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Correlation between Metabolic Syndrome and Allergic Rhinitis

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대사증후군과 알레르기 비염의 상관관계

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ABSTRACT

Metabolic syndrome and allergic rhinitis are two important chronic diseases that affect people all over the world. Metabolic syndrome very often induces other diseases and the prevalence of allergic rhinitis is currently increasing. Aging is known to affect the pathogenesis of various diseases such as metabolic syndrome and allergy. This study examined the effects of metabolic syndrome and the prevalence of allergic rhinitis depending on different age groups and several general characteristics. This study was conducted by using the data from the Korea National Health and Nutrition Examination Survey from the 4th, 5th, 6th, and 7th-1 (2007 ~ 2016). The data used for this study was obtained from 51,854 people. In all age groups, our studies have shown that people without metabolic syndrome have a higher prevalence of allergic rhinitis than those people with metabolic syndrome, and the younger age group had the higher prevalence of allergic rhinitis ($P < 0.05$). Overall, the results of this study found a significant effect on the prevalence of allergic rhinitis in each category of age, general characteristics (physical activity, smoking and drinking) and the presence or absence of metabolic syndrome ($P < 0.05$). The evidence found in this study will help to understand the correlation between metabolic syndrome and allergy, and specifically allergic rhinitis.

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INTRODUCTION

Metabolic syndrome is a condition in which chronic metabolic disorders cause hypertension, hypertriglyceridemia, hyperglycemia, low HDL cholesterol, and abdominal obesity at the same time [1]. In the 2001 American cholesterol syndrome education program

(National Cholesterol Education Program Adult Treatment Panel III; NCEP-ATP III) defined metabolic syndrome as having more than three of the five components of waist circumference (male: >90 cm; female: >85 cm), hyperglycemia (≥ 100 mg/dL), hypertriglyceridemia (≥ 150 mg/dL), hypertension ($\geq 130/85$ mmHg), and low HDL cholesterol (male <40 mg/dL, female <50 mg/dL) [2]. Although the cause of metabolic syndrome is not well known, it is generally assumed that insulin resistance is the root cause. It should also be noted that it is closely related to heart disease and diabetes [3]. However, this does not

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accurately explain the onset of metabolic syndrome.

Allergic rhinitis is caused by Ig E-related immune reactions to characteristic allergic antigens, and the main symptoms are a clear runny nose, stuffy nose, sneezing, and itching, and one or more of these symptoms may be present at any time [4]. The number of patients treated with allergic rhinitis has been on the rise since 2002~2009 and have been diagnosed with allergic rhinitis, atopic dermatitis, and asthma. In 2009, the increase rate of the number of patients treated with atopic dermatitis and asthma decreased from the previous year, following 2008. In 2009, the total number of allergic rhinitis patients (based on the state disease) was 556 million, 253 million men and 304 million women in the world. The number of patients receiving treatment per 10,000 people was 989 in 2008 and 1,109 in 2009. The year-on-year growth rate shows a 12.1% increase in the number of patients treated since 2002. According to the 2015 Health Examination Statistics Report, 14 million people, 72.2% of the total number of participants, had more than one risk factor for metabolic syndrome. The most common allergic disease, allergic rhinitis, is increasing worldwide due to climate change and environmental pollution, with a margin of prevalence ranging from 7.0% to 37.8% [5-8]. Over the past few years, rapidly industrializing, urbanized, and westernized lifestyles have increased the rate of metabolic syndrome and allergic rhinitis among Korean people.

However, research on age and general characteristics between metabolic syndrome and allergic rhinitis is lacking. Accordingly, this study aims to study the correlation between the two diseases using the data from the Korea National Health and Nutrition Examination Survey (KNHANES) IV, V, VI and VII-1. A number of variables have been established and studied, including sex, age group, physical activity (muscle exercise, walking exercise), smoking and drinking.

MATERIALS AND METHODS

1. Subjects

This study was conducted using survey data from the

Korea National Health and Nutrition Examination Survey (KNHANES) IV, V, VI, and VII-1. To produce reliable statistics and to provide basic data on diseases, 10 years of raw data from 2007 to 2016 was integrated by investigating the correlation between metabolic syndrome and allergic rhinitis. The data used in this study were prepared in accordance with the procedures and classifications presented on the KNHANES homepage. The data used in this study were from 62,421 people out of 81,503, excluding the 19,082 who were under the age of 19, and of those that remained, 10,567 had missing values in major variables, leaving 51,854. The missing values were excluded because there were no data related to metabolic syndrome and the prevalence of allergic rhinitis. Age groups were divided into those of young adults (aged 19~39), middle-aged people (aged 40~64), and aged people (over 65).

2. Measurement items

This study was conducted using survey data from the KNHANES-IV, V, VI, and VII-1. The relationship between the prevalence of allergic rhinitis and each component of metabolic syndrome was analyzed according to age group (19~39, 40~64, and over 65) and general characteristics (physical activity, smoking, and drinking).

1) Measurement of metabolic disease variables according to physical activity

The waist circumference was measured to 1 decimal place (0.1 cm) using tape measurements. The final systolic blood pressure and the final diastolic blood pressure, which was the average of the measured blood pressure, were used for the second and third periods. Items of physical activity during the week from 2007 to 2013, as well as moderate and intense physical activity during the week, were not investigated since 2014. Therefore, physical activity was investigated through the practice of muscle exercise and walking exercise, which have been commonly investigated for the past 10 years. People who practiced muscle exercise more than twice a week were surveyed, and those who practiced walking exercise for

more than 30 minutes a week were surveyed. Smoking was divided into three categories: current smokers, past smokers, and non-smokers, according to the KNHANES. Drinking was divided into high-risk drinking and normal/non-drinking, according to the KNHANES.

2) Metabolic syndrome

In the U.S. Cholesterol Education Program (National Cholesterol Education Program Adult Treatment Panel III; NCEP-ATPIII) of 2001, three or more of the five components of waist circumference (male >90 cm, female >85 cm), hyperglycemia (≥ 100 mg/dL), hypertriglyceridemia (≥ 150 mg/dL), hypertension ($\geq 130/85$ mmHg), and low HDL cholesterol (male <40 mg/dL, female <50 mg/dL) were defined as metabolic syndrome. However, in Asians, whose physique differs from that of Westerners, it was suggested that the waist standards for abdominal obesity should be lowered to 90 cm for males and 80 cm for females. Thus, for women in Asia Pacific region, the WHO diagnosed 80 cm as abdominal obesity, and the Korean Society for Obesity reflected this in the diagnosis of abdominal obesity in Korean women as the waist circumference of 85 cm [9].

3) Allergic rhinitis

Allergic rhinitis is a condition characterized by a clear runny nose, stuffy nose, sneezing, and itching due to Ig E-related inflammation reactions in the mucous membrane of the nasal cavity after exposure to certain antigens [10]. Allergens, the cause of allergic rhinitis, can be identified through skin tests or testing for serum-specific Ig E antibodies. A diagnosis can be made if the results of the test match clinical symptoms. Local allergic rhinitis has symptoms of allergic rhinitis, but does not include general body pain as a result of negative reactions to skin tests or serum-specific Ig E antibody tests. However, if a skin test or blood test is negative, the symptoms are examined by directly administering a substance diagnosed as a cause material to the nose before immune treatment or a non-specific Ig E antibody test. If there is a positive reaction, it can be diagnosed.

3. Statistical analysis

The statistical analysis methods undertaken for this study are summarized as follows. Frequency analysis was conducted to identify the general characteristics of the study subjects and characteristics related to metabolic syndrome and allergic rhinitis. A chi-squared test (χ^2 test) was conducted to determine the prevalence of allergic rhinitis according to the general characteristics (physical activity, smoking and drinking) of the study and the presence of metabolic syndrome. Multiple logistic regression analysis was performed to check the effects of metabolic syndrome on allergic rhinitis. IBM SPSS 22.0 (SPSS version 22.0, SPSS Inc., Chicago, IL, USA) was used for statistical analysis and statistical significance was determined at a significance level of <5%.

Table 1. General characteristics of research subjects, allergic rhinitis, and metabolic syndrome

Variables		N (%)
Sex	Men	22,272 (49.9)
	Women	29,582 (50.1)
Age group	Young adult	16,162 (40.2)
	Middle-aged	24,138 (46.6)
	Aged	11,554 (13.2)
Muscle exercise	Yes	10,325 (21.9)
	No	41,529 (78.1)
Walking exercise	Yes	21,147 (41.3)
	No	30,707 (58.7)
Smoking	Present	10,648 (25.3)
	Past	10,393 (20.1)
	Non	30,813 (54.7)
Drinking	High-risk	5,690 (13.4)
	Normal/Non	46,164 (86.6)
Metabolic syndrome	Yes	12,938 (22.7)
	No	38,916 (77.3)
Abdominal obesity	Yes	13,801 (24.8)
	No	38,053 (75.2)
Hyperglycemia	Yes	15,557 (27.5)
	No	36,297 (72.5)
Hypertriglyceridemia	Yes	15,077 (29.3)
	No	36,777 (70.7)
Hypertension	Yes	16,078 (28.3)
	No	35,776 (71.7)
Low HDL cholesterol	Yes	20,556 (35.9)
	No	31,298 (64.1)
Allergic rhinitis	Yes	6,567 (14.2)
	No	45,287 (85.8)
Total		51,854 (100.0)

Abbreviation: HDL, high density lipoprotein.

RESULTS

1. General characteristics of allergic rhinitis and metabolic syndrome

Frequency analysis was conducted to identify the general, metabolic syndrome, and allergic rhinitis-related characteristics of this study (Table 1). A chi-squared test (χ^2 test) was conducted to compare allergic rhinitis prevalence to general characteristics. There was a significant difference in the rate of allergic rhinitis depending on sex ($P<0.001$), age group ($P<0.001$), muscle exercise ($P=0.026$), smoking ($P<0.001$), and

drinking ($P=0.07$) (Table 2). Regarding sex differences, men had a 12.8% allergic rhinitis rate while women had a higher rate of 15.7%. According to the age group, the young adult group was 20.4%, 11.5% for the middle-aged group, and 5.0% for aged group. The higher the age group, the lower the prevalence of allergic rhinitis was. Allergic rhinitis prevalence among those who exercised muscle strength was 15.1% and 14.0% for those who did not exercise muscle strength. Regarding smoking, 12.0% of participants was current smokers, 14.0% were past smokers, and 15.4% was non-smokers, and those who did not smoke had higher levels of allergic rhinitis.

Table 2. Comparison of allergic rhinitis prevalence according to general characteristics

		Allergic rhinitis		Total	P
		Yes	No		
Sex	Men	2460 (12.8)	19812 (87.2)	22272 (100.0)	<0.001
	Women	4107 (15.7)	25475 (84.3)	29582 (100.0)	
Age group	Young adult	3271 (20.4)	12891 (79.6)	16162 (100.0)	<0.001
	Middle-aged	2718 (11.5)	21420 (88.5)	24138 (100.0)	
	Aged	578 (5.0)	10976 (95.0)	11554 (100.0)	
Muscle exercise	Yes	1415 (15.1)	8910 (84.9)	10325 (100.0)	0.026
	No	5152 (14.0)	36377 (86.0)	41529 (100.0)	
Walking exercise	Yes	2676 (14.5)	18471 (85.5)	21147 (100.0)	0.181
	No	3891 (14.0)	26816 (86.0)	30707 (100.0)	
Smoking	Present	1142 (12.0)	9506 (88.0)	10648 (100.0)	<0.001
	Past	1250 (14.0)	9143 (86.0)	10393 (100.0)	
	Non	4175 (15.4)	26638 (84.6)	30813 (100.0)	
Drinking	High-risk	686 (12.9)	5004 (87.1)	5690 (100.0)	0.007
	Normal/Non	5881 (14.4)	40283 (85.6)	46164 (100.0)	
Total		6567 (14.2)	45287 (85.8)	51854 (100.0)	

Table 3. Comparison of allergic rhinitis prevalence according to metabolic syndrome

		Allergic rhinitis		Total	P
		Yes	No		
Metabolic syndrome	Yes	1032 (9.2)	11906 (90.8)	12938 (100.0)	<0.001
	No	5535 (15.7)	33381 (84.3)	38916 (100.0)	
Abdominal obesity	Yes	1338 (11.2)	12463 (88.8)	13801 (100.0)	<0.001
	No	5229 (15.2)	32824 (84.8)	38053 (100.0)	
Hyperglycemia	Yes	1342 (9.8)	14215 (90.2)	15557 (100.0)	<0.001
	No	5225 (15.9)	31072 (84.1)	36297 (100.0)	
Hypertriglyceridemia	Yes	1488 (10.9)	13589 (89.1)	15077 (100.0)	<0.001
	No	5079 (15.6)	31698 (84.4)	36777 (100.0)	
Hypertension	Yes	1421 (10.2)	14657 (89.8)	16078 (100.0)	<0.001
	No	5146 (15.8)	30630 (84.2)	35776 (100.0)	
Low HDL cholesterol	Yes	2292 (12.4)	18264 (87.6)	20556 (100.0)	<0.001
	No	4275 (15.2)	27023 (84.8)	31298 (100.0)	
Total		6567 (14.2)	45287 (85.8)	51854 (100.0)	

Abbreviation: See Table 1.

2. Allergic rhinitis following metabolic syndrome

As a result of a chi-squared test (χ^2 test) to compare the prevalence of allergic rhinitis according to metabolic syndrome, all allergic rhinitis levels were significantly different depending on the presence of metabolic syndrome (all $P < 0.001$) (Table 3). The rate of allergic rhinitis among those with metabolic syndrome was 9.2%, and that of those without metabolic syndrome was 15.7%. The people with metabolic syndrome had lower prevalence of allergic rhinitis than those without metabolic syndrome. Regarding the differences between metabolic syndrome components, the prevalence of allergic rhinitis in abdominal obesity was 11.2%, and that of those was not obese in the abdomen was 15.2%. Of the people who were not obese in the abdomen had high prevalence of allergic rhinitis. The prevalence of allergic rhinitis with hyperglycemia was 9.8%, and that of those was not hyperglycemia was 15.9%. Of the people who were not hyperglycemia had high prevalence of allergic rhinitis. The prevalence of allergic rhinitis with hypertriglyceridemia was 10.9%, and that of those was not hypertriglyceridemia was 15.6%. Of the people who were not hypertriglyceridemia had high prevalence of allergic rhinitis. The prevalence of allergic

rhinitis with hypertension was 10.2%, and that of those was not hypertension was 15.8%. Of the people who were not hypertension had high prevalence of allergic rhinitis. The prevalence of allergic rhinitis with low HDL cholesterol was 12.4%, and that of those was not low HDL cholesterol was 15.2%. Of the people who were not low HDL cholesterol had high prevalence of allergic rhinitis.

3. Effects of metabolic syndrome on allergic rhinitis

To verify the effect of metabolic syndrome on allergic rhinitis, logistic regression analysis was conducted. The general characteristic variables, such as sex, age group, muscle exercise, walking exercise, smoking, and drinking, to metabolic syndrome to determine their influence and referred to the dependent variables for allergic rhinitis. And the reference category is set to 'No allergic rhinitis'. The results are shown in Table 4. As a result, the prevalence of allergic rhinitis with metabolic syndrome was lower by 25.1% compared to the prevalence of allergic rhinitis absence metabolic syndrome (OR=0.749, $P < 0.001$). Logistic regression was conducted for each component of metabolic syndrome in order to verify the effects of each component on allergic rhinitis. Similarly, the influence of sex, age group, muscle exercise, walking exercise, smoking,

Table 4. Effects of metabolic syndrome on allergic rhinitis

		OR	95% CI		<i>P</i>		
			LLCI	ULCI			
Metabolic syndrome	Yes	0.749	0.687	0.818	<0.001		
	No	(reference)					
Sex	Men	0.790	0.725	0.862	<0.001		
	Women	(reference)					
Age group	Young adult	4.843	4.336	5.410	<0.001		
	Middle-aged	2.498	2.237	2.790			
	Aged	(reference)					
Muscle exercise	Yes	1.095	1.013	1.183	0.022		
	No	(reference)					
Walking exercise	Yes	0.995	0.936	1.058	0.878		
	No	(reference)					
Smoking	Present	0.811	0.732	0.898	<0.001		
	Past	1.157				1.051	1.274
	Non	(reference)					
Drinking	High-risk	0.928	0.837	1.029	0.154		
	Normal/Non	(reference)					

Abbreviations: CI, confidence interval; LLCI, lower levels confidence interval; ULCI, upper levels confidence interval.

and drinking was corrected and analyzed (Table 5). Those with abnormal obesity had a lower prevalence of allergic rhinitis than normal (OR=0.855, $P<0.001$). Those with hyperglycemia had a lower prevalence of allergic rhinitis than normal (OR=0.801, $P<0.001$). Those with hypertriglyceridemia had a lower prevalence of allergic rhinitis than normal (OR=0.821, $P<0.001$). Those with hypertension had a lower prevalence of allergic rhinitis than normal (OR=0.853, $P<0.001$). Those with low HDL cholesterol had a lower prevalence of allergic rhinitis than normal (OR=0.868, $P<0.001$). As a result, metabolic syndrome has reduced the prevalence of allergic rhinitis compared to without metabolic syndrome.

4. Allergic rhinitis according to metabolic syndrome by age group

In order to compare the prevalence of allergic rhinitis caused by metabolic syndrome between age groups, the chi-squared test (χ^2 test) was conducted by separating samples into young adults, middle-aged, and aged people.

The results showed that the prevalence of allergic rhinitis in young adults ($P<0.001$), middle aged ($P<0.001$), and aged people ($P=0.013$) is significantly different depending on the presence of metabolic syndrome (Table 6).

5. Effects of metabolic syndrome on allergic rhinitis by age group

For each age group, a logistic regression analysis was conducted to verify the effects of metabolic syndrome components on allergic rhinitis, and the influences of sex, age group, muscle exercise, walking exercise, smoking, and drinking were determined (Table 7). After verifying the effects of each component of metabolic syndrome among young adults on allergic rhinitis, it was found that abnormal obesity, hyperglycemia, and hypertension did not significantly affect allergic rhinitis. On the other hand, hypertriglyceridemia ($P=0.011$) and low HDL cholesterol ($P=0.026$) have been proven to have a significant effect on allergic rhinitis. The prevalence of allergic rhinitis was about 84.9% lower than normal cases of hypertrigly-

Table 5. Effects of metabolic syndrome component on allergic rhinitis

		OR	95% CI		<i>P</i>
			LLCI	ULCI	
Abdominal obesity	Yes	0.855	0.791	0.924	<0.001
	No	(reference)			
Hyperglycemia	Yes	0.801	0.739	0.869	<0.001
	No	(reference)			
Hypertriglyceridemia	Yes	0.821	0.760	0.886	<0.001
	No	(reference)			
Hypertension	Yes	0.853	0.788	0.923	<0.001
	No	(reference)			
Low HDL cholesterol	Yes	0.868	0.811	0.928	<0.001
	No	(reference)			

Abbreviations: See Table 1, Table 4.

Table 6. Comparison of allergic rhinitis prevalence according to metabolic syndrome by age group

Age group	Metabolic syndrome	Allergic rhinitis		Total	P
		Yes	No		
Young adult (aged 19~39), (N=16,162)	Yes	263 (15.5)	1429 (84.5)	1692 (100.0)	<0.001
	No	3008 (21.0)	11462 (79.0)	14470 (100.0)	
Middle-aged (aged 40~64), (N=24,138)	Yes	581 (9.1)	6157 (90.9)	6738 (100.0)	<0.001
	No	2137 (12.5)	15263 (87.5)	17400 (100.0)	
Aged (over 65), (N=11,554)	Yes	188 (4.3)	4320 (95.7)	4508 (100.0)	0.013
	No	390 (5.5)	6656 (94.5)	7046 (100.0)	

Table 7. Effects of metabolic syndrome on allergic rhinitis in young adults

		OR	95% CI		<i>P</i>
			LLCI	ULCI	
Abdominal obesity	Yes	0.896	0.789	1.017	0.090
	No	(reference)			
Hyperglycemia	Yes	0.880	0.757	1.022	0.095
	No	(reference)			
Hypertriglyceridemia	Yes	0.849	0.748	0.963	0.011
	No	(reference)			
Hypertension	Yes	0.919	0.796	1.061	0.250
	No	(reference)			
Low HDL cholesterol	Yes	0.892	0.807	0.986	0.026
	No	(reference)			

Abbreviations: See Table 1, Table 4.

Table 8. Effects of metabolic syndrome on allergic rhinitis in middle-aged people

		OR	95% CI		<i>P</i>
			LLCI	ULCI	
Abdominal obesity	Yes	0.905	0.807	1.016	0.091
	No	(reference)			
Hyperglycemia	Yes	0.828	0.744	0.920	<0.001
	No	(reference)			
Hypertriglyceridemia	Yes	0.861	0.774	0.957	0.006
	No	(reference)			
Hypertension	Yes	0.892	0.807	0.987	0.027
	No	(reference)			
Low HDL cholesterol	Yes	0.889	0.806	0.981	0.019
	No	(reference)			

Abbreviations: See Table 1, Table 4.

ceridemia (OR=0.849, $P<0.011$). In cases of low HDL cholesterol, prevalence of allergic rhinitis was lower than normal for people (OR=0.892, $P=0.026$). In other words, young adults with hypertriglyceridemia and low HDL cholesterol may indicate a lower prevalence of allergic rhinitis. After verifying the effects of each component of metabolic syndrome on middle-aged people and the prevalence of allergic rhinitis, it was found that abnormal obesity did not significantly affect allergic rhinitis (Table 8). On the other hand, hyperglycemia, hypertriglyceridemia, hypertension, and low HDL cholesterol have been proven to have a significant effect on allergic rhinitis ($P<0.05$). The prevalence of allergic rhinitis in people that also had hyperglycemia was lower than normal for people (OR=0.828, $P<0.001$). In cases with hypertriglyceridemia, the prevalence of allergic rhinitis was about 86.1% lower

than normal for people (OR=0.861, $P=0.006$). In cases with hypertension, the prevalence of allergic rhinitis was lower than normal for people (OR=0.892, $P=0.027$). In cases with low HDL cholesterol, the prevalence of allergic rhinitis was lower than normal for people (OR=0.889, $P=0.019$). The results are shown in Table 8. In other words, middle-aged with hyperglycemia, hypertriglyceridemia, hypertension, or low HDL cholesterol can be judged to have a lower prevalence of allergic rhinitis. In aged people, the prevalence of allergic rhinitis, it was found that hyperglycemia, hypertension, and low HDL cholesterol did not significantly affect allergic rhinitis. On the other hand, abnormal obesity and hypertriglyceridemia have been proven to have a significant effect on allergic rhinitis ($P<0.05$) (Table 9). The prevalence of allergic rhinitis in people with abnormal obesity was lower than normal for

Table 9. Effects of metabolic syndrome on allergic rhinitis in aged people

		OR	95% CI		<i>P</i>
			LLCI	ULCI	
Abdominal obesity	Yes	0.748	0.605	0.925	0.007
	No	(reference)			
Hyperglycemia	Yes	0.927	0.757	1.134	0.460
	No	(reference)			
Hypertriglyceridemia	Yes	0.774	0.627	0.955	0.017
	No	(reference)			
Hypertension	Yes	0.913	0.750	1.112	0.365
	No	(reference)			
Low HDL cholesterol	Yes	0.878	0.716	1.077	0.213
	No	(reference)			

Abbreviations: See Table 1, Table 4.

people (OR=0.748, $P=0.007$). In cases with hypertriglyceridemia, the prevalence of allergic rhinitis was lower than normal for people (OR=0.774, $P<0.05$). In other words, aged people with abnormal obesity or hypertriglyceridemia may have a lower prevalence of allergic rhinitis.

DISCUSSION

The study was conducted to provide basic data on the prevalence of allergic rhinitis according to different variables found in normal adult and metabolic syndrome patients. The KNHANES showed that the prevalence of metabolic syndrome and allergic rhinitis is increasing every year, but it was difficult to find any particular relationship between the two diseases. Therefore, it was investigated to determine the correlation between the metabolic syndrome and allergic rhinitis in which prevalence was increasing in the course of rapidly industrializing, urbanized, and westernized lifestyles.

In general, metabolic syndrome has a significant association with age groups. Since the diagnosis of metabolic syndrome has been defined, studies have been conducted on the prevalence of metabolic syndrome in each country, including Korea. As a results, show that metabolic syndrome tends to increase with age [11]. Changes in lifestyle are recommended for the development and management of metabolic syndrome, especially in the

areas of diet and physical activity [12, 13]. Excessive drinking has also been linked to increased abdominal obesity, and alcohol consumption and metabolic syndrome have been linked [14].

If one or more of asthma, allergic rhinitis, atopic dermatitis, and allergic conjunctivitis are diagnosed, the prevalence of allergic diseases decreases with each increase in age. In the preceding study, the prevalence of allergic diseases decreased as both urban and rural populations increased in age [15]. For the personal level variables related to asthma and allergy disorders, the prevalence odds ratio was 0.8 lower for 30~39 years compared to 20~29 years, 0.54 for 40~49 years of age, and 0.4 for 50~59 years of age, and 0.35 for over 60 years of age. The higher age group was lower the prevalence odds ratio. A Swedish population study suggested the importance of gender and age differences [16].

Smoking increases blood LDL cholesterol, lowers HDL cholesterol, and increases the risk of cardiovascular disease [17], which significantly affect metabolic syndrome [18]. Drinking is closely linked to the communities of individuals in Korea, and it is often caused by social motivations, such as work [19]. For women, drinking has a reverse correlation with metabolic syndrome prevalence, and for non-drinking or normal drinking groups, metabolic syndrome prevalence is increased. However, this study is distinguished from other studies in that only the number of times alcohol was consumed was measured without

considering alcohol consumption [20]. No significant link between drinking and metabolic syndrome was identified in some studies [21, 22]. When the effects of drinking, obesity, and metabolic syndrome were identified, a small amount of moderate drinking had the potential to reduce the risk of metabolic syndrome. However, it was concluded that a certain amount of alcohol drinking could increase the risk of obesity and metabolic syndrome [19]. In a three-year follow-up study of Korean men, it was reported that continuous drinking in excess of the appropriate amount could affect the increase in metabolic syndrome prevalence [23]. Physical activity is one of the most important parameters of lifestyle behavior since it increases energy consumption [24]. Changes in lifestyle reduced the frequency of diabetes by 41% [25], and although the effects on metabolic syndrome vary depending on the type of exercise, at least 30 minutes a day of continuous moderate-intense physical activity is effective in controlling blood sugar, improving insulin sensitivity, and controlling blood pressure [26, 27]. Furthermore, moderate and intense physical activity improves cardiovascular health and reduces the risk factor for metabolic syndrome [28-32]. According to the KNHANES in 2016, it has been reported that the level of physical activity in adults has been continuously decreasing in Korea over the past decade [33]. The study that examined the effects of general characteristics affecting metabolic syndrome on allergic rhinitis was insufficient, so the study looked at this relationship.

A variety of studies may have different results, which may be due to the combination of several elements of the relationships between the different factors of metabolic syndrome. The standards of physical activity, drinking, and smoking should be clarified in accordance with the changing social environment and numerous variables affecting these factors should be corrected. It is also believed that continuous research should be conducted with accurate measurements that are excluded from subjective judgments. This study explains the correlation between diseases in statistical ways and has limitations in the extent to which it should be studied in the KNHANES.

Although there is no evidence supporting the preventive effect of allergic rhinitis for cardiovascular disease risk, inflammatory responses of allergic rhinitis are related to atherosclerosis pathogenesis and metabolic conditions [34-36]. Since the study's target is a medical examiner with a relatively high interest in health care, the subject may have a bias of choice due to its own limitations. Furthermore, this study did not consider the prevalence of other diseases and drugs that affect metabolic syndrome and allergic rhinitis, nutritional conditions, or living standards and has statistical analysis. Nevertheless, this study has produced a significant link between metabolic syndrome and allergic rhinitis prevalence by correcting for the age group, physical activity, drinking and smoking of domestic targets.

The correlation between metabolic syndrome and allergic rhinitis prevalence was significant. Therefore, this study is considered meaningful because it has identified the relationship between two diseases, metabolic syndrome and allergic rhinitis, which have increased prevalence among Koreans. In this regard, the factors that affect metabolic syndrome and allergic diseases excluded from this study should be investigated. We also believe that a more detailed correlation should be identified by merging the two diseases into a preceding study.

요약

대사증후군과 알레르기 비염은 중요한 만성질환이다. 본 연구에서는 대사증후군의 각 항목에 따른 알레르기 비염 유병률의 관계를 분석하였다. 제4, 5, 6기 및 제7기 1차년도 국민건강영양조사 자료를 이용한 것으로(KNHANES IV, V, VI, VII-1) (2007~2016년) 이 자료를 통합하여, 51,854명의 연구대상자를 선정하였다. 연령대는 청장년(19~39세), 중년(40~64세), 노년(65세 이상)으로 분류하였다. 또 대사증후군에 영향을 미치는 일반적인 특성인 근력운동, 걷기운동, 흡연, 음주가 미치는 영향이 있다는 사실에 근거하여 조사하였다. 따라서 본 연구는 연령대 및 근력운동, 걷기운동, 흡연, 음주에 따라서 대사증후군 및 알레르기 비염의 유병률에 미치는 영향을 조사했다. 연구 결과 전 연령대에서 대사증후군이 없는 대상자가 대사증후군이 있는 대상자보다 알레르기 유병률이 높았고, 이는 연령대가 낮

을 수록 알레르기 유병률이 높은 것으로 나타났다. 종합해 보면, 이 연구의 결과는 연령별, 일반적 특성별(근력운동, 걷기운동, 흡연, 음주), 대사증후군 또는 대사증후군 각각의 항목별로 알레르기 비염 유병률에 유의한 영향을 미친다는 것을 확인하였다. 본 연구에서 발견된 근거를 바탕으로 대사증후군과 알레르기 비염 유병률의 상관관계를 더 잘 이해하는데 도움이 될 것이다.

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