

## Are Multivitamin Supplements Associated with Periodontal Health?

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### Abstract

**Objectives:** To evaluate the association between multivitamin supplements (MVS) and the severity of periodontitis in older women (PMW) and to delineate demographic, lifestyle factors, anthropometric measurements and pre-existing diseases associated with MVS intake.

**Methods:** Retrospective, cross-sectional study was conducted using a database of over 900 PMW. Subjects were divided into two groups (MVS users, n = 278; nonusers, n = 511) and classified according to periodontal severity: healthy, mild, moderate, and severe periodontitis. Periodontal parameters including: teeth loss (TL), median probing depth (PD), median recession (R), and bleeding on probing (BOP) were recorded. Additionally, anthropometric measurements: body mass index (BMI) and fracture risk assessment tool (FRAX) score, lifestyle factors: MVS intake, smoking status, and average alcohol consumption (AC), socio-economic status: ethnicity, household income, and education level, and pre-existing diseases: secondary osteoporosis, and diabetes were collected. Data were analyzed using the Pearson's chi-square, and Mann-Whitney U test = 0.(05).

**Results:** There were significant differences in BOP, MNTL, and FRAX score between MVS users and non-users: (73.5% vs. 56.8%;  $p < 0.001$ ), (8, 0 - 32 vs. 5, 0 - 32;  $p < 0.001$ ), and (1.8, 0.5 - 54.9 vs. 1.6, 0.4 - 36.2;  $p = 0.043$ ), respectively. BMI, and smoking were inversely related with MVS users compared to non-users, (26.1, 13.5 - 62.5 vs. 25.3, 12.9 - 53.8;  $p = 0.049$ ), and (7.6% vs. 19.0%;  $p < 0.001$ ), respectively.

**Conclusions:** BOP, MNTL, FRAX score, BMI, and smoking are significantly associated with multivitamin supplement intake. MVS intake does not appear to significantly influence the severity of periodontal disease in PMW. Additional longitudinal research is needed to further understand the potential causal relationship between MVS and periodontitis in older women.

**Keywords:** Multivitamin Supplements; Periodontal Health

### Introduction

Periodontitis is an inflammatory disease of the supporting tissues of the teeth caused by group of specific microorganism which results in progressive destruction of periodontal ligament and alveolar bone loss with increased pocket depth, recession, or both [1,2]. The etiology of periodontitis originates with the development of a bacterial biofilm, or plaque, on the tooth surface and oral epithelia [3]. It has been found that increased periodontal attachment loss is related to decreased intakes of both calcium and vitamin D. Research suggests that insufficient calcium intake increased risk of periodontal disease and could be related to decreased alveolar bone density [4].

Moreover, dietary supplements have been shown to have beneficial effects and may decrease the risk for the development of periodontal disease. For example, the antioxidant activity of Vitamin C may attenuate the development of periodontal disease [4]. A large cross-sectional survey using the NHANES III, demonstrated that lower vitamin C intake is associated with a higher risk (OR 1.19) of having periodontal disease, whereas, higher vitamin C intake is associated with reduced risk (OR 0.53) of severe periodontitis [5]. Similarly, the nutrient vitamin D is necessary for the intestinal absorption of calcium and sufficient vitamin D intake is essential to all prevention and treatment for postmenopausal osteoporosis [4,6].

During menopause, gingival epithelium becomes narrower, atrophic, but whether or not it is more prone to inflammatory changes remains under debate, particularly when race is considered [7]. The same osteoclast potentiation that leads to loss of bone in the hips and spine is also reported to contribute to the host response to pathogenic biofilm in periodontitis [8]. Studies have reported that ovarian deficiency, but not aging are the predominant causes of bone loss during the first two decades after menopause [9].

The objective of this study was to characterize the use of multi-vitamin supplement (MVS) with the association of periodontal disease and determinants of health in older women. Understanding the relationship between MVS and periodontal health in this cohort, researchers will be informed to design intervention studies that will support health promoting behaviors.

### Introduction

#### Study design

This is an IRB approved retrospective cross-sectional study. Dental and medical charts obtained from the Case Cleveland Clinic Postmenopausal Oral Wellness Consortium (CCCPOWC), a database of over 996 older women examined between January 2002 and January 2015 were reviewed. Charts contained medical and dental examination data compiled by qualified dentists and physicians. Inclusion criteria were that charts must have comprehensive periodontal examination data with radiographs, and a complete medical record including DEXA scan. After a complete database search, 789 subjects had a complete history and were included in analysis of periodontal parameters, anthropometric measurements, socioeconomic variables, lifestyle factors, and presence of co-morbid risk associated diseases with MVS intake.

Each chart contained a comprehensive periodontal examination findings completed by trained clinicians. The periodontal parameters: median probing depth (MPD), number teeth lost (TL), bleeding on probing (BOP) as a percentage of sites bleeding, and median recession (MR) are recorded for all the teeth, including third molars. MPD and MR were evaluated using a graduated North Carolina 15mm periodontal probe. BOP was recorded by the dichotomous index ("Yes"/ "No") for each tooth and concluded with a percentage of bleeding sites in the mouth. Based on comprehensive exam outcomes participant charts were divided into study group, MVS use, and control group, no MVS use. The dividing line between the healthy, and periodontitis groups is at median clinical attachment level of 5mm based on Armitage Classification of Periodontal diseases. The classification sets 5mm as the bar for "severe" disease, severe disease, in turn places the host at risk for tooth loss [1].

Body mass index (BMI) was calculated as weight (kilograms) divided by the square of height (centimeters). Fracture risk assessment tool (FRAX) score, took into account DEXA scores, weight, height, previous fractures, rheumatoid arthritis, smoking habits, diabetes and other factors. It measures the 10-year probability of a major osteoporotic fracture (clinical spine, forearm, hip or shoulder fracture).

#### Statistical methods

Data are described descriptively in Table 1. The Shapiro-Wilk test showed that the data was not normally distributed. Missing responses were excluded from the analysis. Comparison of MVS with periodontal disease and demographic factors were carried out using

Mann-Whitney U and Pearson’s Chi-square( $\chi^2$ ) tests, (as appropriate. Descriptive statistics for all variables were conducted, including: median, range, and percentages. A significance level of alpha = 0.05 was set for all tests ( $p < 0.05$ ). Statistical analyses were performed using IBM SPSS v22 software (IBM Inc., Armonk, NY).

**Results**

The study population of 789 subjects consisted of 278 MVS users and 511 control (non-MVS users). Severity of periodontal disease with MVS intake was not statistically significant (table 1). There was statistically greater percentage (73.5%) of gingival bleeding in the MVS group compared to controls ( $p < 0.001$ ). Likewise, there were more ( $p < 0.001$ ) teeth lost in the MVS group compared to control (8 vs. 5). The control group had subjects with lower BMI (25.3 vs. 26.1;  $p = 0.049$ ) and FRAX score (1.67 vs. 1.89;  $p = 0.043$ ), respectively. The percentage of supplement use was higher among non-smokers vs. smokers, (92.4% vs, 7.6%;  $p < 0.001$ ).

	Study group (n=278)	Control group (n=511)	
	Median (Min-Max) or n (%)		p-value
<b>Periodontal Parameters</b>			
Severity			$\chi^2 (3) = 4.79$ ; ns
Healthy Gingivitis	14 (10.3%)	35 (12.4%)	
Mild	40 (29.4%)	106 (37.5%)	
Moderate	49 (36.0%)	94 (33.2%)	
Severe	33 (24.3%)	48 (17.0%)	
<b>Gingival Bleeding (BOP)</b>			$\chi^2 (1) = 12.53$ ; $p < 0.001$
Yes	111 (73.5%)	204 (56.8%)	
No	40 (26.5%)	155 (43.2%)	
Teeth Loss (TL)	8 (0-32)	5 (0-32)	U (31983.0) = -6.03; $p < 0.001$
Median mid-facial FGM to sulcus base (mm)	2.0 (1.0-4.0)	1 (0.5-4.0)	U (9126.0) = -1.08; ns
Median mesio-facial FGM to CEJ measurement (mm)- Below CEJ	1.0 (0.0-2.50)	1.0 (0.0-2.0)	U (7405.5) = -1.681; ns
Median mesio-facial FGM to CEJ measurement (mm) - Above CEJ	2.0 (-4.0 - (-1.0))	1.5 (-5.0 - (-0.50))	U (36.0) = -1.19; ns
<b>Anthropometric Measurements</b>			
BMI	25.3 (12.9-53.8)	26.1 (13.5-62.5)	U (45227.5) = -1.91; $p = .049$
FRAX Score (osteoporotic fracture)	1.89 (0.50-54.9)	1.67 (0.47-36.16)	U (43835.5) = -2.02; $p = .043$
<b>Lifestyle Factors</b>			
<b>Current Smoker</b>			$\chi^2 (1) = 18.49$ ; $p < 0.001$
Yes	21 (7.6%)	97 (19.0%)	
No	257 (92.4%)	414 (81.0%)	
$\chi^2$ -Pearson’s Chi-square test			
U-Mann-Whitney U test; Shapiro Wilk normality test was performed; $p < 0.05$			
A significance $\alpha = 0.05$ was level set of for all tests ( $P < 0.05$ )			

**Table 1:** General Characteristics of Study Population (n = 789).

### Discussion

MVS is a health promoting, wellness behavior, which is poorly understood. The lack of some health promoting behaviors, such as diet, physical fitness, and weight control have been associated with periodontitis [10-12]. This investigation elucidates whether such a relationship exists between MVS use and periodontitis in a large sample of older women.

Our findings show only a non-significant trend that participants with moderate gingivitis used supplements more than periodontally healthy participants. This is similar to the findings by Pavlesen., *et al.* who found that Vitamin D supplementation likewise had no significant effect on periodontitis or tooth loss [2,13] and another health promoting behavior associated with periodontitis, is non-smoking. In this study, smokers used fewer supplements than non-smokers. This finding supports the assertion that non-smokers and MVS use are consistent health promoting behaviors, even though MVS use did not promote periodontal health the way that non-smoking does [14].

The findings also suggest that participants who use MVS had higher BOP and TL. This is counterintuitive to the hypothesis that a health promoting behavior such as MVS would have greater bleeding and inflammation. A prospective study showed a similar trend that individuals taking vitamin E (50 mg vitamin D/day) or acetylsalicylic acid (ASA, 100 - 3200 mg/day) had greater gingival bleeding compared to individuals taking neither vitamin E or ASA alone [15]. However, in this study, information regarding the vitamins found in the supplements was limited; therefore, it is hard to conclude whether the blood thinning effect of vitamin E in the supplement was causing an inverse relationship. Moreover, because of the paucity of data in this area and the myriad vitamins and minerals found in multivitamin supplements, a review of the evidence regarding dietary components and periodontal health would be useful in understanding how multivitamin supplements contribute to overall periodontal health. On the other hand, both MVS and TL infer health care utilization. Teeth cannot be lost without accessing dental care, and MVS cannot be undertaken without accessing a pharmacy or drug store.

With respect to BMI, our findings are in concordance with published literature. According to the Health Styles consumer survey, women with a higher BMI were less likely than lower BMI women to use multivitamins (OR = 0.63, CI 0.41 - 0.98). The study suggests that fewer overweight individuals consider multivitamins “important for their health.” Considering the higher incidence and prevalence of obesity in the US population, more research is needed to understand whether BMI affects nutrient requirements [16]. However, the control group had lower BMI. The health promoting low BMI seems mismatched with not using a multivitamin. On the other hand, FRAX score of fracture risk is lower in MVS users than control. A possible explanation for this is once FRAX score determines risk for fracture, many intervening physicians recommend MVS, Vitamin D and calcium in particular.

These findings need to be confirmed in other samples, which include males, adolescents and children. In addition, limited research has observed the reasons leading to multivitamin use, which may include social, knowledge, and economic factors. For example, Conner *et al.* reported that a major predictor of the decision for multivitamin use, may be due to the lack of clear scientific evidence supporting the benefits of multivitamins [17]. This study is cross-sectional, future prospective randomized controlled trials will give information on casual relationships.

### Conclusion

Results of this study show that MVS cannot be considered one of the health promoting behaviors, such as nutritious diet, fitness, weight maintenance, associated with periodontal health. Future dietary intervention studies that focus on MVS in different populations are indicated.

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