A Study on the Oral Health of Allergic Rhinitis Patients

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Abstract

This study carries out the analysis by using raw data of the 2010 National Health and Nutrition Survey. 8,313 people are selected as final subjects and PASW 18.0 statistical program was used for the analysis. Allergic diseases were used in the analysis by dividing them into atopic dermatitis and AR and the presence or absence of permanent tooth caries experience and presence or absence of periodontal disease were used as oral health-related variables. As a result, atopic dermatitis was found to be related to permanent tooth caries experience and AR to a periodontal disease.

Keywords: *Allergic rhinitis, periodontal disease, oral health*

1. Introduction

Allergic rhinitis (AR) is a disease with symptoms showing repeated sneezing, clear runny nose, nasal stuffiness, and itchy nose caused by IgE mediated allergic inflammation in the nasal mucosa [1] and is one of chronic diseases common in both adults and children, and the prevalence rate is about 20 % [2]. Due to the increase in allergic disease around the world, starting with 'International Study of Asthma and Allergies in Childhood (ISAAC)' program [3, 4] in 1991, Korea also participated in this study and conducted 'Nationwide Study of Asthma and Allergies in Korean Children' [5]. According to this data, elementary school students showed a slight decrease from 31.0% to 29.7% and middle school students showed a tendency to increase from 30.0% to 34.5% in "symptom experience within the last 12 months" [6].

AR patients experience sleep disorder caused by nasal stuffiness, the main symptom and the causes are diverse such as acoustic pressure formation by resistivity, abnormality of antireflection caused by nasal stuffiness, mouth breathing, genetic predisposition *etc.* [7]. Mouth breathing caused by sleep disorder lowers the mandible, reduces the airway [8] and causes xerostomia. Xerostomia is a symptom defined as the expression of the subject for dryness in the mouth [9]. Guggenheimer and Moore [10] said that the most dangerous factors of xerostomia are systemic disease and medication. Those with xerostomia complain of discomfort while having a meal or talk and when putting in dentures and also show expansion of the salivary glands or changes in taste *etc.* [11]. In the case of xerostomia caused by reduced salivation, the prevalence rate of oral diseases such as dental caries and periodontal disease increases [12] and the inflammatory condition in the mouth lasts as well [13].

AR is treated based on four principles of avoidance of cause antigen, medication, immunotherapy, and patient / guardian education. The principle is to stop the exposure to possible causing materials but it is not easy to remove or avoid them so medication becomes the center of treatment to control the inflammation and symptom [14]. AR is a chronic disease that affects the patient's quality of life and associated diseases and its

prevalence rate is increasing continuously. Therefore, it is necessary to understand AR as an allergic inflammatory systemic disease not an individual disease and associated diseases common during diagnosis and treatment should also be evaluated and treated.

Based on a number of previous studies reporting that AR patients breathe with their mouth caused by nasal stuffiness symptom and mouth breathing will have a bad influence on xerostomia and oral health, this study was carried out to find out the relevance between AR and oral health. At the end, the researchers used raw data of the National Health and Nutrition Survey [15] and identified the relevant variables of AR and were to check the oral health status of patients with AR.

2. Research Methods

2.1. Subjects and Data Collection

This study used the raw data of the 1st year (From January to December 2010) of the 5th National Health and Nutrition Survey [15] as research materials. The researchers received analysis data through a review after submitting a research proposal in accordance to the raw data use procedures. Of 8,958 subjects of 1st year of the 5th term, 8,313 subjects who underwent both health survey and ENT (ear-nose-and-throat) examination survey were selected as final subjects. The application ratio of the weighting was applied according to the use guidelines of the 5th (2010-2012) National Health and Nutrition Survey raw data.

2.2. Methods

Oral health is divided into the presence or absence of permanent tooth caries experience and presence or absence of periodontal disease and both variables were responded with 'yes', 'no'. That is, in the presence or absence of permanent tooth caries experience, no caries experience was responded with 'no' and more than 1 caries experiences with 'yes'. For atopic dermatitis and presence or absence of allergic rhinitis, the ENT examination survey items, the presence or absence of doctor's diagnosis was used for the analysis.

2.3. Data Analysis

For the analysis of data, PASW 18.0(Statistical Packages for Social Science Inc., Chicago, IL, USA) was used and the significance level for statistical significance determination was set to 0.05. A plan file was created with strata as a strata variable, cluster as a cluster variable and weighted value (w) as a weighted variable. For the general characteristics of subjects, the complex sample frequency analysis was carried out and the complex sample cross-analysis was conducted in order to check the relevance with oral health. And in order to find out the effect of allergic diseases on oral health, the researchers carried out the complex sample logistic regression analysis with all variables corrected.

3. Results

The general characteristics of subjects are male 50.1%, female 49,9%, age '19 years old or younger' 20.0% and income 'low' 28.1%. The education level was 'Graduate from elementary school or lower' 32.2%, occupation 'Jobless (Housewives, students, etc.,)' 39.3%, smoking 'non-smoking' 63.2%, 'current smoking' 21.1%, and obesity status was 'normal' 63.7%. Atopic dermatitis was found to be 20.4% and AR to be 14.8% (Table 1).

Table 1. General Characteristics of Subjects

	Variables	N	%[1]
Gender	Male	3,774	50.1
	Female	4,539	49.9
Age	19 years old or younger	1,820	20.0
	20-29	787	14.7
	30-39	1,465	18.6
	40-49	1,153	17.1
	50-59	1,171	14.0
	60 years old or older	1,917	15.6
Income	Low	2,040	28.1
	Middle low	2,030	25.1
	Middle high	2,070	24.0
	High	2,052	22.7
Education level	Graduation from elementary school or lower	3,370	32.2
	Graduation from middle school	926	12.1
	Graduation from high school	2,075	30.3
	Graduation from university or higher	1,852	25.4
Occupation	Managers, professionals	753	12.8
	Office workers	503	8.8
	Service and sales workers	800	13.8
	Agriculture, forestry and fishery workers	527	7.1
	Craftsmen, Device. machine operation and assembly workers	569	10.6
	Simple labor workers	501	7.7
	Jobless (Housewives, students, etc.)	2,800	39.3
Smoking	Smoking	1,179	18.8
	Occasional smoking	132	2.3
	Past smoking	1,247	15.7
	Non-smoking	5,675	63.2
Obesity prevalence	Underweight	282	4.7
	Normal	3,956	63.7
	Overweight	1,926	31.5
Atopic dermatitis	Yes	1,917	20.4
	No	6,330	79.6
AR	Yes	1,228	14.8
	No	7,085	85.2
Total		8,313	100.0

[1] Weight %

The relevance between general characteristics and permanent tooth caries experience of subjects were examined and as a result, there was a significant relevance in 'sex'($p<0.001$), 'age'($p<0.001$), 'education level'($p<0.001$), 'occupation'($p<0.01$), 'smoking'($p<0.001$), 'obesity status'($p<0.01$), 'atopic dermatitis'($p<0.001$) and 'AR'($p<0.001$). That is, permanent tooth caries experiences were found in females than males, those in their 50s and 60s or older, higher level of education, managers, professionals and service and sales workers, current smokers, underweight subjects and subjects with atopic dermatitis. In addition, 78.6% of subjects with AR were found to have permanent tooth caries experiences (Table 2).

Table 2. Relevance between General Characteristics and Permanent Tooth Caries Experiences of Subjects

Category		Total[1]	No.	permanent tooth caries experience		p-value[2]
				No	Yes	
				No(%)	No(%)	
Gender	Male	8,284	3,761	1,092(24.2)	2,669(75.8)	.000***
	Female		4.523	873(16.2)	3,650(83.8)	
Age	19 years old or younger	8,284	1,802	974(45.6)	828(54.4)	.000***
	20-29		788	156(14.3)	632(85.7)	
	30-39		1,476	376(20.3)	1,100(79.7)	
	40-49		1,150	115(10.9)	1,035(89.1)	
	50-59		1,164	122(12.1)	1,042(87.9)	
	60 years old or older		1,904	222(10.8)	1,682(89.2)	
Income	Low	8,167	2,027	475(21.1)	1,552(78.9)	.459
	Middle low		2,046	508(20.8)	1,538(79.2)	
	Middle high		2,065	467(19.2)	1,598(80.8)	
	High		2,029	486(19.2)	1,543(80.8)	
Education level	Graduation from elementary school or lower	8,199	3,337	1,414(38.1)	1,923(61.9)	.000***
	Graduation from middle school		922	119(13.7)	803(86.3)	
	Graduation from high school		2,072	242(13.6)	1,830(86.4)	
	Graduation from university or higher		1,868	174(8.7)	1,694(91.3)	
Occupation	Managers, professionals	6,453	758	63(7.9)	695(92.1)	.002**
	Office workers		508	57(13.2)	451(86.8)	
	Service and sales workers		797	65(7.6)	732(92.4)	
	Agriculture, forestry and fishery workers		517	75(11.8)	442(88.2)	
	Craftsmen, Device. machine operation and assembly workers		575	86(15.8)	489(84.2)	
	Simple labor workers		497	53(12.1)	444(87.9)	
	Jobless (Housewives, students, etc.)		2,801	314(12.2)	2,487(87.8)	
Smoking	Smoking	8,210	1,185	158(12.5)	1,027(87.5)	.000***
	Occasional smoking		134	19(18.2)	115(81.8)	
	Past smoking		1,247	176(13.9)	1.071(86.1)	
	Non-smoking		5,644	1,596(24.2)	4,048(75.8)	
Obesity prevalence	Underweight	6,147	277	21(6.4)	256(93.6)	.009**
	Normal		3,948	397(10.3)	3,551(89.7)	
	Overweight		1,922	232(13.1)	1,690(86.9)	
Atopic dermatitis	Yes	2,354	455	231(36.7)	224(63.3)	.000***
	No		1,899	1,103(49.5)	796(50.5)	
AR	Yes	7,805	1,212	313(21.4)	899(78.6)	.000***
	No		6,593	1,289(19.6)	5,304(80.4)	

[1]exclude missing values 2) **p<0.01, ***p<0.001 by value for Chi-square test

The relevance between general characteristics and periodontal diseases of subjects were examined and as a result, there was a significant relevance in 'sex'(p<0.001), 'age'(p<0.001), 'education level'(p<0.001), 'occupation' (p<0.001), 'smoking'(p<0.001), 'obesity status' (p<0.001), 'atopic dermatitis'(p<0.001) and 'AR'(p<0.001). That is,

periodontal diseases were found in males than females, older people, those with lower level of education, agriculture, forestry and fishery workers, current smokers and overweight subjects. In addition, 4.5% of subjects with atopic dermatitis were found to have a periodontal disease and 31.2% of subjects with AR to have a periodontal disease (Table 3).

Table 3. Relevance between General Characteristics and Periodontal Diseases of Subjects

Category		Total[1]	No.	Periodontal disease		p-value[2]
				No	Yes	
				No (%)	No (%)	
Gender	Male	6,697	2,961	2,065(74.1)	896(25.9)	.000***
	Female		3,736	2,987(82.9)	749(17.1)	
Age	19 years old or younger	6,697	790	785(98.9)	5(1.1)	.000***
	20-29		690	654(94.5)	36(5.5)	
	30-39		1,228	1,077(87.2)	151(12.8)	
	40-49		1,148	826(72.0)	322(28.0)	
	50-59		1,146	717(63.1)	429(36.9)	
	60 years old or older		1,695	993(58.6)	702(41.4)	
Income	Low	6,599	1,636	1,210(78.1)	426(21.9)	.349
	Middle low		1,645	1,220(77.5)	425(22.5)	
	Middle high		1,659	1,256(78.1)	403(21.9)	
	High		1,659	1,298(80.7)	361(19.3)	
Education level	Graduation from elementary school or lower	6,633	1,835	1,246(69.8)	589(30.2)	.000***
	Graduation from middle school		897	647(75.7)	250(24.3)	
	Graduation from high school		2,047	1,571(80.3)	476(19.7)	
	Graduation from university or higher		1,854	1,550(84.5)	304(15.5)	
Occupation	Managers, professionals	6,238	752	630(85.1)	122(14.9)	.000***
	Office workers		505	398(80.7)	107(19.3)	
	Service and sales workers		788	601(77.7)	187(22.3)	
	Agriculture, forestry and fishery workers		472	256(57.0)	216(43.0)	
	Craftsmen, Device. machine operation and assembly workers		570	357(65.2)	213(34.8)	
	Simple labor workers		472	322(73.8)	150(26.2)	
	Jobless (Housewives, students, etc.)		2,679	2,067(82.2)	612(17.8)	
Smoking	Smoking	6,646	1,145	735(69.4)	410(30.6)	.000***
	Occasional smoking		132	105(80.9)	27(19.1)	
	Past smoking		1,185	788(72.5)	394(27.5)	
	Non-smoking		4,184	3,391(83.7)	793(16.3)	
Obesity prevalence	Underweight	5,917	258	218(86.8)	40(13.2)	.000***
	Normal		3,806	2,800(77.1)	1,006(22.9)	
	Overweight		1,853	1,266(71.5)	587(28.5)	
Atopic dermatitis	Yes	997	234	201(97.7)	33(4.5)	.000***
	No		763	743(95.5)	20(8.3)	
AR	Yes	6,584	987	679(68.8)	308(31.2)	.000***
	No		5,597	4,131(77.0)	1,460(23.0)	

[1]exclude missing values 2) ***p<0.001 by value for Chi-square test

In order to analyze factors affecting periodontal diseases, the logistic regression analysis was carried out by setting statistically significant items to independent variables and the presence or absence of periodontal disease to a dependent variable. As a result, sex, age and AR were the variables affecting periodontal diseases. That is, periodontal diseases were common in males and periodontal diseases were found in subjects with AR as age increases (Table 4).

Table 4. Logistic Regression Analysis for Factors affecting Periodontal Diseases

Variables	β	S.E	t	p	Exp(B)
Gender					
Male	0.619	0.098	6.328	.000***	1.856
Female(ref.)					
Age					
19 years old or younger	-4.140	0.516	-8.017	.000***	0.016
20-29	-2.552	0.241	-10.609	.000***	0.078
30-39	-1.690	0.139	-12.196	.000***	0.184
40-49	-0.714	0.116	-6.182	.000***	0.490
50-59	-0.240	0.086	-2.800	.006**	0.787
60+(ref.)					
Smoking					
Smoking	1.056	0.814	1.298	0.196	
Occasional smoking	0.623	0.857	0.726	0.469	
Past smoking	0.576	0.814	0.708	0.480	
Non-smoking(ref.)					
Atopic dermatitis					
Yes	-0.077	0.761	-0.101	0.829	0.926
No(ref.)					
AR					
Yes	0.864	0.491	-1.761	0.018*	0.421
No(ref.)					
Adjusted R^2 = 0.242 F=30.634					

*p<0.05, **p<0.01, ***p<0.001

4. Discussion

A periodontal disease is a representative oral disease with dental caries and is a chronic inflammatory disease that the periodontal tissue is destroyed by dental plaque formed on the tooth surface and the host's reaction to this and causes tooth loss [16]. 68.8% of Korean adults are reported to have periodontitis [17] and National Health Survey [18] reported that the prevalence rate continues to increase. It is difficult to clearly distinguish the cause-and-effect relationship between systemic disease and periodontal disease but there are more and more studies on the relevance between periodontal disease and systemic disease in recent years [19-21]. Thus, this study was carried out in order to find out the relevance between oral health and allergic diseases, the most common chronic diseases in adults and children.

According to the study findings, permanent tooth caries experiences were found to be higher in females and to be higher in those in their 40s-50s and 60s or older. And as the education level is higher, caries experiences turned out to be higher. As the results of the previous studies, Jang and Kim [22] showed the opposite results saying that lower income has a negative impact on oral health and Jin, *et al.,* [23] said that those with higher education level are highly interested in oral health. Attention should be paid to the interpretation because the National Health and Nutrition Survey is a cross-sectional

survey and the sequencing of the causal relationship cannot be identified. That is, a subsequent follow-up study is required to find out if the results were shown because those with higher education level are highly interested in oral health and visit a dentist frequently or caries experiences turned out to be high caused by intake of food containing a lot of sugar or other causes. In occupation, the reason for high permanent tooth caries experience in managers, professionals and service・sales workers is considered in the same context as education level. Caries experiences were higher in past smokers or current smokers than non-smokers and in underweight subjects. This shows the opposite results of the study of Choi, *et al.,* [24] who studied the relevance between dental caries and obesity. This is regarded as the result caused by the severe difference in the number of underweight subjects compared to 'normal'or 'overweight'subjects in the obesity status and the need for a subsequent follow-up study is proposed. Subjects with atopic dermatitis, an allergic disease and AR subjects were found to have caries experience by 63.3% and 78.6%, respectively.

On the contrary to permanent tooth caries experience, the relevance of permanent tooth caries experience was found to be higher in males 25.9% than in females 17.1%. This is considered to be the result of reflecting a social phenomenon that smoking and drinking rates are higher in males [15]. And older people and those with lower education level were found to have a periodontal disease and agriculture, forestry and fishery workers and current smokers were found to have a periodontal disease. This is the result of reflecting a trend that as age increases, the number of remaining teeth is reduced and those with lower education level are considered to be the result caused by a lack of the concept on a periodontal disease with invisible symptoms, lack of awareness about scaling and regular check-ups. The results of the previous studies related to smoking were consistent with the research findings of Jeong [24], *et al.,* who investigated that periodontal diseases occur more often in smokers and consistent with the findings of Lee and Park [25] who studied the relevance between obesity and periodontal disease, supporting the results of this study. The onset of periodontal diseases was found to be higher in subjects with AR than in subjects without AR, 31.2% and 23.0%, respectively. Comparison with the results of previous studies was impossible because there are no studies on the relevance between AR and periodontal diseases but the logistic regression analysis also showed the significant relevance between the two variables, implying the need for active research on allergic diseases and oral health in the future.

The limitations of this study are that this is a cross-sectional research and is not enough to explain the causal relationship and does not include variables on a number of allergens. However, there is a meaning in that this study included the concept of oral health as part of the concept of the whole body and was carried out at the time when there are no previous studies related to allergic diseases. In the future, the researchers expect active research on the relevance between oral health and a variety of systemic diseases as well as ENT diseases.

5. Conclusions

This study targeted 8,313 patients who underwent the health survey 와 ENT examination survey by using raw data of the 1st year of the fifth National Health and Nutrition Survey (2010). This study was carried out in order to find out the relevance between allergic diseases and oral health and obtained the following results:

1. The relevance between general characteristics and permanent tooth caries experience of subjects is more significant in females, those in their 50s-60s, those with high education level, smokers and subjects with atopic dermatitis ($p<0.01$).

2. The relevance between general characteristics and periodontal disease of subjects is more significant in males, younger people, those with low education level, smokers, overweight subjects and subjects with AR ($p<0.001$).

Through the above results, the researchers could find the relevance between allergic diseases and oral health and expect them to be provided as basic data of the oral health counseling program of allergy patients.

Acknowledgments

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