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Original Article

EVALUATION OF POSTMENOPAUSAL WOMEN'S VITAMIN D LEVELS, PERIODONTAL HEALTH, AND ORAL MANIFESTATIONS

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ABSTRACT

Objectives: *Women's periodontal health may be impacted by the hormonal changes that occur throughout puberty, pregnancy, and menopause. When there is no underlying illness and amenorrhea lasts for 12 months, natural menopause takes place. Whether the menopause was forced or spontaneous, the time after the final menstrual cycle is referred to as the post-menopause.*

Materials and Methods: *Fifty postmenopausal women between the ages of 50 and 65 who were in good overall health were included. Every participant possessed at least 20 natural teeth. A history of hysterectomy & hormone alternate therapy, the use of xerogenic medications & vitamin D supplements, a history of periodontal handling within the previous 12 months, & adverse habits were the exclusion criteria.*

Results: *In postmenopausal women, an evaluation of oral symptoms revealed that 20 (40%) had taste change, 27 (54%) had burning mouth syndrome, and 32 (64%) had xerostomia. 31 (62%) of the patients had a lower salivary flow rate. Forty-three (86%) participants had in sufficient salivary vitamin D levels while, five subjects (10%), and two subjects (4%), had deficient and sufficient salivary vitamin D levels respectively.*

Conclusion: *The study concludes that postmenopausal women's oral and periodontal health is greatly impacted by hormonal changes that occur after menopause, including estrogen deficit and vitamin D insufficiency.*
Key words: *Oral Manifestation, Post menopausal, Salivary Flow, Periodontitis, Vitamin D.*

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INTRODUCTION

Periodontal disease is an inflammatory state brought on by bacterial invasion, which is trailed by a host-bacterial interface that results in the destruction of gingival connective tissue & the supporting alveolar bones[1]. But the disease's start, severity, & course depend on several risk factors (such as smoking, hormonal changes, etc.) as well as personal vulnerability. The growth and integrity of the skeleton as well as the oral cavity, particularly the periodontium, are known to be significantly impacted by the sex steroid hormones estrogen and oestradiol[2]. Women's periodontal health may be impacted by the hormonal changes that occur throughout puberty, pregnancy, and menopause. When there is no underlying illness and amenorrhea lasts for 12 months, natural menopause takes place. Whether the menopause was forced or spontaneous, the time after the final

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menstrual cycle is referred to as the post-menopause[3].

Ovarian function declines as a woman gets closer to menopause age, and the amount of estrogen in the blood decreases significantly throughout the late luteal & follicular stages of the menstrual cycle[4]. The gingiva has been shown to contain estrogen receptors, making it a target organ[5]. Furthermore, the receptors were found in the fibroblasts & osteoblasts of the periodontal ligament, periosteum & lamina propria[6]. Postmenopausal women frequently complain of mouth soreness in accumulation to a range of climacteric symptoms[7]. Changes in taste perception, burning in the mouth, and enhanced dryness of the oral mucosa are frequently noted. Today, vitamin D deficiency is considered an epidemic and a serious public health concern[8]. A steroid hormone, vitamin D is essential for the metabolism of calcium & bone, cell development and differentiation, immunological regulation, cardiovascular health, and antibacterial activity. By protecting the periodontal tissues, additionally, it is recognized to have an impact on the pathogenesis of periodontal disease[9].

Additionally, a particular vitamin D receptor was discovered in the junctional epithelium, which was believed to strengthen the periodontium's host-immune response. The enzyme that activates vitamin D functions better when estrogen is present[10]. However, vitamin D insufficiency may arise because estrogen levels significantly decrease after menopause. Considering this, the study's objective was to evaluate postmenopausal women's salivary vitamin D levels, periodontal health, and oral symptoms.

MATERIALS AND METHODS

The study's subjects were drawn from the Abbottabad International Medical and Dental College's Department of Periodontology in Abbottabad. All members gave their cognisant permission after being fully educated about the study's nature & objectives of the current study. The Institutional Ethics and Research Committee gave its approval to the project (ERC/AIMDC/2024/09). Fifty postmenopausal women between the ages of 50 and 65 who were in good overall health were included after calculation with Arifin (2023) calculator. Every participant possessed at least 20 natural teeth. A history of hysterectomy & hormone alternate remedy, the use of xerogenic medications & vitamin D supplements, a history of periodontal treatment within the previous 12 months, & adverse habits were the exclusion criteria. Three researchers investigated over seven months, from February to August 2024.

The demographic information, prior medical history, and prior dental history were entered using a standard pro forma. To determine the state of periodontal health, a thorough intraoral examination was conducted. Clinical periodontal parameters included probing depth (PD), clinical attachment loss (CAL), plaque index (PI), and full-mouth bleeding on probing (BOP). The symptoms associated with oral menopausal signs were evaluated using a standard questionnaire. A yes/no response was recorded for each question pertaining to the individuals' mouth dryness symptoms. Similar questions on the location, severity, and duration of the symptoms were used to evaluate burning mouth syndrome. Modified Schirmer test strips were used to measure the un-stimulated salivary flow rate. It was first derived from the Schirmer tear test, also known as tear touch, which ophthalmologists frequently use to measure tear production. Before the test, the patients were instructed to swallow all their saliva while sitting up straight in a dentist chair. To prevent the tongue from hitting the hard palate while taking measurements, they were also told to keep their tongue against it. A cotton plier was then used to hold the strip vertically. The dark dye moves up the strip when the round end comes into touch with saliva. At one, two, and three minutes, the distance was measured. Hyposalivation was identified at 3 minutes when the colour changed by less than 25 mm. Using a draining technique, a 5 mL unstimulated saliva sample was taken from the chosen subjects. To permit the saliva to submissively flow from the lower lip into the sterile saliva collecting container, individuals were told to sit with their head bowed down & their mouth vaguely exposed. After being moved to the Central Research Laboratory, the collected samples were centrifuged for twenty mins at 2500 rpm, & the supernatant was then kept at -70°C. All individuals' salivary samples were quantitatively determined in vitro using a Calbiotech, Inc. salivary vitamin D ELISA kit. Vitamin D levels were measured within the following reference range: <10 ng/mL (deficient), 10–30 ng/mL (insufficient), and 30–100 ng/mL (sufficient).

Epi Info software was used to determine the sample size. For continuous data, the descriptive statistics (mean & standard deviation) were figured, while for

categorical variables, the frequency & percentage were determined. The periodontal health and salivary vitamin D levels were correlated using Spearman's correlation. Software called SPSS version 26 was used to do the analysis.

Post-hoc power analysis. With the achieved sample size of n = 50, two-tailed α = 0.05 and power = 0.80, the study had sufficient power to detect correlations of approximately $|r| \geq 0.39$. Therefore, the study is adequately powered to identify moderate or larger monotonic associations between salivary vitamin D levels and clinical periodontal indices, but it may be underpowered to detect small effect sizes.

RESULT

The study had 50 individuals in total. As shown in the table 1, the average age was 57.11 ± 2.81 years, and the average menopausal duration was 4.06 ± 2.05 years. In postmenopausal women, an evaluation of oral symptoms revealed that 20 (40%) had taste change, 27 (54%) had burning mouth syndrome, and 32 (64%) had xerostomia. (Figure 1) shows that 31 (62%) of the patients had a lower salivary flow rate.

A mean PD of 1.75 ± 0.68, mean PI score of 1.5 ± 0.71, mean CAL of 1.78 ± 0.68, and BOP of 57.81± 4.82 were observed by the periodontal parameters (Table 2).

Table 1: Characteristics of study population

Variable	Maximum-Minimum	Mean + SD
Age (Years)	50-65	57.11 ± 2.81
Duration of menopause (Years)	1-14	4.06 ± 2.05
Oral Discomfort in Post menopausal women	N	%
Taste change	20	(40)
Burning mouth syndrome	27	(54)
Xerostomia (Dryness of mouth)	32	(64)

Table 2: The state of postmenopausal women's periodontal health

Variable	Maximum-Minimum	Mean + SD
Mean PD (mm)	1.7–3.4	1.75 ± 0.68
PI (scores)	0.1–2.0	1.5 ± 0.71
Mean CAL (mm)	1.6–3.4	1.78 ± 0.68
BOP (%)	50–63	57.81± 4.82

Forty-three (86%) participants had insufficient salivary vitamin D level while, five subjects (10%), and two subjects (4%), had deficient and sufficient salivary vitamin D levels respectively (Fig 2).

Salivary vitamin D quantities & periodontal clinical indicators showed a statistically significant strong negative correlation ($p < 0.01$) (Table 3).

DISCUSSION

In a growing population, menopause is nature's defence against reproductive morbidity & death[11]. Depletion of ovarian follicles leads to natural or spontaneous menopause. Estrogen insufficiency is the main cause of the primary effects of menopause. Vasomotor symptoms, osteoporosis, cognitive

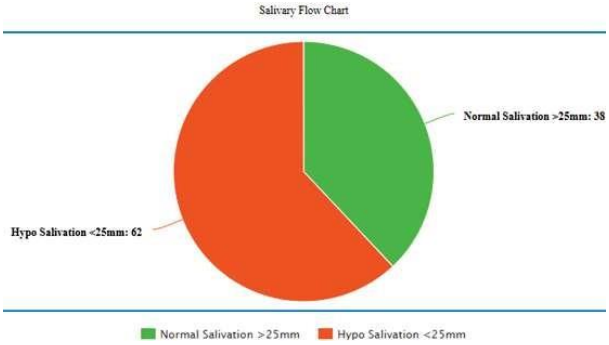

Fig 1: Pie chart showing postmenopausal women's salivary flow rate based on the modified Schirmer test.

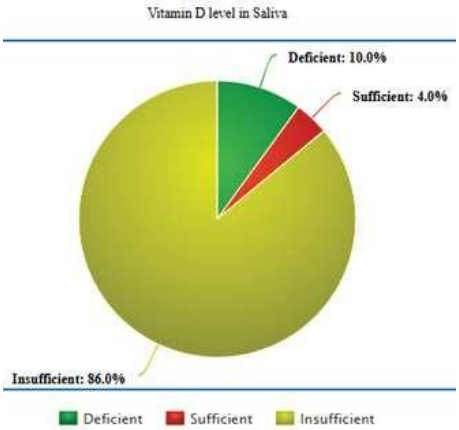

Fig 2: A pie chart showing postmenopausal women's salivary vitamin D levels

Table 3: Association of Salivary vitamin D levels & periodontal health in post-menopausal subjects.

Variable	Spearman's Association	P-value
PD	–1.615	<0.002*
CAL	–0.615	<0.001*
PI	–1.700	<0.003*
BOP	–0.71	<0.001*

impairment, and mental dysfunction are some of the symptoms that are linked to post menopause[12]. Changes in hormone levels affect the oral cavity because the salivary glands and oral mucosa have estrogen receptors. It is also well known that the oral mucosa and vaginal mucosa share traits and react to estrogen in comparable ways. Reduced salivary flow causes dry mouth, dental caries, glossodynia, atrophic gingivitis, altered taste perception, osteoporosis, & periodontal disease, among other oral discomforts. Anxiety is frequently the result of patients' failure to associate these changes with the hormonal shifts that occur throughout menopause[13]. Additionally, vitamin D, a well-known regulator of musculoskeletal health, must be activated by estrogen. Increased bone loss, mood swings, & an added risk of infections and cardiovascular illnesses are all linked to vitamin D insufficiency after menopause[11-15]. Participants in the current cross-sectional study reported 32 cases (64%) of xerostomia, 27 cases (54%) of burning mouth, and 20 cases (40%) of taste change, all of which resulted in discomfort in the mouth (Table 1). In their evaluation of 348 menopausal women's oral health, John et al. (2022)[13] found that the most reported symptoms were dry mouth, burning mouth, and impaired taste perception. Several additional studies also reported an increase in the incidence of mouth pain during menopause. Hormonal variations that result in both vasomotor and neurologic alterations may be the cause of this[11,16-18]. Furthermore, most participants 31 (62%) also showed a decrease in the proportion of unstimulated salivary flow rate (Fig. 1). Similar results have also been observed by several other investigations[11,13,17]. In postmenopausal women, a lack of estrogen may result in decreased salivary flow. The increased prevalence of additional symptoms, such as burning mouth syndrome, taste changes, and periodontal disease, is caused by xerostomia, which is brought on by a decreased salivary flow rate. The BOP (Table 2) and the clinical indicators assessed show how inflamed the periodontium is. The weakening and atrophy of the oral epithelium due to anomalies in its development caused by an estrogen-deficient condition may help to explain this. Additionally, estrogen's suppressive influence on osteoclast action decreases. The oral microcirculation is more tortuous and has a smaller loop diameter.

Additionally, the neutrophil and complement system, which protects against infections, are also frequently impacted by hormone changes. As a result, there is a greater chance of contracting other illnesses, such as periodontal disease. To evaluate the periodontal health condition of 100 postmenopausal women, Uwitonze et al. (2020)[19] found that if proper oral hygiene is not maintained, the participants are at a significant peril of acquiring a destructive periodontal disease. Numerous more studies assessing postmenopausal women's periodontal health have also determined that postmenopausal women may be at risk for developing periodontal disease because of estrogen deficiency.

Vitamin D insufficiency has been linked with decreased estrogen levels following menopause. Forty-three (86%) of the subjects had inadequate vitamin D levels (Fig. 2). One may anticipate a vitamin D shortage because of menopausal hypoestrogenism. The participants may be at risk for osteoporosis, poor bone mineral density, & chronic inflammatory & infectious disorders such as periodontitis as a result. Vitamin D levels & periodontal health were shown to be statistically significantly correlated negatively (Table 3). Low vitamin D levels have also been linked to periodontitis in several other studies. According to a comprehensive study by Qi et al. (2023)[20] individuals with chronic periodontitis had lower vitamin D levels than healthy controls. It has been shown that low vitamin D levels prevent the repair of periodontal tissue, which exacerbates the progression of periodontal disease. The severity of periodontal disease was not evaluated in this study. The cross-sectional study design, the subjective questionnaire used to identify oral symptoms, & the lack of radiographic examination were some of the study's other shortcomings.

CONCLUSION

According to the study's limitations, menopause has a significant impact on vitamin D levels and the state of periodontal health. Therefore, it is critical to raise awareness of dental health issues and highlight the need of vitamin D and other nutritional supplements for postmenopausal women. The study concludes that postmenopausal women's oral and periodontal health is greatly impacted by hormonal changes that occur after menopause, including estrogen deficit and vitamin D insufficiency. Salivary vitamin D levels and indices of periodontal health showed a substantial negative connection, highlight-

ing the necessity of focused therapies to address these deficits. It is advised that more study be done to examine long-term management techniques for enhancing oral health in this group, such as hormone therapy and supplements.

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CONFLICT OF INTEREST
Authors declare no conflict of interest.
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AUTHORS' CONTRIBUTION

The following authors have made substantial contributions to the manuscript as under:

Conception or Design:	MIKJ, MN, NA, HA, N, ZA
Acquisition, Analysis or Interpretation of Data:	MIKJ, MN, NA, HA, N, ZA
Manuscript Writing & Approval:	MIKJ, MN, NA, HA, N, ZA

All the authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.