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RESEARCH ARTICLE

Association between Drinking Behaviors and Periodontal Status in Adults by Age Group

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The purpose of this study was to determine the association between drinking behaviors and the need for periodontal treatment. The data of 5,995 adults from the 2012 Korea National Health and Nutrition Examination Survey were categorized into young adulthood (19～39 years), middle age (40～64 years), and old age (≥65 years) and analyzed. Chi-square test was performed to determine those who needed periodontal treatment by the respondents' general characteristics and drinking behaviors, and logistic regression analysis was carried out to determine the impact of each drinking behavior on the need for periodontal treatment. The results of this study have confirmed that alcohol intake is a factor adversely affecting periodontal status; therefore, patients should know the fact that excessive alcohol intake and increased frequency of drinking may affect the prevalence rate of periodontal diseases. Moreover, moderate-drinking programs that can reinforce prevention of drinking so that dental hygienists can provide good oral health care should be developed. A systematic oral health promotion program should be introduced for constant prevention with the objective of activating oral health education that focused on middle-aged and young-adult people in pursuit of healthy aging society.

Key Words: Alcohol drinking, Periodontal index

Introduction

Recently, chronic diseases such as obesity, diabetes, dental caries, and periodontal disease are drastically increasing, as healthy lifestyles have not been properly established due to rapid social and cultural changes. According to the 2010 National Oral Health Survey, the prevalence of periodontal disease for Korean adults aged 30 and above was 42.4% in 2007, 40.0% in 2008, 36.2% in 2009, and 28.0% in 2010[1)]. Periodontal disease is a chronic inflammatory disease involving damage of periodontal tissues caused by a biofilm formed on the surface of the teeth and the host response against bacteria, which eventually leads to the loss of tooth. The prevalence of periodontal disease is gradually increasing due to insufficient oral health care, smoking, and aging[2)]. In addition, periodontal disease is very common in adults, and approximately 35% of Korean adults are affected based on the report by the Korean Academy of Periodontal Science[3)]. As periodontal disease can cause various complications and deteriorate the quality of life, its active management is needed[4)]. According to the 2009 and 2010 National Oral Health Survey, not only sociodemographic but also lifestyle factors including smoking, drinking, obesity, and exercise are closely associated with the risk factors of periodontal disease[1,5)]. Among these, smoking and drinking are known to be some of the major factors leading to periodontal disease, and it has been reported that drinkers have higher frequency and severity of chronic periodontal disease than nondrinkers[6)]. Furthermore, periodontal disease reduces the quality of life associated with oral health in daily life, increases medical costs, and reduces productivity. It is also a major oral disease affecting the incidence of systemic disease such as cardiovascular

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disease and diabetes[7-9]. In particular, adulthood in which one begins to face health problems is a period when dental caries and periodontal disease started and progress based on an individual's ability to manage their oral health. Oral care is critical in this period as lack of efforts for dental care or practicing wrong oral care may lead to tooth loss[10]. According to the 2012 Korea National Health and Nutrition Examination Survey (KNHANES), the prevalence of periodontal disease was 26.2% in the age group 40～49 and 34.7% in the age group 50～59, showing that the prevalence of periodontal disease is higher in adults and increases upon aging[11]. As the quality of life is associated with adult health and periodontal status, an individual's oral health care is important[12]. Moreover, health management is very crucial during adulthood as this affects their health status when they get older[13]. Hence, prevention-oriented and comprehensive oral health care must be practiced regularly during adulthood, a stage prior to the elderly stage, and preparation for increasing quantitative life expectancy as well as qualitative life satisfaction in the aging society is required by analyzing periodontal disease factors that reduce the quality of life associated with oral health. However, although oral hygiene management is important in adulthood, studies on the association between periodontal diseases and drinking, a major preferred behavior in adults, are still lacking. Therefore, in this study, adults were divided into young adulthood (19～39 years), middle age (40～64 years), and old age (≥65 years) using data from the National Health and Nutrition Examination Survey, and their drinking behaviors associated with periodontal treatment were analyzed. Thus, we provide basic data needed to develop tools for preventive oral health care in the future.

Materials and Methods

1. Study participants

In this study, statistics with credibility that represent the nation regarding the national health status, health behavior, and the status of food and nutrition intake were derived. In addition, data from the National Health and Nutrition Examination Survey, which were obtained to be used as basic data for the development of health promoting programs and public health policies, were used for this study. The 3rd year (2012) raw data of the 5th KNHANES conducted between January and December 2012 were used. The subjects were 5,995 adults aged 19 years and above who participated in all health surveys and examinations. The age group 19～39 years was classified as young adulthood, 40～64 years as middle age, and 65 years and above as old age for the analysis. Our study was approved by the institutional review board (IRB no. P01－201703-22-001) of public institution appointed by the Ministry of Health and Welfare.

2. Study tools

The independent variables for analyzing the association between drinking and periodontal health were the general characteristics of subjects including sex, age, education, and income level as well as oral health-related life style situations, including the number of tooth brushing and usage of oral hygiene products. The frequency, amount, and problem-related drinking were examined as variables associated with drinking behavior. The subjects were divided into nondrinkers, those who drink once or fewer in a month, and those who drink twice or more a month, based on the frequency of drinking. The amount of drinking at a time was divided into 1～2, 3～6, and 7 glasses or more of drink. For the problem-related drinking, the alcohol use disorders identification test (AUDIT) was used to divide the subjects into two groups: those with scores 0～7 were classified as average drinkers and those with scores 8～15 were classified as problem drinkers[14]. For periodontal health status, periodontal tissue test results using a scale of 0～4 were used to divide the subjects into two groups: those who do not need periodontal treatment (those who need plaque control on the tooth surface) and those who need periodontal treatment (those who need scaling periodontal disease treatment).

3. Analytical methods

The general characteristics of the study subjects were analyzed using the frequency and fraction derived from a complex sample frequency analysis. To analyze the differences in periodontal status based on the general characteristics and drinking behavior of study subjects, the

chi-square test was used. A multiple logistic regression analysis was conducted to analyze the effects of drinking behavior on periodontal status and the statistical significance was set at $p<0.05$. PASW Statistics ver. 18.0 (IBM Co., Armonk, NY, USA) was used for all the analyses.

Results

1. General characteristics of study subjects

General characteristics of study subjects are shown in Table 1. Among the subjects, 50.7% were female and 49.3% were male. Regarding age distribution, 39.0% was young adulthood (19～39 years), 46.1% middle age (40～64 years), and 14.8% old age (≥65 years). High school degree was the highest educational level for 40.6%, followed by college degree or higher for 31.8%, elementary school degree or lower for 18.0%, and middle school degree for 9.7%. Regarding income level, 29.2% had high, 28.8%, medium-high, 26.8%, medium-low, and 15.2%, low, income levels. The highest number of times of tooth brushing a day were three times or more, for 50.2%, followed by twice for 38.3%, and once or less for 11.5%. A total of 54.4% responded that they do not use oral hygiene products, which was higher than 45.6% of those who use them.

Table 1. General Characteristics of Subjects

Variable		Frequency (%)
Gender (n=5,995)	Male	2,506 (49.3)
	Female	3,489 (50.7)
Age (n=5,995)	Young adult (19～39 y)	1,681 (39.0)
	Middle age (40～64 y)	2,719 (46.1)
	Old age (≥65 y)	1,595 (14.8)
Education (n=5,592)	Elementary school or lower	1,443 (18.0)
	Middle school	601 (9.7)
	High school	1,871 (40.6)
	College or higher	1,677 (31.8)
Income level (n=5,896)	Low	1,138 (15.2)
	Lower middle	1,535 (26.8)
	Upper middle	1,545 (28.8)
	Higher	1,678 (29.2)
Toothbrushing (n=5,588)	1 day	686 (11.5)
	2 days	2,193 (38.3)
	3 days or more	2,709 (50.2)
Use of oral hygiene products (n=5,726)	No	3,100 (54.4)
	Yes	2,626 (45.6)

Values are presented as unweighted n (weight %).

2. Need for periodontal treatment according to general characteristics by age group

The need for periodontal treatment based on the general characteristics by age group is shown in Table 2. In young adulthood (19～39 years), men who required the treatment were 59.2%, which was higher than 44.4% of women. For educational level, middle school degree showed 70.2%. For income level, 58.4% was low and 60.8% medium-low. This demonstrates that the need for periodontal treatment decreases as educational and income levels increase. For the number of tooth brushing, those who brush once or more were 58.6%, those who brush twice were 58.0%, and those who brush 3 times or more were 47.7%. Those who do not use oral hygiene products were 55.5%, showing a stronger need for periodontal treatment than 48.7% of those who use them ($p<0.01$). In middle age (40～64 years), men were 78.4%, which was higher than 66.7% of women. For educational level, elementary school degree was 80.5%, and in income level, low was 77.2%, showing that the need for periodontal treatment decreases as education and income levels increase. For the number of tooth brushing, those who brush once or more were 81.9%, those who brush twice were 77.3%, and those who brush 3 times or more were 66.9%. Those who do not use oral hygiene products were 78.1%, showing a stronger need for periodontal treatment than 66.7% of those who use them ($p<0.05$). In old age (≥65 years), the need for periodontal treatment did not show significant results based on sex, educational level, income level, and the number of tooth brushing ($p>0.05$). Those who do not use oral hygiene products were 76.3%, showing a stronger need for periodontal treatment than 65.9% of those who use them ($p<0.01$).

3. Need for periodontal treatment based on the drinking behavior by age group

The need for periodontal treatment based on the drinking behavior by age group is shown in Table 3. In young adulthood (19～39 years), based on the yearly

Table 2. Periodontal Treatment according to General Characteristics by Age Group

Variable		Young adult (19～39 y)			Middle age (40～64 y)			Old age (≥65 y)		
		No	Yes	p-value	No	Yes	p-value	No	Yes	p-value
Total		788 (48.0)	816 (52.0)		756 (27.4)	1.806 (72.6)		373 (26.8)	974 (73.2)	
Gender	Male	261 (40.8)	383 (59.2)	<0.001	243 (21.6)	828 (78.4)	<0.001	155 (25.4)	430 (74.6)	0.356
	Female	527 (55.6)	433 (44.4)		513 (33.3)	978 (66.7)		218 (27.9)	544 (72.1)	
Education	Elementary or lower	0	0	<0.001	109 (19.5)	408 (80.5)	<0.001	191 (24.6)	568 (75.4)	0.064
	Middle school	7 (29.8)	16 (70.2)		91 (22.4)	282 (77.6)		48 (27.7)	125 (72.3)	
	High school	302 (40.9)	382 (59.1)		296 (30.6)	609 (69.4)		65 (30.5)	133 (69.5)	
	College or higher	449 (56.4)	389 (43.6)		233 (30.7)	443 (69.3)		39 (33.9)	76 (66.1)	
Income level	Low	37 (41.6)	52 (58.4)	0.002	61 (22.8)	197 (77.2)	0.019	160 (24.8)	475 (75.2)	0.187
	Lower middle	172 (39.2)	234 (60.8)		172 (28.0)	449 (72.0)		104 (28.3)	265 (71.7)	
	Upper middle	273 (49.2)	276 (50.8)		207 (25.3)	514 (74.7)		61 (30.5)	135 (69.5)	
	Higher	295 (54.7)	248 (45.3)		301 (30.2)	620 (69.8)		41 (31.0)	84 (69.0)	
Toothbrushing	1	39 (41.4)	54 (58.6)	0.004	52 (18.1)	212 (81.9)	<0.001	63 (23.6)	181 (76.4)	0.066
	2	224 (42.0)	282 (58.0)		252 (22.7)	741 (77.3)		146 (24.4)	430 (75.6)	
	3 or more	496 (52.3)	450 (47.7)		423 (33.1)	790 (66.9)		133 (31.7)	286 (68.3)	
Use of oral hygiene products	No	317 (44.5)	391 (55.5)	0.003	295 (21.9)	967 (78.1)	<0.001	213 (23.7)	665 (76.3)	<0.001
	Yes	448 (51.3)	405 (48.7)		442 (33.3)	800 (66.7)		143 (34.1)	261 (65.9)	

Values are presented as unweighted n (weight %).
The data was analyzed by chi-squared test.

Table 3. Drinking Behaviors according to General Characteristics by Age Group

Variable		Young adult (19～39 y)			Middle age (40～64 y)			Old age (≥65 y)		
		No	Yes	p-value	No	Yes	p-value	No	Yes	p-value
Drinking frequency (mo)	Never	106 (52.7)	96 (47.3)	0.045	126 (31.4)	262 (68.6)	<0.001	77 (29.0)	177 (71.0)	0.265
	≤1	285 (52.3)	260 (47.7)		246 (28.8)	490 (71.2)		71 (25.8)	220 (74.2)	
	≥2	339 (44.6)	400 (55.4)		261 (24.4)	770 (75.6)		90 (23.4)	260 (76.6)	
Drinking quantity (glass/d)	1～2	180 (54.1)	164 (45.9)	0.009	245 (30.4)	485 (69.6)	<0.001	98 (25.1)	288 (74.9)	0.506
	3～6	266 (51.0)	255 (49.0)		185 (25.3)	469 (74.7)		44 (20.5)	148 (79.5)	
	7 or over	178 (40.7)	241 (59.3)		77 (20.6)	306 (79.4)		19 (31.2)	44 (68.8)	
Problematic drinking	No	494 (51.0)	482 (49.0)	0.140	491 (30.1)	1,006 (69.9)	<0.001	192 (26.3)	518 (73.7)	0.573
	Yes	236 (44.2)	272 (55.8)		141 (21.1)	514 (78.9)		45 (23.8)	136 (76.2)	

Values are presented as unweighted n (weight %).
The data was analyzed by chi-squared test.

drinking frequency, 55.4% subjects drank twice or more a month, and 47.7% drank once or less a month, and those who do not drink were 47.3%. For the amount of drinking at a time, those who drink seven glasses or more were the highest with 59.3%, and the need for periodontal treatment tended to decrease as the amount of drinking decreased ($p<0.05$). In middle age (40～64 years), those whose yearly drinking frequency was two or higher were 75.6% and those whose drinking amount was seven glasses or more were 79.4%, which were higher than those of other groups. The need for periodontal treatment tended to decrease when the frequency and amount of drinking were low. Problem drinkers were 78.9% and average drinkers were 69.9%, showing a stronger need for periodontal

treatment in problem drinkers ($p < 0.01$). In old age (≥65 years), the need for periodontal treatment based on the yearly drinking frequency, amount of drinking at a time, and the presence of problem drinking did not show significant difference ($p > 0.05$).

4. The effects of drinking behavior by age group on the need for periodontal treatment

The results of multiple logistic regression analysis conducted in order to examine the effects of drinking behavior (yearly drinking frequency, amount of drinking at a time, problem-related drinking) are shown in Table 4. After adjusting the sex, educational level, income level, number of tooth brushing, and usage of oral hygiene products, those who drink seven glasses or more at a time showed an increased need for periodontal treatment by 1.55 times compared to those who drink 1～2 glasses in young adulthood (19～39 years) ($p < 0.05$). In middle age (40～64 years), those whose yearly drinking frequency was two or higher showed an increased need for periodontal treatment by 1.464 times compared to nondrinkers; those who drink seven glasses or more at a time showed an increase by 1.656 times compared to those who drink 1～2 glasses; problem drinkers showed an increase by 1.575 times compared to average drinkers ($p < 0.05$). However, in old age, each drinking behavior did not show a significant effect on the need for periodontal treatment ($p > 0.05$).

Table 4. Association between the Presence of Periodontal Treatments and Drinking Behaviors by Age Group

Variable		Young adult (19～39 y)		Middle age (40～64 y)		Old age (≥65 y)	
		Adjusted OR[a] (95% CI)	p-value	Adjusted OR[a] (95% CI)	p-value	Adjusted OR[a] (95% CI)	p-value
Drinking frequency (mo)	Never	1.000		1.000		1.000	
	≤1	1.030 (0.685～1.548)	0.888	1.188 (0.835～1.691)	0.335	1.189 (0.733～1.928)	0.482
	≥2	1.371 (0.960～1.957)	0.082	1.464 (1.054～2.033)	0.023	1.258 (0.788～2.007)	0.334
Drinking quantity (glass/d)	1～2	1.000		1.000		1.000	
	3～6	1.024 (0.735～1.426)	0.888	1.255 (0.929～1.694)	0.138	1.262 (0.725～2.196)	0.409
	7 or over	1.552 (1.079～2.233)	0.018	1.656 (1.204～2.278)	0.002	0.667 (0.293～1.520)	0.333
Problematic drinking	No	1.000		1.000		1.000	
	Yes	1.244 (0.967～1.602)	0.089	1.575 (1.215～2.042)	0.001	1.064 (0.652～1.738)	0.803

OR: odda ratio, CI: confidence interval.
The data was analyzed by multivariable logistic regression.
[a]Adjusted OR taking account for gender, education, income, frequency of tooth brushing, use of oral hygiene products.

Discussion

Lifestyle habits such as smoking and drinking are frequently observed in adults who have high morbidity of periodontal disease. As age increases, dental caries and periodontal disease developed in school age are accumulated, which can still occur and develop in adulthood. Hence, dental caries and periodontal disease are becoming the major causes of tooth loss[15]. Especially for adults, periodontal disease can induce or maintain a chronic inflammation state systemically, and various complications may deteriorate the quality of life for an extended time without the active management of periodontal disease[5]. Therefore, understanding the cause of periodontal disease

is crucial. Furthermore, alcohol comes in direct contact with the mouth upon drinking, and hence it is highly probable that oral tissues can be negatively affected by drinking[16]. Taking this into account, further studies are needed in this field. Therefore, in this study, we examined the association between periodontal disease and drinking, which is a natural and common habit in middle-aged adults in Korea, using the data from the 2012 KNHANES and hoping to encourage people to quit drinking or cutting down their alcohol intake in order to prevent periodontal disease. It is worth noting that we divided adults into young adulthood (19～39 years), middle age (40～64 years), and old age (≥65 years) for the analysis. The drinking behavior associated with periodontal treatment was analyzed for each age group, and we found that preventive tools for oral health are required for the preparation of aging society. Our study shows that higher level of drinking behavior (yearly drinking frequency, drinking amount at a time, problem drinking) increases the need for periodontal treatment ($p < 0.05$). It shows that in young adulthood and middle age, those who drink seven glasses or more at a time have increased need for periodontal treatment compared to those who drink 1～2 glasses ($p < 0.05$), suggesting that the amount and frequency of drinking affect periodontal disease. This is in line with the study by Han et al.[17] in periodontal status based on the health behavior, which showed that the periodontal status differed depending on the frequency and amount of drinking. In our study, the prevalence of periodontal disease was significantly higher in men than in women ($p < 0.01$). This is in line with the study result by Jang and Nam[18] showing that periodontal disease is high in men. In addition, according to the data from the KNHANES, the prevalence of periodontal disease was 10.8% in the age group 30～39 years, 26.2% in 40～49 years, 34.7% in 50～59 years, 36.4% in 60～69 years, and 44.0% in 70 years and older[11]. This shows that the prevalence of periodontal disease in Korean adults is increasing upon aging[11]. In this study, in young adulthood (19～39 years) and middle age (40～64 years), the need for periodontal treatment decreased as the frequency and amount of drinking were lower. The middle age (40～64 years), especially, had higher drinking frequency than young adulthood (19～39 years), and those who drink seven glasses or more at a time accounted for a high percentage, which shows an increase in the need for periodontal treatment. Moreover, the need for periodontal treatment was high in problem-related drinking ($p < 0.01$). This indicates that middle-aged individuals (40～64 years) are more highly exposed to the risk factors of periodontal disease. Education targeting the middle age group (40～64 years) that encourages them to quit drinking or cutting down the amount of drinking is required.

Periodontal disease very frequently occurs in adults, and its potential risk factors that include age, educational level, sex, economic status, smoking, drinking, hypertension, stress, and social adaptability have been previously reported[19]. Regarding the educational level, one of the potential risk factors of periodontal disease, the need for periodontal treatment tended to decrease as the education and income levels increased in young adulthood and middle age. This is in line with the study by Kim et al.[20] interpreting that people with lower education lack knowledge in oral healthcare or awareness for prevention, neglecting their morbidity of oral disease. Thus, preparing preventive measures for periodontal disease in consideration of educational level and low-income class and reducing the gap between each group are extremely needed. In addition, Kanzler et al.[21] argued that periodontal tissue disease can be highly developed in alcohol addicts as their oral condition is far worse than that of non-addicts. Our study also showed that problem drinkers had an increased need for periodontal treatment by 1.58 times compared to average drinkers ($p < 0.05$). In a study by Jang and Nam[18], drinking had significant association with periodontal disease, and a study by Machuca et al.[22] showed that constant intake of alcohol components can lead to rapid spread of inflammation in the presence of an existing infection of gum.

In this study, the need for periodontal treatment in young adulthood (19～39 years) and middle age (40～64 years) increased by 1.464, 1.656, and 1.575 times in drinkers with the yearly drinking frequency of two or higher than nondrinkers, those who drink seven glasses or more at a time than those who drink 1～2 glasses, and in

problem drinkers than average drinkers ($p < 0.05$), respectively. In addition, the association between drinking and periodontal disease showed mostly high values in the drinker group[16]. Although the negative effects of drinking on health are widely known, drinking habits are still high in Korea. These results show that drinking is a negative factor for periodontal health status. To maintain oral health, we need to remind patients that excessive drinking and increased frequency of drinking can negatively affect periodontal disease, and moderation-in-drinking programs need to be developed to strengthen the prevention of drinking. Furthermore, to activate oral health education centered on middle-aged adults that can help prepare healthy aging society, a consistent oral health improvement program needs to be introduced as a preventive measure.

The limitation of this study is that elucidating the cause-and-effect relationships between periodontal disease and related factors was limited as it was designed as a cross-sectional study. However, the significance of our study is the division of adults in Korea by age using the data from the National Health and Nutrition Examination Survey, which represents the national population, and examined the association between drinking and periodontal disease. Further studies with a wider selection of study subjects as well as studies investigating different factors other than those used in our study are required. Development of programs and education to reinforce the prevention of drinking are also needed.

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