sharp, J., Lambert, H. J., Plant, N. D., & Coulthard, M. G. (2000). Oral health in children with renal disease. Pediatric Nephrology, 14(10–11), 997–1001.

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4. Klassen, J. T., & Krasko, B. M. (2002). The dental health status of dialysis patients. Journal of the Canadian Dental Association, 68(1), 34–38.
5. Bots, C. P., Brand, H. S., Veerman, E. C., van Amerongen, B. M., Valentijn-Benz, M., & Veerman, E. C. (2006). Oral and salivary changes in patients with end stage renal disease. Clinical Oral Investigations, 10(1), 17–21.
6. Kho, H. S., Lee, S. W., Chung, S. C., & Kim, Y. K. (1999). Oral manifestations and salivary flow rate, pH, and buffer capacity in patients with end-stage renal disease. Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology, 88(3), 316–319.
7. Proctor, R., Kumar, N., Stein, A., Moles, D., & Porter, S. (2005). Oral and dental aspects of chronic renal failure. Journal of Dental Research, 84(3), 199–208.
8. Bayraktar, G., Kurtulus, I., Kazancioglu, R., Bayramgurler, D., Bural, C., & Bozfakioglu, S. (2007). Evaluation of periodontal parameters in patients undergoing peritoneal dialysis or hemodialysis. Oral Diseases, 13(4), 393–397.
9. Craig, R. G. (2008). Interactions between chronic renal disease and periodontal disease. Oral Diseases, 14(1), 1–7.
10. Fisher, M. A., Taylor, G. W., Shelton, B. J., Jamerson, K. A., Rahman, M., Ojo, A. O., & Sehgal, A. R. (2008). Periodontal disease and other nontraditional risk factors for CKD. American Journal of Kidney Diseases, 51(1), 45–52.