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Salivary calcium and phosphate in relation to oral health among postmenopausal women in Baghdad governorate

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Abstract

In women approaching menopause many physiological changes take place including oral discomfort in addition to general climacteric complaints. The aim of this study was to evaluate the oral health status in relation to some salivary constituents including calcium and phosphate of pre and postmenopausal women.

Oral health status of 40 women (20 pre-menopause and 20 post-menopause) were examined including (Decayed, Missing, and Filled teeth index (DMFT), gingival index, plaque index, and calculus index). Stimulated whole saliva was collected to determine salivary calcium and phosphate composition. The data were analysed with Student's t-test.

The mean values of pH and flow rate were lower among postmenopausal women than premenopausal one. Plaque, gingival and calculus indices were higher in post-menopause women. Dental caries was also higher among postmenopausal women with a highly significant difference. Concerning the level of salivary calcium and phosphate, both of these elements were significantly higher among premenopausal women than postmenopausal one.

Postmenopausal women showed significantly more oral changes than the premenopausal women. These changes could be related to the hormone alterations. Therefore, it is necessary to take preventive and educational measures targeted at these women.

Key words: Menopause, postmenopausal women, hormone alterations.

Introduction

Natural menopause is defined as a spontaneous cessation of natural menstruation for 12 consecutive months at 45-55 years of age. Formally, menopause is the moment of the final menstruation, directly preceded by the permanent cessation of ovarian follicular function. The average age of a woman at menopause is 51 years [1, & 2]. During the menopause, women go through biological and endocrine changes, particularly in their sex steroid hormone production, affecting their health. Because the oral mucosa contains estrogen receptors, variations in hormone levels will affect the oral cavity. A few oral conditions and or diseases are seen more frequently during post menopausal years [3]. Estrogen can affect oral mucosa

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directly or through neural mechanism thus altering the periodontal health in menopausal women [4]. The principal post-menopausal oral symptoms are sensation of painful mouth (PM) due to various causes and less frequently burning mouth syndrome (BMS). Another common symptom exhibited by menopausal women is dryness of mouth or xerostomia. Saliva acts as a defence mechanism for prevention of caries and reduced salivary flow can encourage oral microbial colonization thus affecting the dental health [5, 6, & 7]. Many studies have attempted to relate certain aspects of salivary output and composition to caries susceptibility. It has been shown that individuals who suffer from low salivary flow rates have higher caries experience than individuals with normal salivary flow rates [8, & 9]. Sex steroid hormones are also responsible for health of periodontium. They can lead to changes in inflammatory mediators, vascular permeability and growth and differentiation of fibroblasts. There are estrogen receptors in osteoblasts and fibroblasts of periodontal tissues, which respond to the varying levels of hormones in different stages of reproductive life and thus affect the health of the periodontium. In addition to that the gums become more susceptible to plaque and thus leading to a much higher risk for gingivitis and advanced periodontitis [10, & 11]. Calcium and phosphate play considerable roles in the physiology of human oral cavity, functioning together in a tightly regulated system, alterations in the level of one of these chemicals have significant effects on the levels of the other [12]. No data available to show altered saliva compositions as well as the oral health status among menopausal women.

This study is designed to evaluate the oral changes in postmenopausal women and to compare the result with regularly menstruating women.

Materials and methods

The study group consisted of 20 healthy postmenopausal women with the mean age of 52 years (range 45-60). The control group consisted of 20 regular menstruating healthy women with mean age of 26 years (range 21-40).Women in both groups had normal chewing ability with no evidence of dry mouth or any salivary gland disorders. Patients who were diabetic, hypertensive, on any medications, completely edentulous were excluded from the study. The women were told not to eat, drink, smoke or wash their teeth for at least one hour before saliva collection. Saliva was collected between 9 and 12 a.m., salivary samples of the control group were collected within the first three days of menstruation. Participants chewed a piece of paraffin of standardized size. The saliva secreted during the first 1 min was swallowed, that secreted during the next 5 min was spat into graduated test tubes. pH strips were used to determine the salivary pH, and the flow rate of saliva was expressed as milliliter per minute (ml/min). Salivary calcium and phosphate were analyzed at the Poisoning Consultation Centre / specialized surgeries hospital. Samples were centrifuged, the clear supernatant was separated by micropipette and was stored at (-20°C) in a deep freeze till being assessed. Calcium ion was determined using Atomic Absorption Spectrophotometer, while phosphate was determined by UV Spectrophotometer. Oral examination was carried out using plane mouth mirror and dental explorer, in addition to CPI (probe) used for the detection of gingival inflammation. The WHO criterion was used for diagnosis of dental caries. The status of permanent

teeth was scored according to the DMFT Index [13]. The Plaque Index of Sillness and Loe (1964) was applied for the assessment of the dental plaque adjacent to gingival margin of six index teeth (Ramfjord) [14]. For each index- tooth, the gingival health was evaluated by the application of Loe and Sillness (1963) [15]. Dental calculus was assessed according to calculus index component of the simplified oral hygiene index of Greene and Vermillion (1964)[16]. Data were analyzed by descriptive statistics, and comparisons between the pre and postmenopausal groups were performed using Student's t-test. The confidence limit was accepted at 95%.

Results

Table (1) shows the mean value of different variables for the postmenopausal and premenopausal women. It has been found that the pH and the flow rate of premenopausal women was higher than that of postmenopausal one with a significant difference for pH rate while a non significant difference for the flow rate was shown. Concerning the oral hygiene indices (Plaque, gingival and calculus) and DMFT index, lower values of all these indices were revealed among the premenopausal women with a non significant difference for the plaque and calculus indices, while a significant difference was shown concerning the gingival index and a highly significant difference for DMFT index as shown in Table (2).

The concentration of salivary calcium and phosphate in pre and post--menopausal women was presented in Table (3), it has been shown that the salivary calcium concentration and phosphate of pre-menopause was higher than post-menopause group with a significant difference between both test groups.

Discussion

Most researches have shown the advantage of using saliva in detecting physiologic or pathologic conditions because there is a close relationship between saliva and serum parameters. Saliva plays an essential role in protecting oral tissues and preventing foreign materials from entering the body [17, &18]. In women approaching climacterium, many physiological changes take place, most of which are due to decreased ovarian estrogen production. In addition to these changes an increase in oral symptoms was shown, one of the most significant oral symptoms found in the menopausal women is oral dryness [19].

This study showed that salivary flow rate decreases after menopause, although the rate of decrease was not found to be statistically significant. Previous studies showed a controversial result about the effect of menopause on salivary flow rate. Some studies have shown lower flow rates in postmenopausal women [20, &21]. While other studies have reported no change in the salivary flow rate after menopause [22, & 23]. It has been suggested that oral dryness might be due to undetermined qualitative changes in the salivary composition, an imbalance between the various salivary glands or changes in the mucosal sensory receptors [20].

Concerning the salivary pH, this study showed that the pH of the postmenopausal group was significantly lower than that of the pre-menopausal group. This result disagrees with the results of Yalçın et al. However it should be considered that the study by Yalçın et al. was performed with unstimulated saliva [20].

Previous investigations have shown that salivary pH, and flow rate play important roles in the oral mucosal defence. When the salivary flow rate is reduced, susceptibility to various oral diseases is enhanced. It has been shown that individuals who suffer from low salivary flow rates have higher caries experience than individuals with normal salivary flow rates [24, & 25]. This might explain the high rate of dental caries and gingivitis found in this study among postmenopausal women. It has shown that changes in periodontal conditions might be associated with variations in sex hormone levels. They can lead to changes in inflammatory mediators, vascular permeability and growth and differentiation of fibroblasts. There are estrogen receptors in osteoblasts and fibroblasts of periodontal tissues, which respond to the varying levels of hormones in different stages of reproductive life and thus affect the health of the periodontium. Estrogen deficiency may contribute to more intense gingival inflammation during periodontitis. Lower estrogen levels have been linked to gingival inflammation and reduced clinical attachment levels [26,& 27]. Among the electrolytes of whole saliva, salivary calcium and phosphate account as the main mineral component of the human teeth, they play essential role in the mineralisation of teeth. In menopausal women the composition of saliva seem to be estrogen-dependent [28, &29], the present study showed that salivary constituents (calcium and phosphate) were lower among postmenopausal women compared to premenopausal one with significant difference.

In conclusion a reduction in the salivary flow rate and pH was seen among postmenopausal women compared to premenopausal one, for plaque and calculus indices lower values were revealed among the premenopausal women with a non significant difference. Dental caries and gingivitis were found to be more prominent among postmenopausal women, concerning salivary calcium and phosphate a significant decrease was found among postmenopausal women in comparison to premenopausal women. Further studies are necessary to identify the relation between salivary flow, pH and oral symptoms among postmenopausal women, also importance of preventive dentistry increases for those women.

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Table (1): Comparison of different variables between pre and postmenopausal women.

Variable	postmenopausal women (study group)		premenopausal women (control group)	
	Mean	SD	Mean	SD
pH	6.54	0.67	7.10	0.38
Flow rate	2.34	1.01	2.94	1.10
Plaque index	0.59	0.29	0.51	0.34
Calculus index	0.27	0.21	0.17	0.19
Gingival index	1.03	0.54	0.56	0.35
DMFT	7.26	0.79	5.18	1.01

Table (2): Statistical differences in different variables between study and control groups.

Study (postmenopausal group) / Control (pre menopausal group)	pH	Flow rate	Plaque index	Calculus index	Gingival index	DMFT
pH	**3.22***					
Flow rate		**1.79**				
Plaque index			**0.82**			
Calculus index				**1.54**		
Gingival index					**3.30***	
DMFT						**7.27****

d.f= 38, * significant P<0.05, * *Highly Significant P<0.001, NS Non Significant.

Table (3): Salivary Calcium, and Phosphate Concentrations in (mg/100ml) in pre and postmenopausal women.

Groups	No.	Calcium		p-value	t- test	Phosphate		p-value	t- test
		Mean	SD			Mean	SD		
Postmeno pausal women	20	3.75	1.09	0.038	2.13*	13.04	3.11	0.031	2.22*
Premeno pausal women	20	4.34	0.86			14.99	3.07		

* significant P<0.05, * *Highly Significant P<0.001, NS Non Significant.