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Oral Health and Salivary pH Changes in Menopausal Women: A Cross-sectional Study

Shilpa Prasad, BDS^{1*} | Durgadevi Pancharethinam, MDS^{1*} |Sabitha Gokulraj, MDS^{1*} | Kumar A, MDS^{1*}

¹Department of Oral Medicine and Radiology, Vinayaka Mission's Sankarachariyar Dental College, Vinayaka Mission's Research Foundation, Salem, Tamil Nadu, 636008, India

Correspondence

Dr. Durgadevi Pancharethinam, Assistant Professor, Department of Oral Medicine and Radiology, Vinayaka Mission's Sankarachariyar Dental College, Vinayaka Mission's Research Foundation, Salem, Tamil Nadu, 636008, India
Email: dr.durgadevi8@gmail.com

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Abstract

Introduction: Menopause is a natural process in life of women often associated with hormonal changes. It affects oral health by influencing the growth of bacteria and plaque, which can cause tooth decay and gum disease. Menopause can alter salivary pH by reducing estrogen levels, which may lead to dry mouth, inflammation, and increased risk of infections. Therefore, it is important for women in menopause to monitor their salivary pH and maintain good oral hygiene habits. However, there is contradictory evidence about the level of salivary pH and oral symptoms. The present study was carried out to assess the oral findings and salivary pH in premenopausal and postmenopausal women. **Methods:** The study was carried out on 60 patients who reported to the Department of oral medicine and radiology and were divided into two groups consisting of 30 patients each. Group 1: premenopausal women with no known systemic illness and deleterious habits. Group 2: postmenopausal women. **Results:** Salivary pH is higher in postmenopausal women than in premenopausal women. Both pre and postmenopausal women have oral symptoms such as dry mouth, facial pain, and ulcerative lesions, but they are more frequent in postmenopausal women. **Conclusions:** Menopause affects the oral health and salivary pH of women. Postmenopausal women are more prone to oral diseases and have lower salivary pH than premenopausal women. Salivary pH may be used as a biomarker for oral health status in postmenopausal women.

KEYWORDS

Salivary pH; Menopause; Dry Mouth; Facial Pain; Dentist; Health Quality; Well-being

1 | INTRODUCTION

Women go through a physiological process called menopause that results in both systemic and oral adaptations. Menopause, which literally translates as "without estrogen," is the point in a woman's life when her men-

strual cycle stops. Menopause is typically defined as the day of the last menstrual period and, as such, is a brief and discrete time (an interruption of 12 months). During the transition period to menopause, there are changes in hormones.¹ Studies have observed changes in follicle

* All authors have contributed equally.

stimulating hormone (FSH) and estrogen in menopausal women.² These changes in hormones are responsible for several physical and psychological changes, such as hot flashes, sleep disruption, lower energy, emotional instability, and weight gain.³ These often lead to a decrease in productivity and quality of life.⁴ Not only do hormonal changes affect the body, but they also have an impact on the oral cavity. The studies have observed changes in oral mucosa in early or start of menopause, such as dry mouth (xerostomia) and mucosal infections.⁵

Oral Mucosa and salivary gland expresses the estrogen receptors on cells through which estrogen exert its actions.⁶ Further, these hormones also interact on with fibroblast.⁷ These changes usually are of inflammatory in nature such as gingivitis, mucosal ulceration. It was suggested that hormones could alters the salivary flow through their action in estrogen receptors; although, studies have contradicted these findings.⁸ Reduced salivary flow is responsible of oral discomfort, root caries, periodontal disease, and taste changes after menopause. Further, these symptoms can aggravate menopause symptoms in women. Therefore, it is important to take identify them in early stages as well as address them to reduce the discomfort and improve quality of life. Saliva is most often affect component of oral cavity through action of hormones on salivary gland. It can give the early sign of menopause in women. Further, studies have observed the decrease in salivary flow rate, pH in postmenopausal women compared to premenopausal women.⁹ However, Laine et al study did not find any difference in salivary pH in pre and post menopause women.¹⁰ Salivary pH play significant role in oral health maintenance and can prevent oral disease such as gingivitis, dental caries. Hence, it is important to understand the change in salivary pH. Further, being non-invasive it is ideal fluid of routine examination. Therefore, the present study was carried out to assess the oral findings and salivary pH in pre-menopausal and post-menopausal women.

2 | METHOD

The study was conducted in the Department of Oral Medicine and Radiology, Vinayaka Mission Sankarachariyar Dental College and Hospitals and in Central Research Laboratory. The study sample consisted of 60 women,

divided into two groups: Group A (n=30) included premenopausal women with regular menstrual cycles, and Group B (n=30) included post-menopausal women who had experienced menopause for more than one year. Written consent was obtained from all participants before the study.

2.1 | Eligibility criteria

2.1.1 | Inclusion criteria

- Women between 30 and 70 years old
- 30 pre-menopausal women with regular periods
- 30 post-menopausal women having episodes of menopause more than one year
- Women who do not use tobacco, alcohol or other harmful substances

2.1.2 | Exclusion criteria

- Women with diabetes, chronic infections or salivary gland disorders that cause dry mouth
- Women taking medications that affect salivary flow
- Women with autoimmune diseases
- Women who have undergone radiotherapy or chemotherapy
- Women who have become amenorrhoeic due to surgery

Investigator collected 2 ml of unstimulated saliva from each women between 9 AM to 12 PM using the spitting method, after ensuring they met the inclusion and exclusion criteria. Further, pH of the saliva samples was measured using a digital pH meter that was calibrated with buffer solutions of pH 7 and 4. Investigator asked the individuals about their dry mouth, taste and breath changes, mucosal/facial pain, burning sensation, and burning mouth syndrome symptoms, and examined their oral cavity for any signs of ulceration, white and red lesions. All the relevant information was recorded in a proforma. The descriptive statistical analysis and Mann-Whitney U test was used to analyze the results with the statistical significance at $p < 0.05$.

3 | RESULTS

The average age of women having menopause was 39 years, with a standard deviation of 5.86 years, while

the average age of women who have reached menopause was 54.20, with a standard deviation of 6.98. The data indicates a higher variation in the postmenopausal group than in the premenopausal group (Table 1).

TABLE 1 Mean age in premenopausal and postmenopausal women

Groups	N	Mean age (year)	SD
Pre-menopausal	30	29	5.86
Post-menopausal	30	54.20	6.98

In this present study, we measured the salivary pH of premenopausal and postmenopausal women. The average salivary pH was 6.32 ± 0.50 for premenopausal women and 6.93 ± 0.58 for postmenopausal women. We used a 95% confidence interval (CI) to estimate the range of the true population mean. The CI was 5.88 - 6.82 for premenopausal women and 6.35 - 7.51 for postmenopausal women. We also performed a statistical test to compare the mean salivary pH of the two groups. The P value less than 0.01, was considered as a significant difference (Table 2).

In context to oral health symptoms and salivary pH, the study observed that postmenopausal women had a higher prevalence of oral symptoms than premenopausal women. Specifically, we found a statistically significant difference between the two groups in terms of salivary pH ($p < 0.05$), dry mouth ($p < 0.05$), facial pain ($p = 0.03$), and ulcerative lesion ($p = 0.04$). These findings suggest that hormonal changes during menopause may affect oral health, salivary pH and quality of life in women.

4 | DISCUSSION

Saliva plays a vital role in maintaining the oral tissue health and offering a non-invasive method.¹¹ However, when the quantity or quality of saliva is compromised, it can lead to various issues. The hormonal changes before menopause have an impact on the immune system and the oral health of women.¹² Therefore, it is important to have a comprehensive understanding of the oral health

condition of patients who are undergoing or approaching menopause. Recently, researchers and health policymakers have started to focus on and increase their interest in menopause as a global condition affecting millions of women. Further, to advocate on measures to have longer and better quality of life in those women as the hormonal changes can also result in oral changes which can further reduce the quality of life.

It was noticed that hormonal change have effect on saliva composition that directly linked to its pH. Usually saliva is neutral tightly maintained by buffering system and maintaining salivary pH is crucial to oral health.¹³ However, certain condition^{10,14-17} including the hormonal imbalance such as menopause can altered the salivary pH. In present study, there is a significant difference in the salivary pH between premenopausal and postmenopausal women. The average salivary pH was higher in postmenopausal women compared to premenopausal women. This was in contrast to Foglio-Bonda et al, where they observed lower salivary pH values.¹⁸ Lower (acidic) salivary pH increases the incidence of dental caries by creating the environment conducive to bacterial growth.¹⁹ Further, it can induces the periodontitis and bone destruction. These contradicting findings indicates the influence of different factors in maintenance of salivary pH. In addition to the difference in salivary pH, the study also found that postmenopausal women had a higher prevalence of oral symptoms than premenopausal women. Specifically, there were statistically significant differences between the two groups in terms of dry mouth, facial pain, and ulcerative lesions. Similar, oral changes have been reported in studies on menopause women.²⁰

One of the main oral health problems of these patients is dry mouth, which is characterized by dryness, thick and stringy saliva, difficulty in chewing, speaking, and swallowing, sore throat and hoarseness, dry or cracked tongue, and altered taste sensation. These patients may also suffer from dental or facial pain, ulcerative lesions, and dry mouth. According Jacob et al. it is more prevalent in menopause women.²¹ This could be due to reduction in salivary flow. Studies have found significant association between menopause and salivary flow rate. Similar, observations were noted in present study. In

present study, majority postmenopausal women had dry mouth.¹⁰ However, Minicucci et al. suggested that reduction in saliva flow might not always associated with clinical symptoms of xerostomia.²² In that case, it may be possible to be associated with stress in menopause women. It is evident from correlation of salivary cortisol and xerostomia.²³ Similarly, association is also evident between salivary progesterone and dryness.²⁴ However, exact mechanism is not clear.

Dryness or xerostomia make the oral mucosa susceptible to ulceration, and infection. As result, person feels facial pains due to constant friction during oral function. Facial pain can be of varying degree depending upon the involvement of oral tissue. Dryness often lead to small mucosal ulceration which often developed and have superadded infection. In present study, facial pain and ulceration were more evident in postmenopausal women compared to premenopausal. Besides oral mucosal pain, postmenopausal women are reported to be prone for trigeminal neuralgia and have high prevalence among postmenopausal women.²⁵ Mechanism behind these are yet to be clear and may warrant further studies.

Overall, the results of this study suggest that menopause may be associated with changes in oral health, including changes in salivary pH and an increased prevalence of oral symptoms. These findings suggest that hormonal changes during menopause may have an impact on oral health and quality of life in women. Further research may be needed to better understand the mechanisms underlying these changes and to develop interventions to improve oral health in postmenopausal women.

5 | CONCLUSION

Menopause affects the oral health and salivary pH of women. Postmenopausal women are more prone to oral diseases and have lower salivary pH than premenopausal women. Salivary pH may be used as a biomarker for oral health status in postmenopausal women.

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Conflict of interest

The authors have no conflicts of interest to declare.

Supporting Information

Additional supporting information may be found at the journal's website.

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TABLE 2 Comparison of mean salivary pH between pre- and post-menopausal women using student't' test

Groups	N	Mean \pm SD	95% CI	P-value
Premenopausal	30	6.32 \pm 0.50	5.88 - 6.82	0.001
Postmenopausal	30	6.93 \pm 0.58	6.35 - 7.51	