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Research Article

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Analysis of Risk Factors for COPD Incidence in Adults Over 40 Years of Age in Korea

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| Abstract |

PURPOSE: The purpose of this study is to identify the incidence of chronic obstructive pulmonary disease (COPD) and risk factors for diseases in adults over 40 years of age in Korea, and to provide basic data for the prevention of COPD incidence through management.

METHODS: Based on the 2019 data of the Korea National Health and Nutrition Examination Survey (KNHANES), 1,788 adults over the age of 40 who participated in pulmonary function test and health survey were selected as subjects. COPD incidence risk factors were analyzed using complex sample multiple logistic regression analysis.

RESULTS: As a result of the analysis, the incidence of COPD in Korea was 11.5%, and the risk of developing COPD was higher in men, age, and current smokers. Compared to women, men had an increased risk of developing COPD by 2.369 times (95% CI 1.289-4.355). In age, the risk of COPD incidence increased by 3.702-fold (95% CI 1.923-7.124) in their 50s, 11.238-fold (95% CI 6.009-21.017) in their 60s, and 28.320-fold (95% CI 14.328-55.977) in their 70s compared to those in their 40s. In the smoking state, 2.302 times (95% CI 1.373-3.860) of past smokers and 4.542 times (95% CI 2.694-7.658) of current smokers were found to have a higher risk of developing COPD than non-smokers.

CONCLUSION: To reduce the incidence of COPD, interventions are required to prevent disease development through lifestyle and smoking cessation education in subjects with COPD risk factors.

Key Words: COPD, Incidence, Risk factor

Ⅰ. Introduction

Chronic Observational Pulmonary Disease (COPD) is a disease that reduces airflow due to excessive sputum production along with respiratory airway inflammation [1]. This disease is mainly caused by middle-aged and elderly people, resulting in physical problems such as independent daily life limitations due to dyspnea, weight loss, and hormonal abnormalities, as well as mental problems such as depression, anxiety, and sleep disorders, and increases mortality [2]. The prevalence of COPD over the age of 40 in Korea was reported to be 12.4% in 2011, 11.5% in 2015 and 13.6% in 2019 [3,4]. In addition, the mortality rate from respiratory diseases, including COPD, is 27.7

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per 100,000 people, which is the fifth leading cause of death after cancer, cerebrovascular disease, heart disease, and diabetes [5].

Due to the aging of the population and related risks, respiratory diseases are an important cause of morbidity and mortality [6]. COPD is identified as the leading cause of death worldwide [7]. These facts suggest that health care professionals should monitor COPD prevalence and manage diseases in the long term, as COPD will be a major factor in increasing individual patient health care costs, and furthermore, social health care costs.

In the management of COPD patients, the focus should be on prevention of risk factors along with diagnosis and treatment [7]. Smoking, age, genetic factors, low socioeconomic status, chemicals, or infection have been pointed out as risk factors for COPD disease, and among them, smoking is known to be the most important risk factor for the development and exacerbation of COPD [8]. The mortality rate from COPD also increased as the smoking age increased, and the total amount of smoking increased. In addition, it has been shown that stopping smoking can slow the progression of COPD [9].

This study aims to examine the prevalence and risk factors of COPD in Koreans over 40 years of age with significantly reduced lung function using data from the National Health and Nutrition Survey (KNHANES) conducted by the Korea Disease Control and Prevention Agency in 2019. The sample area (survey area) of the KNHANES was extracted by the multistage cluster stratified sampling method, a complex sample design method, to improve the representativeness of the sample and the accuracy of the estimation. Therefore, when using data from the KNHANES, a complex sample design reflecting weights should be used when analyzing data in accordance with the guidelines for using raw data so that it can represent the entire population in Korea. Therefore, this study provides basic data for developing health care strategies and intervention programs by monitoring COPD prevalence and risk factors for disease occurrence using national statistics that are representative and reliable of the data.

The specific purpose of this study is as follows. First, this study identifies the prevalence of COPD in the study subjects. Second, this study compares and analyze the differences of sociodemographic, health related, and lifestyle characteristics in the COPD and normal groups. Third, this study identifies risk factors that affect the development of COPD.

Ⅱ. Methods

1. Research Participants

This study used data from the KNHANES 2019 conducted by the KCDCA. The subjects were determined as those who responded to all health surveys among adults over 40 years of age, participated in physical measurement tests such as blood sugar and blood pressure, and measured lung function tests. Of the 8,110 subjects who participated in the survey, 3,302 under the age of 40, 2,048 who did not participate in the health survey and physical measurement test, and 972 who did not participate in the lung function test were excluded. Finally, 1,788 subjects were selected (Fig. 1).

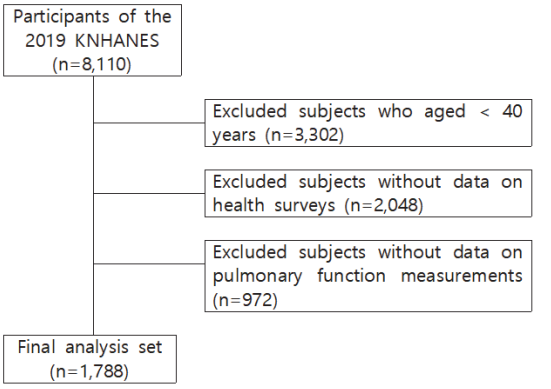

Fig. 1. Flowchart of participants throughout the study.

2. Research Variables

1) Demographic and Sociological Characteristic Factors

As for the demographic and sociological variables, items such as sex, age, education level, marital status, and income level were collected. Age was divided into 40s, 50s, 60s, and 70s or older. Education level was divided into Low and High based on high school graduation. Marital status was classified according to whether you currently live with your spouse. individual income level was divided by the average monthly personal income using the quartile.

2) Health-related Characteristic Factors

Body mass index (BMI) was calculated by dividing body weight (kg) by height squared value (m2). It was divided into underweight, normal, overweight, and obese. Blood pressure was measured using a mercury blood pressure gauge, and after stabilizing for 5 minutes using a cuff suitable for the arm circumference, it was measured three times at intervals of 30 seconds. Hypertension was classified as having systolic blood pressure of 130mmHg or higher, diastolic blood pressure of 85mmHg or higher, or currently taking antihypertensive drugs. Blood tests were collected with an empty stomach maintained for more than 8 hours and analyzed within 24 hours using Hitachi Automatic Analyzer 7600 (Hitachi, Tokyo, Japan). Dysglycemia was defined as fasting blood glucose ≥ of 100 mg/dL or the case of taking diabetic medications. Hypertriglyceridemia was classified as triglyceride above 150 mg/dL. Low HDL-C was classified as less than 40 mg/dL in men and less than 50 mg/dL in women, and abdominal obesity was classified as more than 90 cm in men and more than 85 cm in women based on waist circumference (WC) [10].

3) Lifestyle Characteristic Factors

Smoking status was classified as "daily smoking" and "sometimes smoking" as current smoking, "smoking in the past, but not smoking now" as past smoking, and "never smoking" as non-smoking. Drinking status was classified as non-drinking when responding to 'more than once a month', 'less than once a month', and 'I haven't drunk at all in the last year'.

Aerobic exercise was defined based on the rate of aerobic physical activity practice. Medium-intensity physical activity per week was classified according to whether to practice 2 hours and 30 minutes or high-intensity physical activity for 1 hour and 15 minutes or by mixing medium-intensity and high-intensity physical activity (high-intensity 1 minute is medium-intensity 2 minutes). When asked, "How many times a week do you do muscle exercises (push-ups, sit-ups, dumbbells, or barbells?" resistance exercise was classified according to the presence or absence of exercise for more than 2 days.

4) COPD Definition

Pulmonary function was measured using a spirometer (model 2130; SensorMedics, Yorba Linda, California). Participants were classified according to spirometry patterns into a normal group (FEV 1/FVC ≥ .70, FVC ≥ .80% predicted), an COPD group (FEV1/FVC < .70) [11].

3. Data Analysis

The SPSS 28.0 program was used for data analysis in this study, and the statistical significance level was based on 0.05. To analyze the data of the KNHANES, a complex sampling method was used, and sample survey tools and weights were applied so that the data used in this study could represent the Korean. The specific analysis method is as follows.

First, the difference in characteristics between COPD and normal groups was analyzed by t-test and chi-square test (χ^2-test), and variance estimation was compared using standard errors. Second, complex sample multiple logistic regression analysis was used to analyze risk factors affecting COPD, and the statistics were expressed as odds

ratios and 95% confidence intervals (CI). Conditional forward-stepwise multiple logistic regressions were used to establish the predictive model.

Ⅲ. Results

1. General Characteristics and Health Related Characteristics

In this study, the prevalence of COPD was 11.5%. The differences in the characteristics of the subjects of this study are presented in Tables 1 and 2. The demographic and sociological characteristics of COPD and normal groups were statistically significant differences in gender, age, height, and education level. The proportion of COPD was higher in those the gender of the subjects was men than women, in those in their 60s, and those with low education level. Health-related characteristics were significantly different in hypertriglyceridemia. There was a statistically significant difference in lifestyle characteristics in smoking status. The COPD rate was high in the case of current smoking and past smoking.

2. Factors Affecting COPD Incidence

As a result of simple logistic regression, the factors affecting COPD were gender, age, education level, and smoking status. However, in the multiple regression analysis that adjusted the influencing factors, significant differences were found only in the sex, age, and smoking status. Nagelkerke R^2=0.291 of the final multiple logistic regression model. Compared to women, men had an increased risk of developing COPD by 2.369 times (95% CI 1.289-4.355). In age, the risk of COPD incidence increased by 3.702-fold (95% CI 1.923-7.124) in their 50s, 11.238-fold (95% CI 6.009-21.017) in their 60s, and 28.320-fold (95% CI 14.328-55.977) in their 70s compared to those in their 40s. In the smoking state, 2.302 times (95% CI 1.373-3.860) of past smokers and 4.542 times (95% CI 2.694-7.658) of current smokers were found to have a higher risk of developing COPD than non-smokers (Table 3).

Table 1. General characteristics of continuous variables in subjects according to COPD

Variables	COPD (n=227)	Normal (n=1,561)	p
Age(y)	63.2 ± .84	53.14 ± .33	< .001
Height (cm)	166.55 ± .61	163.73 ± .26	< .001
Weight (kg)	66.01 ± .77	64.36 ± .36	.058
BMI (kg/m²)	23.73 ± .21	23.9 ± .11	.472
Systolic BP (mmHg)	124.41 ± 1.11	118.65 ± .47	< .001
Diastolic BP (mmHg)	76.17 ± .62	77.5 ± .29	.034
Fasting glucose (mg/dL)	106.14 ± 1.62	101.8 ± .71	.018
Triglyceride	152.34 ± 7.86	137.01 ± 2.83	.058
HDL-cholesterol	49.98 ± .87	53.25 ± .43	< .001
WC (cm)	86.64 ± .60	83.81 ± .31	< .001
FVC (L)	3.58 ± .07	3.66 ± .03	.248
FEV1 (L)	2.31 ± .05	2.89 ± .02	< .001
FEV1/FVC (%)	0.65 ± .01	0.80 ± .01	< .001
PEF (L/sec)	6.29 ± .15	7.40 ± .07	< .001

Data were presented as means ± SE (%). BMI=body mass index; BP=blood pressure; HDL=high density lipoprotein; WC=Waist circumference; FVC=forced vital capacity, FEV1=forced expiratory volume in 1 second; PEF=peak expiratory flow

Table 2. General characteristics of categorical variables in subjects according to COPD

Factors	Categories	COPD (n=227)		Normal (n=1561)		χ^2	p
		U/F N	W/F %	U/F N	W/F %		
Sex	Men	167	77.5	628	46.5	69.911	< .001
	Women	60	22.5	933	53.5		
Age	40-49	18	9.0	621	41.6	169.289	< .001
	50-59	56	28.2	520	34.8		
	60-69	88	33.9	286	16.1		
	≥70	65	28.9	134	7.4		
Education	Low	170	71.2	889	54.4	20.828	< .001
	High	57	28.8	672	45.6		
Marital status	with	185	83.2	1287	85.2	.557	.448
	without	42	16.8	247	14.8		
Individual income	Q1 (Lowest)	52	21.7	354	22.2	1.792	.668
	Q2	53	22.9	386	24.3		
	Q3	57	25.1	418	27.5		
	Q4 (Highest)	65	30.3	403	26.1		
BMI	Low	8	3.0	32	1.8	2.246	.558
	Normal	152	68.4	1050	66.3		
	Overweight	59	25.7	426	28.0		
	Obesity	8	2.9	53	3.9		
Blood pressure	Normal	141	63.0	1073	67.5	1.720	.191
	Hypertension	86	37.0	524	32.5		
Glucose	Normal	107	50.9	915	58.8	4.650	.051
	Dysglycemia	120	49.1	646	41.2		
TG	Normal	143	60.2	1099	68.4	5.615	.025
	High	84	39.8	462	31.6		
HDL-C	Normal	161	71.2	1101	71.6	.019	.889
	Low	66	28.8	460	28.4		
WC	Normal	137	60.8	1078	68.4	4.774	.050
	abdominal obesity	90	39.2	483	31.6		
Smoking status	current	73	35.6	245	17.5	73.713	< .001
	past	87	38.1	359	25.3		
	non	67	26.3	957	57.1		
Alcohol	Yes	173	77.7	1170	75.8	.373	.557
	No	54	22.3	391	24.2		
Aerobic exercise	Yes	103	46.9	648	41.8	1.964	.153
	No	124	53.1	913	58.2		
resistance exercise	Yes	49	23.8	258	17.7	4.414	.083
	No	178	76.2	1303	82.3		

Data were presented as means ± SE (%).
BMI=body mass index; BP=blood pressure; HDL=high density lipoprotein; WC=Waist circumference

Table 3. Multiple logistic regression analysis for COPD risk factor

Variables		Crude OR		Adjusted OR	
		OR (95% CI)	p	OR (95% CI)	p
Sex	Men	3.961 (2.635-5.953)	< .001	2.369 (1.289-4.355)	.006
	Women	1.0		1.0	
Age	40-49	1.0		1.0	
	50-59	3.724 (2.076-6.681)	< .001	3.702 (1.923-7.124)	< .001
	60-69	9.650 (5.588-16.666)	< .001	11.238 (6.009-21.017)	< .001
	≥70	17.860 (9.932-32.117)	< .001	28.320 (14.328-55.977)	< .001
Education	Low	2.070 (1.416-3.027)	< .001	1.304 (0.798-2.131)	.288
	High	1.0		1.0	
Smoking status	current	4.413 (2.936-6.633)	< .001	4.542 (2.694-7.658)	< .001
	past	3.267 (2.228-4.790)	< .001	2.302 (1.373-3.860)	.002
	non	1.0		1.0	
WC	Normal	1.0		1.0	
	abdominal obesity	1.395 (1.000-1.944)	.050	1.166 (0.817-1.663)	.396

Data were presented as means ± SE (%).
BMI=body mass index; BP=blood pressure; HDL=high density lipoprotein; WC=Waist circumference

Ⅳ. Discussion

This study was conducted to identify COPD prevalence and risk factors affecting disease incidence, and to provide basic data for developing health care strategies for COPD disease and intervention programs for prevention. In this study, the prevalence of COPD among adults over 40 years of age in Korea was 11.5%.

In this study, the final risk factors for COPD revealed in the multiple regression analysis of this study were sex, age, and smoking status. The prevalence of COPD in men was shown to be about 2.37 times higher than in women. COPD generally has a high prevalence in men. Although it varies from study to study, several previous studies have shown that men are 2 to 4 times higher than women in the COPD rate of middle-aged people, which is consistent with the results of this study [12,13]. These gender differences support the need for targeted assessment and management of COPD in women and men.

As age increased, the risk of developing COPD increased, and compared to those in their 40s, it increased 3.70 times in their 50s, 11.24 times in their 60s, and 28.32 times in their 70s and older. The prevalence of COPD increases with age, especially in those over 60 years of age [14]. This phenomenon is similar not only in Korea but also abroad. The results of this study, the prevalence of COPD increased with increasing age, especially in those over 60 years of age [15]. Therefore, it is thought that national health prevention or customized environmental health policy projects will help the public's health care for the elderly, who are sensitive to COPD.

Smoking is a major trigger for the occurrence of COPD, and as the smoking rate increases, the prevalence of COPD also increases [16]. In the results of this study, past smokers had a 2.30 times higher risk of developing COPD than non-smokers and current smokers had a 4.54 times higher risk of developing COPD. According to the World Health Organization, men's smoking rate is 34 percent worldwide,

6 percent of women smoke, and Korea's smoking rate is 40.9 percent for men and 6.2 percent for women [17]. Although the male smoking rate has halved due to various tobacco control policies compared to 20 years ago, the current smoking rate in Korea is high among OECD member countries, and the smoking rate for women in their 20s and 30s is increasing [18]. Accordingly, the incidence of COPD in Korea due to smoking is thought to continue, and the prevalence of women is expected to increase. In particular, the negative effects of smoking on the lungs are more lethal in women than in men, depending on their physical structural characteristics. This may further increase disease morbidity caused by smoking, as the lung size of women is relatively small, and the metabolism of nicotine is slower than that of men [19]. Therefore, active smoking cessation management is necessary to prevent COPD diseases.

This study has several limitations. First, this study is a cross-sectional study, which identified the factors affecting the occurrence of COPD at the time of investigation. Therefore, there is a limit to explaining the causal relationship. Therefore, it is necessary to confirm the causal relationship through cohort studies in the future. Second, the smoking period and amount of smoking of smokers were not considered in this study, and factors that can affect the development of COPD, such as secondhand smoke or family history, were not considered even for non-smokers, so further studies considering this will be needed in the future. Third, in several recent studies, air pollution, especially fine dust, has attracted attention among the risk factors for COPD [20]. Moreover, smelter workers and chefs with jobs related to incomplete combustion in addition to cigarettes are also emerging as risk factors [21, 22]. However, there is a limitation because related information cannot be obtained from the data of this study. Therefore, it is difficult to determine only smoking as a risk factor for COPD, and further research is needed. Despite these limitations, this study has research significance as a primary basis for health promotion projects for COPD subjects.

Ⅴ. Conclusion

This study was conducted to provide basic data for COPD prevention and management by identifying the prevalence and risk factors of COPD in adults over 40 years of age in Korea. COPD prevalence was found to be 11.5%. Analysis of the factors affecting the incidence of COPD showed that in men, the higher the age, the higher the risk of occurrence in past and current smokers. Therefore, intervention programs to prevent diseases through smoking cessation education and lifestyle control are required for subjects with COPD risk factors.

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