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RESEARCH ARTICLE

An Association between Vitamin Intakes and Established Periodontitis in Korean Adult Population

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한국 성인에서 비타민 섭취와 치주염 유병간의 관련성

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The aim of this study was to examine whether there is an association between vitamin intakes and established periodontitis in Korean adult population. The 6,245 subjects aged over 19 years old, who participated in health survey, oral examination and nutrition survey were selected for this study from the database of the Fourth Korean National Health and Nutrition Examination Survey. Established periodontitis was defined as ≥ code 3 in community periodontal index. Vitamin intake was assessed with the food-frequency questionnaire. In analysis, participants were classified by quintile of vitamin intakes. We also considered covariates as socio-demographic characteristics, health-related behaviors including physical activities, systemic diseases and oral health-related behaviors. Multiple logistic regression was performed to assess the crude and adjusted associations. All analyses considered a complex sampling design using SAS 9.2. In crude analysis, less intake of vitamin A, retinol and vitamin B2 significantly increased the risk of periodontitis (vitamin A, odds ratio [OR] Q1=1.00, Q2=0.73, Q3=0.80, Q4=0.77, Q5=0.78; retinol, OR: Q1=1.00, Q2=0.86, Q3=0.73, Q4=0.62, Q5=0.55; vitamin B2, OR: Q1=1.00, Q2=0.70, Q3=0.63, Q4=0.67, Q5=0.68). However, after adjusting for socio-demographics, general and oral health status and behaviors, only vitamin B2 was significantly associated with established periodontitis (OR: Q1=1.00, Q2=0.72, Q3=0.73, Q4=0.76, Q5=0.84). An adequate vitamin B2 intake was significantly associated with a decreased risk of periodontitis. This finding shows that nutrient intake is slightly correlated with periodontitis in Korean adult population. Further studies are needed to understand this association between nutrients intake and periodontitis in more details.

Key Words: Adult, Periodontitis, Vitamins

Introduction

Periodontitis is a major oral health problem, which affects a considerable proportion of the adult population. Li et al.[1] explained that periodontitis is disorders of the gums, gingival, and other tissues around the teeth. Moreover, periodontitis is the most common chronic inflammatory disease involving gingival inflammation and the destruction of periodontal tissue[2-4].

Nowadays, inflammatory periodontitis affects 10 to 15 percents of the world's population and is a major cause of tooth loss in adults[5]. An estimated 8% to 10% of American adults have some form of periodontitis, on the other hand, Kwon et al.[6] reported that the prevalence of periodontitis is 73.4% among aging over 19 years old in Korea. By the reduced prevalence of caries and subsequent loss of

teeth in the aging population, periodontitis has become a more significant problem[7].

Stewart et al.[8] reported that oral health is an essential component of health throughout life and is recognized to be an important determinant of nutritional status and general health. Thus, poor oral health status is associated with poor nutritional health, just as inadequate nutrition can affect oral health[9]. Nutritional factors have been implicated in several chronic inflammatory diseases as risk factors included oral health such as periodontitis[10]. A few studies reported that there were more associations between nutrition and periodontitis as an inflammatory disease, including the effect of vitamin C, vitamin E, and carotenoids as dietary antioxidants in inflammation modulation[11], and the impact of obesity on modulating the host's immune and inflammatory system leaving the patient with a greater risk of periodontitis[12]. Eating habits and nutrients also influence periodontitis, some studies also have reported that consumption of vitamin C, E and calcium is connected to periodontitis[13].

Vitamin is the one of nutrients associated with periodontits. In particular, vitamin C is also an effective nutrient in treatment of acute necrotizing ulcerative gingivitis (ANUG)[14]. Melnick et al.[15] reported ANUG has provided the evidence for an association between ascorbate deficiency and disease risk. Furthermore, there is biological plausibility for such an association between vitamins and periodontitis, due to the role of ascorbate in collagen synthesis and leukocyte function. According to the most studies relating nutrition and oral health, vitamin A and iron improve host resistance to infections, vitamin C, D, E reduce tissue destruction and enhance wound healing, and vitamin D and calcium also have a beneficial effect on bones and tooth retention[16]. Moreover vitamin C deficiency is known to reduce the host immune response by increasing the activity of polymorphonuclear leukocytes[17]. For these reasons, a well-balanced diet and vitamin intakes should be required for maintenance of optimal general and oral health[18].

Studies related to the association between diet and established periodontitis are sufficient; however, analytical study about the association between vitamin intake and established periodontitis is still inadequate. This study is hypothesized that vitamin intake is directly associated with periodontitis.

The aim of this cross sectional study is to examine whether vitamin intake is independently associated with established periodontitis adjusted for socio-demographic characteristics, general and oral health status, and those related behaviors using a representative sample of Korean adults.

Materials and Methods

1. Subjects

The data of this study was a subset of the Fourth Korean National Health and Nutrition Examination Survey (KNHANES IV) which was conducted in 2009[19]. The total of 7,893 subjects over 19 years old were selected from the database of the KNHANES IV. Among of them, only 6,245 subjects, who participated in health survey, oral examination and nutrition survey, were included in this study.

2. Study variables

1) Periodontitis

Periodontitis was assessed by community periodontal index (CPI) based on bleeding, presence of calculus, and pocket depth at sextant of mouth. The CPI score was rated into 5 categories at each sextant: sound (CPI 0), gingival bleeding (CPI 1), calculus (CPI 2), shallow periodontal pocket of 3.5~5.5 mm (CPI 3), and deep periodontal pocket of 5.5 mm or more (CPI 4). In this study, the subject's CPI score was recorded the highest score of the sextant. According to the subject's CPI score, established periodontitis was defined as the highest CPI score of sextant $\geq$ code 3[20].

2) Vitamin intakes

The food-frequency questionnaire was designed to estimate daily amount of food-group consumption and nutrient intake the day before the survey started (24-hours recall method). The trained nutritionists visited individual participants in each household to interview about diet and meal patterns of the 97 food items. The consumption of a

food item was estimated by multiplying the standard portion size by its intake frequency. Vitamin intakes were calculated based on the standard food composition table in Korea[19].

In this study, the 5 kinds of vitamins were evaluated such as vitamin A, retinol, vitamin B1, vitamin B2, and vitamin C and then classified by quintiles of amount of intakes: Q1 (intake ≤ 1st quintile), Q2 (1st quintile < intake ≤ 2nd quintile), Q3 (2nd quintile < intake ≤ 3rd quintile), Q4 (3rd quintile < intake ≤ 4th quintile), and Q5 (4th quintile < intake).

3) Covariates

The socio-demographic characteristics, general health status and related behaviors, and oral health status and related behaviors were considered as covariates in this study. The socio-demographic characteristics included gender, age, marital status, education level, and income. Income was classified by quartiles of monthly household income investigated in Korea Centers for Disease Control and Prevention[19] (2010): low (< 25%), middle-low (25~ 50%), middle-high (50~75%), and high (> 75%).

The general health status and related behaviors included perceived health status, cardiovascular disease (CVD), diabetes mellitus (DM), body mass index (BMI), alcohol consumption, smoking status, and physical activity. Scores from the alcohol use disorder identification test with four categories classified the alcohol consumption: normal (0~8), hazardous (9~12), dependence (13~19), or harmful (more than 20).

The oral health status and related behaviors included the number of decayed, missing, or filled tooth, perceived oral health status, daily frequency of tooth-brushing, experience of dental checkup in the past 1 year, and use of dental auxiliary device.

3. Statistical analysis

The prevalence of periodontitis according to the socio-

Table 1. Prevalence of Periodontitis according to Socio-Demographic Characteristics

	Non-periodontitis		Periodontitis		p-value
	n	Percent (95% CI)[a]	n	Percent (95% CI)[a]	
Gender					< 0.0001
Male	1,543	63.2 (60.6~65.8)	1,026	36.8 (34.2~39.4)	
Female	2,678	74.7 (72.6~76.9)	998	25.3 (23.1~27.4)	
Age (y)					< 0.0001
Less than 30	787	93.3 (91.1~95.5)	61	6.7 (4.5~ 8.9)	
30~39	298	80.9 (77.4~84.3)	218	19.1 (15.7~22.6)	
40~49	841	62.4 (58.9~65.9)	434	37.6 (34.1~41.1)	
50~59	589	51.3 (47.4~55.1)	483	48.7 (44.9~52.6)	
60~69	571	50.9 (46.2~55.6)	485	49.1 (44.4~53.8)	
More than 70	450	51.8 (46.4~57.2)	343	48.2 (42.8~53.6)	
Marital status					< 0.0001
Married	3,435	63.1 (60.8~65.5)	1,935	36.9 (34.5~39.2)	
Unmarried	773	90.5 (88.3~92.7)	87	9.5 (7.3~11.7)	
Education					< 0.0001
Elementary	966	52.7 (48.8~56.7)	708	47.3 (43.3~51.2)	
Middle school	428	59.0 (54.1~63.9)	295	41.0 (36.1~45.9)	
High school	1,583	73.2 (70.5~75.8)	625	26.8 (24.2~29.5)	
College	1,221	76.2 (73.6~78.8)	384	23.8 (21.2~26.4)	
Income (quartile)					0.0006
Low	1,009	67.0 (63.7~70.3)	526	33.0 (29.7~36.3)	
Middle-low	1,000	65.1 (61.8~68.3)	548	34.9 (31.7~38.2)	
Middle-high	1,058	70.4 (67.1~73.7)	477	29.6 (26.3~32.9)	
High	1,109	72.6 (69.8~75.5)	457	27.4 (24.5~30.2)	

[a]Weighted percent and 95% confidence interval (CI).

demographic characteristics, general health status and related behaviors, oral health status and related behaviors, and quintiles of vitamin intake was summarized by weighed percent and 95% confidence interval (CI), and then analysed by chi-square test procedure accounting for individual weight of complex sampling design. To access the crude or adjusted associations between vitamin intakes and periodontitis, odds ratio (OR) and 95% CI were calculated by multivariate logistic regression model. Four models were fitted to assess an association between vitamin intakes and established periodontitis. Model 1 was a crude association between vitamin intakes and periodontitis. Model 2 was an association between vitamin intakes and periodontitis after adjusting for socio-demographic characteristics. Model 3 was an association between vitamin intakes and periodontitis after adjusting for socio-demographic characteristics and general health status and related behaviors, and model 4 was an association between vitamin intakes and periodontitis after adjusting for socio-demographic characteristics, general health status and related behaviors, and oral health status and related behaviors.

Table 2. Prevalence of Periodontitis according to General Health Status and Related Behaviors

	Non-periodontitis		Periodontitis		p-value
	n	Percent (95% CI)[a]	n	Percent (95% CI)[a]	
Perceived health status					<0.0001
Healthy	1,862	72.6 (70.1~75.0)	756	27.4 (25.0~29.9)	
Neutral	1,376	66.6 (63.6~69.6)	708	33.4 (30.4~36.4)	
Unhealthy	975	65.2 (61.8~68.6)	550	34.8 (31.4~38.2)	
Cardiovascular disease					0.0001
Yes	69	52.4 (42.5~62.3)	63	47.6 (37.7~57.5)	
No	4,143	69.2 (67.2~71.2)	1,959	30.8 (28.8~32.8)	
Diabetes mellitus					<0.0001
Yes	242	48.6 (43.1~54.1)	238	51.4 (45.9~56.9)	
No	3,970	70.2 (68.2~72.3)	1,784	29.8 (27.7~31.8)	
Alcohol consumption					<0.0001
Normal	2,931	72.0 (69.8~74.2)	1,245	28.0 (25.8~30.2)	
Hazardous	231	63.0 (57.2~68.7)	140	37.0 (31.3~42.8)	
Dependence	394	62.4 (58.0~66.7)	253	37.6 (33.3~42.0)	
Harmful	64	71.1 (61.2~81.0)	33	28.9 (19.0~38.8)	
Smoking status					<0.0001
Current	776	61.9 (58.3~65.5)	515	38.1 (34.5~41.7)	
Ex-smoker	697	62.0 (58.5~65.5)	475	38.0 (34.5~41.5)	
Non-smoker	2,739	74.9 (72.7~77.1)	1,032	25.1 (22.9~27.3)	
Physical activity					
Hard					0.6517
Yes	715	69.6 (66.1~73.2)	318	30.4 (29.1~33.3)	
No	3,487	68.8 (66.7~70.9)	1,692	31.2 (26.8~33.9)	
Mild					0.2363
Yes	599	66.8 (62.8~70.8)	308	33.2 (29.2~37.2)	
No	3,600	69.3 (67.1~71.5)	1,703	30.7 (28.5~32.9)	
Walking					0.1374
Yes	1,911	70.1 (67.6~72.6)	906	29.9 (27.4~32.4)	
No	2,291	68.0 (65.6~70.5)	1,104	32.0 (29.5~34.4)	
Body mass index					<0.0001
Underweight	201	77.9 (72.3~83.5)	65	22.1 (16.5~27.7)	
Normal	2,705	70.7 (68.5~72.8)	1,239	29.3 (27.2~31.5)	
Obesity	1,275	63.8 (60.8~66.8)	715	36.2 (33.2~39.2)	

[a]Weighted percent and 95% confidence interval (CI).

Statistical analyses were conducted by SAS 9.2 for Windows (SAS Institute Inc., Cary, NC, USA), and considered statistically significant as a p-value of < 0.05.

Results

Table 1 showed the prevalence of periodontitis according to the socio-demographic characteristics. The prevalence of periodontitis was significantly higher for males, married persons, and persons aged over 50 years than for females, married persons, and those in other age groups ($p < 0.05$). The prevalence of periodontitis was significantly lower for graduated high school or above and more than middle-high income levels than for those in other education and income groups ($p < 0.05$).

Table 2 showed prevalence of periodontitis according to the general health status and related behaviors. The prevalence of periodontitis was the lowest for persons who answered 'healthy' in perceived health status ($p < 0.05$). The prevalence of periodontitis was significantly higher for persons with CVD or DM than for those without CVD or DM ($p < 0.05$). The prevalence of periodontitis was

significantly lower for normal alcohol consumption and non-smoker groups than for those in other alcohol consumption and smoking status groups ($p < 0.05$). Moreover, the prevalence of periodontitis was significantly higher for obesity group than for those in other BMI groups ($p < 0.05$).

Table 3 showed prevalence of periodontitis according to the oral health status and related behaviors. The prevalence of periodontitis statistically decreased with increasing toothbrushing frequencies ($p < 0.05$). The prevalence of periodontitis was the highest for persons who answered 'unhealthy' in perceived oral health status ($p < 0.05$). Moreover the prevalence of periodontitis was significantly lower for persons used dental auxiliary device than for those not used dental auxiliary device ($p < 0.05$).

Table 4 showed the association between vitamin intakes and established periodontitis. The persons who had a fewer intakes of vitamin A, retinol and vitamin B2 had a greater risk of periodontitis (vitamin A, OR: Q1=1.00, Q2=0.73, Q3=0.80, Q4=0.77, Q5=0.78; retinol, OR: Q1=1.00, Q2=0.86, Q3=0.73, Q4=0.62, Q5=0.55; vitamin B2, OR: Q1=1.00, Q2=0.70, Q3=0.63, Q4=0.67, Q5=0.68).

Table 3. Prevalence of Periodontitis according to Oral Health Status and Related Behaviors

	Non-periodontitis		Periodontitis		p-value
	n	Percent (95% CI)[a]	n	Percent (95% CI)[a]	
Decayed, missing, and filled teeth					0.0733
0	366	74.1 (69.6~78.6)	131	25.9 (21.4~30.4)	
1~4	1,143	67.4 (64.4~70.3)	597	32.6 (29.7~35.6)	
5~9	1,520	68.6 (65.8~71.5)	763	31.4 (28.5~34.2)	
More than 10	1,192	69.6 (66.8~72.5)	533	30.4 (27.5~33.2)	
Tooth-brushing frequency (daily)					< 0.0001
0	43	75.8 (63.5~88.1)	17	24.2 (11.9~36.5)	
1	449	61.4 (57.3~65.5)	303	38.6 (34.5~42.7)	
2	1,640	66.1 (63.2~68.9)	896	33.9 (31.1~36.8)	
More than 3	2,080	72.9 (70.6~75.2)	806	27.1 (24.8~29.4)	
Perceived oral health status					< 0.0001
Healthy	554	80.1 (76.4~83.8)	160	19.9 (16.2~23.6)	
Neutral	1,871	75.5 (73.2~77.8)	668	24.5 (22.2~26.8)	
Unhealthy	1,793	60.0 (57.4~62.6)	1,194	40.0 (37.4~42.6)	
Dental checkup past 1 year					0.0796
Yes	1,071	71.0 (68.0~74.0)	444	29.0 (26.0~32.0)	
No	3,133	68.2 (65.9~70.4)	1,571	31.8 (29.6~34.1)	
Dental auxiliary device					0.0173
Yes	1,453	71.3 (68.7~73.8)	584	28.7 (26.2~31.3)	
No	2,759	67.6 (65.2~70.1)	1,438	32.4 (29.9~34.8)	

[a]Weighted percent and 95% confidence interval (CI).

Table 4. Association between Vitamin Intakes and Established Periodontitis

	Vitamin intakes (quintile)				
	Q1	Q2	Q3	Q4	Q5
Vitamin A					
Model 1[a]	1.00	0.73 (0.60~0.88)	0.80 (0.66~0.97)	0.77 (0.61~0.96)	0.78 (0.65~0.94)
Model 2[b]	1.00	0.86 (0.68~1.09)	0.96 (0.76~1.21)	0.87 (0.67~1.12)	0.84 (0.66~1.06)
Model 3[c]	1.00	0.83 (0.62~1.10)	0.99 (0.76~1.29)	0.85 (0.64~1.12)	0.89 (0.68~1.16)
Model 4[d]	1.00	0.81 (0.61~1.08)	1.00 (0.77~1.30)	0.85 (0.63~1.14)	0.89 (0.68~1.16)
Retinol					
Model 1[a]	1.00	0.86 (0.69~1.07)	0.73 (0.59~0.91)	0.62 (0.50~0.76)	0.55 (0.44~0.69)
Model 2[b]	1.00	1.03 (0.81~1.32)	1.05 (0.82~1.33)	1.03 (0.80~1.31)	1.00 (0.77~1.30)
Model 3[c]	1.00	1.10 (0.83~1.46)	1.10 (0.82~1.46)	1.00 (0.76~1.31)	1.07 (0.80~1.44)
Model 4[d]	1.00	1.09 (0.82~1.44)	1.08 (0.81~1.44)	0.98 (0.74~1.28)	1.07 (0.80~1.44)
Vitamin B1					
Model 1[a]	1.00	1.01 (0.80~1.27)	0.92 (0.76~1.13)	1.05 (0.86~1.29)	0.86 (0.70~1.06)
Model 2[b]	1.00	1.06 (0.81~1.37)	0.95 (0.75~1.20)	1.11 (0.88~1.41)	0.93 (0.74~1.19)
Model 3[c]	1.00	1.03 (0.77~1.39)	0.91 (0.70~1.19)	1.12 (0.85~1.46)	0.91 (0.70~1.20)
Model 4[d]	1.00	1.02 (0.76~1.38)	0.91 (0.70~1.20)	1.10 (0.84~1.44)	0.93 (0.71~1.20)
Vitamin B2					
Model 1[a]	1.00	0.70 (0.57~0.87)	0.63 (0.51~0.77)	0.67 (0.54~0.85)	0.68 (0.56~0.83)
Model 2[b]	1.00	0.74 (0.58~0.94)	0.74 (0.59~0.93)	0.81 (0.63~1.04)	0.81 (0.63~1.03)
Model 3[c]	1.00	0.74 (0.57~0.96)	0.71 (0.55~0.92)	0.79 (0.61~1.03)	0.83 (0.63~1.08)
Model 4[d]	1.00	0.72 (0.55~0.94)	0.73 (0.56~0.95)	0.76 (0.58~1.00)	0.84 (0.64~1.11)
Vitamin C					
Model 1[a]	1.00	1.12 (0.88~1.42)	1.15 (0.94~1.40)	0.91 (0.74~1.12)	1.02 (0.82~1.28)
Model 2[b]	1.00	1.15 (0.89~1.50)	1.10 (0.89~1.37)	0.90 (0.71~1.15)	1.03 (0.80~1.32)
Model 3[c]	1.00	1.15 (0.86~1.55)	1.12 (0.88~1.42)	0.93 (0.71~1.23)	1.07 (0.82~1.40)
Model 4[d]	1.00	1.21 (0.84~1.50)	1.15 (0.88~1.42)	0.91 (0.69~1.20)	1.03 (0.79~1.35)

Values are odds ratio (95% confidence interval).

Q1: intake ≤ 1st quintile, Q2: 1st quintile < intake ≤ 2nd quintile, Q3: 2nd quintile < intake ≤ 3rd quintile, Q4: 3rd quintile < intake ≤ 4th quintile, Q5: 4th quintile < intake.

[a]Crude association between vitamin intake and periodontitis.

[b]Association between vitamin intake and periodontitis after adjusting for socio-demographic characteristics.

[c]Association between vitamin intake and periodontitis after adjusting for socio-demographic characteristics, general health status and related behaviors.

[d]Association between vitamin intake and periodontitis after adjusting for socio-demographic characteristics, general health status and related behaviors, and oral health status and related behaviors.

Moreover, after adjusting for all confounding variables, only vitamin B2 was significantly associated with established periodontitis (OR: Q1=1.00, Q2=0.72, Q3=0.73, Q4=0.76, Q5=0.84). However, vitamin B1 and vitamin C were not significantly associated with established periodontitis in crude and adjusted analysis.

Discussion

This study investigated the association between vitamin intake and periodontitis using the data from the KNHANES IV.

In this cross sectional study, there was not consistently significant association between vitamin intakes and periodontitis in Korean adult population. However, after adjusting for confounding variables, only vitamin B2 was significantly associated with established periodontitis. Our findings supported that vitamin B2 deficiency was associated with periodontitis. Neiva et al.[21] demonstrated that vitamin B complex could positively influence wound healing processes. Vitamin B complex supplement in combination with access flap surgery resulted in statistically significant superior clinical attachment levels gains. Vitamin B2, also called riboflavin, is one of eight vitamin

Bs. Most healthy people who eat a well-balanced diet get enough riboflavin. However, elderly people and alcoholics may be at risk for riboflavin deficiency because of poor diet. Symptoms of riboflavin deficiency include fatigue, slowed growth, digestive problems, cracks and sores around the corners of the mouth, swollen magenta-colored tongue, eye tiredness, swelling and soreness of the throat, and sensitivity to light.

In previous study, vitamin C was significantly associated with periodontal disease. Paek and Lee[22] reported vitamin C intake is significantly associated with periodontitis in Korean adults, and also suggested that vitamin C will be helpful in the prevention of periodontitis. Nishida et al.[23] found a relationship between reduced dietary vitamin C and increased risk for periodontal disease for the representative of the US population. Meanwhile, although in some studies decreased dietary vitamin C intake was found to be associated with increased risk of periodontal disease, no conclusive evidence could be demonstrated[24]. Our results showed that periodontitis was not clearly associated with vitamin C. A possible clarification is that serum levels reflect only the present nutritional status and not the lifelong times past. Furthermore, serum levels are affected by several factors, for example recent dietary intake, diurnal variability, concomitant medication, inflammations, and stress[25].

Stein et al.[26] reported vitamin D is also potential role in protecting the periodontium as well as in regulating periodontal wound healing. On the other hand, Lee and Roh[27] reported vitamin D has a significant negative correlation to periodontal disease among the post-menopausal women including the women who underwent bilateral ovariectomy. This study could not determine any association between vitamin D and periodontitis due to lack of data. This association must be confirmed in future.

Bawadi et al.[12] found that a low physical activity level and a poor diet were significantly associated with increased odds of periodontitis throughout conducting to determine the relationship between physical activity, healthy eating habits and periodontal health status among adults in Jordan. However, our findings showed that physical activity even divided into hard and mild physical activity and walking was no statistically significant difference in the prevalence of periodontitis. Further study will be need to study about why the reason the current study was not significant difference of the association physical activity and periodontitis in great detail.

There were a few limitations even though the study showed that vitamin intakes were significantly associated with established periodontitis in the Korean adult population. The CPI assessed the periodontal status. Although CPI is an easier way of evaluating the periodontal treatment needs in a community setting, it can overestimate or underestimate the prevalence of periodontitis because the use of representative teeth includes pseudo pockets. One of the most important limitations of this study is its cross-sectional study design, which makes it impossible to determine the direction of the causal relationship between vitamin intakes and periodontitis. Therefore, this study was to assess the independent association of vitamin intake and periodontitis for adjusting an influence of possible confounded variables such as sociodemographic characteristics, general health behaviors and status, and oral health behaviors and status.

Summary

This study was conducted comprehensively in the Korean representative population sample. Vitamin B2 was just considerably associated with established periodontitis. An adequate vitamin B2 intake was significantly associated with a decreased risk of periodontitis. Past studies about the association of vitamin intakes and established periodontitis is still sufficient, however, this finding shows that vitamin B2 intake is correlated with periodontitis. Prospective studies are required to identify the link between vitamin intakes and periodontitis from longitudinal database. Furthermore, the underlying biological mechanism presentation a causal effect relationship between vitamin intakes and established periodontitis remain to be found out through prospective cohort studies.

요 약

본 연구는 국민건강영양조사 제4기 자료를 이용하여 한국 성인에서 비타민 섭취와 치주염과의 관련성을 구명하고

자 하였다. 국민건강영양조사 원시자료에서 건강조사와 구강검진 및 식이조사에 모두 참여한 19세 이상 성인 6,245명의 자료를 추출한 후 복합표본설계를 반영하기 위하여 가중치를 고려한 통계분석을 실시하였다. 대상자의 인구사회학적 특성, 전신건강상태와 행태, 구강건강상태와 행태 및 비타민 섭취 5분위에 따른 치주염 유병률의 차이를 χ^2-검정을 이용하여 분석하였으며, 로지스틱 회귀분석을 이용하여 인구사회학적 특성, 전신건강상태와 행태 및 구강건강상태와 행태를 보정한 비타민 섭취와 치주염과의 관련성을 분석하였다. 치주염 유병률은 성별, 나이, 결혼상태, 교육, 수입에 따라 통계적으로 유의한 차이가 있었으며(p<0.05), 주관적 건강상태, 심혈관질환 여부, 당뇨 여부, 음주행태, 흡연상태, 및 BMI에 따른 차이도 통계적으로 유의하였고(p<0.05), 칫솔질 횟수, 주관적 구강건강상태, 구강위생용품 사용여부에 따른 차이도 통계적으로 유의하였다(p<0.05). 한편 고려된 비타민 중 비타민 A와 레티놀 및 비타민 B2 섭취가 적을수록 치주염 유병위험이 통계적으로 유의하게 높았고, 인구사회학적 특성과 전신건강상태와 행태 및 구강건강상태와 행태를 보정한 후에는 비타민 B2에서만 통계적으로 유의한 관련성이 있었다(OR: Q1=1.00, Q2=0.72, Q3=0.73, Q4=0.76, Q5=0.84). 따라서 적절한 비타민 B2의 섭취는 치주염 유병위험을 감소시킴으로써 한국 성인 인구의 지속적인 치주건강을 유지하는 데 도움이 될 수 있을 것으로 생각된다.

References

1. Li P, He L, Sha YQ, Luan QX: Relationship of metabolic syndrome to chronic periodontitis. J Periodontol 80: 541-549, 2009.

2. Jenzsch A, Eick S, Rassoul F, Purschwitz R, Jentsch H: Nutritional intervention in patients with perodontitis: clinical, immunological and microbiological variables during 12 months. Br J Nutr 101: 879-885, 2009.

3. Won JH, Ha MN: An association of periodontitis and diabetes. J Dent Hyg Sci 14: 107-113, 2014.

4. Jung JO, Lee KH, Youn HJ: The correlation between diabetes and periodontitis in Korea adults. J Dent Hyg Sci 11: 221-228, 2011.

5. Iain LC, Chapple IL: Potential mechanisms underpinning the nutritional modulation of periodontal inflammation. J Am Dent Assoc 140: 178-184, 2009.

6. Kwon YE, Ha JE, Paik DI, Jin BH, Bae KH: The relationship between periodontitis and metabolic syndrome among a Korean nationally representative sample of adults. J Clin Periodontol 38: 781-786, 2011.

7. Ritchie CS, Kinane DF: Nutrition, inflammation, and periodontal disease. Nutrition 19: 475-476, 2003.

8. Stewart R, Sabbah W, Tsakos G, D'Aiuto F, Watt RG: Oral health and cognitive function in the third national health and nutrition examination survey (NHANES III). Psychosom Med 70: 936-941, 2008.

9. Sheetal A, Hiremath VK, Patil AG, Sajjansetty S, Kumar SR: Malnutrition and its oral outcome: a review. J Clin Diagn Res 7: 178-180, 2013.

10. Velden U, Kuzmanova D, Chapple IL: Micronutritional approaches to periodontal therapy. J Clin Periodontol 38: 142-158, 2011.

11. Boyd D, Madden E: Nutrition, infection, and periodontal disease. Dent Clin North Am 47: 337-354, 2003.

12. Bawadi HA, Khader YS, Haroun TF, Al-Omari M, Tayyem RF: The association between periodontal disease, physical activity and healthy diet among adults in Jordan. J Periodontal Res 46: 74-81, 2011.

13. Kushiyama M, Shimazaki Y, Murakami M, Yamashita Y: Relationship between intake of green tea and periodontal disease. J Periodontol 80: 372-377, 2009.

14. Muroff FI, Singer D, Walford WF: The role of nutrition in the treatment of periodontal disease. Oral Health 69: 15-17, 1979.

15. Melnick SL, Alvarez JO, Navia JM, Cogen RB, Roseman JM: A case-control study of plasma ascorbate and acute necrotizing ulcerative gingivitis. J Dent Res 67: 855-860, 1988.

16. Mangan DF: Nutrition and oral infectious diseases: Connections and future research. Compend Cont Educ Dent 23: 416-422, 2002.

17. Alfano MC, Miller SA, Drummount JF: Effect of ascorbic acid deficiency on the permeability and collagen biosynthesis of oral mucosal epithelium. Ann NY Acad Sci 258: 253-263, 1975.

18. Enwonwu CO, Phillips RS, Falkler WA: Nutrition and oral infectious diseases: State of the science. Compend Cont Educ Dent 23: 431-438, 2002.

19. Ministry of Health and Welfare: The Korean National Health and Nutrition Examination Survey 2007-2009. Ministry of Health and Welfare, Seoul, 2010.

20. Han DH, Lim SY, Sun BC, et al.: The association of metabolic syndrome with periodontal disease is confounded by age and smoking in a Korean population. J Clin Periodontol 37: 609-616, 2010.

21. Neiva RF, Al-Shammari K, Nociti FH, Soehren S, Wang HL: Effects of vitamin-B complex supplementation on periodontal wound healing. J Periodontol 76: 1084-1091, 2005.

22. Paek KW, Lee SJ: Correlation between vitamin C intake and periodontal disease: the Fifth Korea National Health and Nutrition Examination Survey, 2010. J Korean Acad Oral Health 38: 82-89, 2014.

23. Nishida M, Grossi SG, Dunford RG, Ho AW, Trevisan M, Genco RJ: Dietary vitamin C and the risk for periodontal disease. J Periodontol 71: 1215-1223, 2000.

24. Putten GJ, Vanobbergen J, Visschere L, Schols J, Baat C: Association of some specific nutrient deficiencies with periodontal disease in elderly people: a systematic literature review. Nutrition 25: 717-722, 2009.

25. Pussinen PJ, Laatikainen T, Alfthan G, Asikainen S, Jousilahti P: Periodontitis is associated with a low concentration of vitamin C in plasma. Clin Diagn Lab Immunol 10: 897-902, 2003.

26. Stein SH, Livada R, Tipton DA: Re-evaluating the role of vitamin D in the periodontium. J Periodontal Res 49: 545-553, 2014.

27. Lee SH, Roh SC: Vitamin D level in blood of menopausal women over 50 and the relation with the proportion requiring dental scaling. J Dent Hyg Sci 13: 393-402, 2013.