Original Article

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Impact of Alcohol Consumption on Quality of Life, Depressive Mood and Metabolic Syndrome in Obstructive Lung Disease Patients: Analysis of Data from Korean National Health and Nutrition Examination Survey from 2014 and 2016

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Abstract

Background: The objective of this study was to investigate whether alcohol consumption might affect the quality of life (QOL), depressive mood, and metabolic syndrome in patients with obstructive lung disease (OLD).

Methods: Data were obtained from the Korean National Health and Nutrition Examination Survey from 2014 and 2016. OLD was defined as spirometry of forced expiratory volume in 1 second/forced vital capacity <0.7 in those aged more than 40 years. QOL was evaluated using the European Quality of Life Questionnaire-5D (EQ-5D) index. Patient Health Questionnaire-9 (PHQ-9) was used to assess the severity of depressive mood. Alcohol consumption was based on a history of alcohol ingestion during the previous month.

Results: A total of 984 participants with OLD (695 males, 289 females, age 65.8±9.7 years) were enrolled. The EQ-5D index was significantly higher in alcohol drinkers (n=525) than in non-alcohol drinkers (n=459) (0.94±0.11 vs. 0.91±0.13, p=0.002). PHQ-9 scores were considerably lower in alcohol drinkers than in non-alcohol drinkers (2.15±3.57 vs. 2.78±4.13, p=0.013). However, multiple logistic regression analysis showed that alcohol consumption was not associated with EQ-5D index or PHQ-9 score. Body mass index ≥25 kg/m^2, triglyceride ≥150 mg/dL, high-density lipoprotein <40 mg/dL in men and <50 mg/dL in women, and blood pressure ≥130/85 mm Hg were significantly more common in alcohol drinkers than in non-alcohol drinkers (all p<0.05).

Conclusion: Alcohol consumption did not change the QOL or depressive mood of OLD patients. However, metabolic syndrome-related factors were more common in alcohol drinkers than in non-alcohol drinkers.

Keywords: Alcohol; Quality of Life; Obstructive Lung Disease; Depression

Introduction

Chronic obstructive pulmonary disease (COPD) is characterized by airway inflammation, parenchymal destruction, and expiratory airflow limitation[1]. It causes various respiratory symptoms such as cough, sputum, and dyspnea on exertion. However, the manifestation of COPD is usually not limited to the respiratory system. It may present with various systemic manifestations such as cardiovascular disease, osteoporosis, mental health issue, malnutrition, and skeletal muscle dysfunction[2]. These respiratory and systemic manifestations might decrease the quality of life (QOL) and cause psychological problems in COPD patients. For example, depression is a frequent comorbidity, occurring in 15% to 40% of COPD patients[3-5]. In addition, metabolic syndrome is more frequently found in patients with COPD, with an estimated prevalence of more than 30%[6,7].

Alcohol consumption may affect QOL and depressive mood in the general population. In a cross-sectional study in Finland, the amount of alcohol drinking and frequency of binge drinking were associated with impaired QOL in persons with depression[8]. Contrarily, moderate-risk alcohol drinkers had a lower risk of depressive mood and higher QOL than low-risk drinkers in the general population in Korea[9]. A cohort study in Korea has reported that as a metabolic syndrome-related factor, heavy alcohol drinking is associated with higher blood pressure (BP), fasting glucose, and triglyceride (TG) levels in the general population[10].

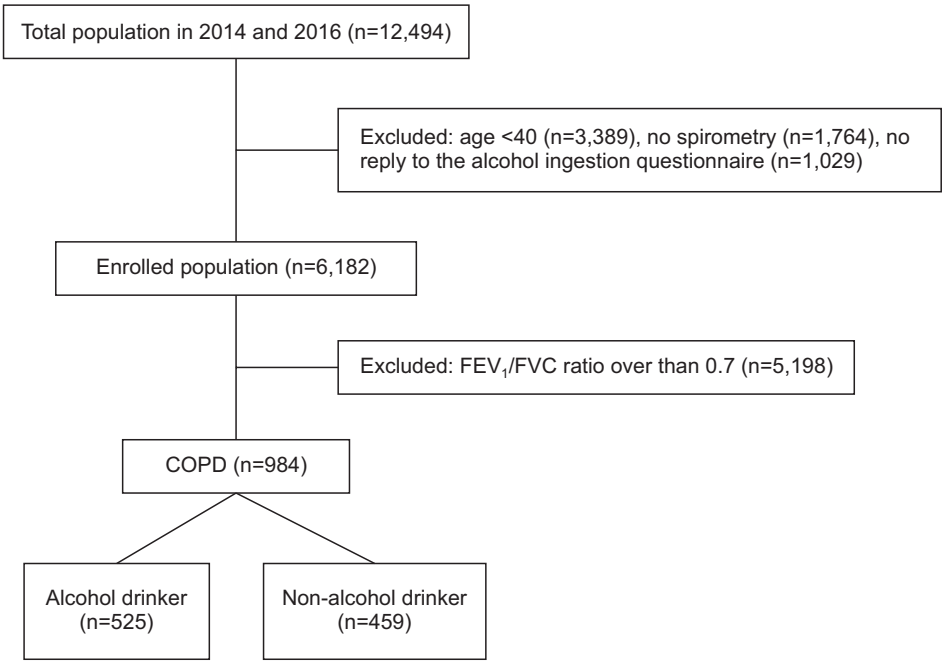
People with COPD usually stop smoking because of respiratory symptoms or a doctor's advice. However, many continue to drink to reduce psychological stress and halt the declining QOL after quitting smoking. Relationships of alcohol consumption with QOL, depressive mood, and metabolic syndrome-related factors have not been extensively studied in patients with COPD. Therefore, the objective of this study was to investigate whether alcohol consumption might be associated with QOL, depressive mood, and metabolic syndrome in patients with COPD.

Materials and Methods

1. Study population

This was designed as a cross-sectional observational study. Data were obtained from the Korea National Health and Nutrition Examination Survey from 2014 and 2016 (KNHANES VI). KNHANES is a nationwide, population-based, cross-sectional program that collects detailed information on the health and nutrition status of non-institutionalized Korean population. Data on demographics, smoking status, and physician-diagnosed comorbidities such as hypertension, stroke, ischemic heart disease, diabetes mellitus, activity limitations, lung function, depressive mood, and QOL were

Figure 1. Flow diagram of the study population. FEV_1/FVC: forced expiratory volume per 1 second/forced vital capacity; COPD: chronic obstructive pulmonary disease.



obtained using complex, stratified, multistage probability sampling to represent the Korean population.

Of a total of 12,494 participants in 2014 and 2016 of the KNHANES, we included adults aged over 40 years who had received pulmonary function tests. We also included participants who replied to the alcohol ingestion questionnaire (Figure 1). The Institutional Review Board (IRB approval number: 2013-07CON-03-4C, 2013-12EXP-03-5C, and 2018-01-03-PA) approved the KNHANES protocol of the Korean Centers for Disease Control and Prevention. All participants provided informed consent to participate in this study.

2. Definition of obstructive lung disease

The presence of obstructive lung disease (OLD) was defined as forced expiratory volume in 1 second (FEV_1) divided by forced vital capacity (FVC) ≤0.7 as suggested by the Global Obstructive Lung Disease (GOLD) guidelines. Trained medical technicians conducted pulmonary function tests using the Thoracic Society/European Respiratory Society Task Force with dry rolling seal spirometers (Model 2130, Sensor Medics, Yorba Linda, CA, USA).

3. Assessment of QOL and depressive mood

Patient Health Questionnaire-9 (PHQ-9) is a screening tool for measuring depressive mood. It comprises nine symptom-related items that measure the frequency of a participant's experience of depressive symptoms over the previous 2 weeks. Participants responded to each item with "not at all" (scored as 0), "on several days" (scored as 1), "on more than half the days" (scored as 2), or "nearly every day" (scored as 3). Scores for all individual items were summed to obtain a total PHQ-9 score ranging from 0 to 27, with a higher score indicating a higher severity of depressive mood.

The European Quality of Life Questionnaire-5D (EQ-5D) was used to evaluate five dimensions (mobility, self-care, usual activities, pain/discomfort, and anxiety/depression) to assess QOL. Participants responded to each dimension with three functional levels: no problems, some problems, or extreme problems. These responses were converted into EQ-5D summary index scores using a specific Korean valuation set developed by the time trade-off protocol at the Korean Centers for Disease Control and Prevention. EQ-5D index ranged from 0 to 1[11].

4. Assessment of metabolic syndrome

Metabolic syndrome was defined according to the new International Diabetes Federation criteria except that waist circumference cutoff was modified to be specific to the Korean population[12]. According to these criteria, metabolic syndrome was defined based on central obesity, waist circumference ≥90 cm in men and ≥80 cm in women, or a body mass index (BMI) ≥25 kg/m^2, and any two of the following four factors: (1) systolic BP ≥130 mm Hg, diastolic BP ≥85 mm Hg, or use of antihypertensive medications; (2) TG level ≥150 mg/dL or use of anti-hyperlipidemic medications; (3) high-density lipoprotein cholesterol (HDL-C) level <40 mg/dL in men and <50 mg/dL in women; and (4) fasting plasma glucose level ≥100 mg/dL or previous diagnosis of diabetes.

5. Assessment of alcohol consumption

The definition of a drinker was based on self-report. A person was classified as a drinker if he or she had consumed at least one glass of alcohol per month over the past year without distinguishing between beers, soju, and foreign liquors. Otherwise the person was classified as a non-drinker. Alcohol drinkers were additionally asked to complete a questionnaire regarding the amount and frequency of alcohol consumption in the past 30 days. Daily alcohol consumption was calculated based on the average consumption frequency and amount per occasion. Participants were categorized into three groups according to their baseline alcohol consumption: low-risk (<5 g/day), moderate-risk (≥5 but <30 g/day for men, ≥5 but <15 g/day for women), and high-risk (≥30 g/day for men, ≥15 g/day for women) alcohol drinkers[13].

6. Nutrition survey

The nutrition survey was divided into a 24-hour dietary recall, a dietary behavior survey, and a food security survey. For the 24-hour dietary recall, a team of dieticians visited each participant's household and conducted individual interviews with all household members over the age of 1 year to collect data about names of dishes or food, amounts consumed, and the location and type of meals eaten a day prior in chronological order. To determine the exact amount of the intake, we investigated each individual's intake using various measuring aids. For nutrients, we examined total energy and proportions of energy from carbohydrates, proteins, fats, and other components[14].

7. Statistical analysis

All continuous values are described as mean±standard deviation and categorical values are reported as absolute numbers and percentages. Student's t-test or Mann-Whitney U test was used to analyze continuous values according to data distribution. Categorical val-

Table 1. Comparison of clinical characteristics between alcohol drinkers and non-alcohol drinkers in enrolled obstructive lung disease patients

Characteristic	Alcohol drinkers (n=525)	Non-alcohol drinkers (n=459)	p-value
Age, yr	63.7±10.0	68.2±8.78	0.000
Male sex	447 (85.1)	78 (14.9)	0.000
BMI, kg/m^2	24.1±2.87	23.7±3.14	0.034
Smoking status			
Current smoker	167 (31.8)	95 (20.7)	0.000
Never smoked	108 (20.6)	232 (50.5)	0.000
Ex-smoker	250 (47.6)	132 (28.8)	0.000
Alcohol consumption			
Light to moderate-risk	318 (60.6)		
High-risk	207 (39.4)		
PFT			
FEV_1, L	2.49±0.6	2.03±0.61	0.005
FEV_1, % predicted	80.5±14.6	78.4±17.1	0.036
FVC, L	3.87±0.83	3.19±0.88	0.000
FVC, % predicted	91.3±13.3	88.5±15.8	0.000
FEV_1/FVC, L	0.64±0.06	0.63±0.07	0.116
Underlying disease			
Hypertension	218 (41.5)	184 (40.1)	0.083
Ischemic heart disease	26 (5.1)	24 (5.4)	0.961
Stroke	6 (1.1)	14 (3.1)	0.055
Diabetes	71 (13.5)	80 (17.4)	0.220
Arthritis	57 (11.2)	100 (22.5)	0.000
CRF	3 (0.6)	1 (0.2)	0.590
LC	1 (0.2)	3 (0.7)	0.427
Lung cancer history	5 (1)	0	0.926
Pulmonary TB history	37 (7.0)	45 (9.8)	0.241
Depression history	13 (2.5)	17 (3.7)	0.445
Laboratory finding (n=939)			
Glucose, mg/dL	107.7±25.3	103.8±23.9	0.016
AST, IU/L	24.9±7.17	22.6±7.16	0.001
ALT, IU/L	22.9±13.8	20.5±11.5	0.004
Hemoglobin, g/dL	14.8±1.31	13.8±1.45	0.000
Hematocrit, %	44.4±3.68	42.1±4.08	0.000
BUN, mg/dL	15.9±4.47	16.49±4.81	0.049
Creatinine, mg/dL	0.82±0.20	0.89±0.22	0.027
Nutritional intake (n=845)			
Food, g	1,616.5±809.4	1,381±719.8	0.000
Water, g	1,146.7±711.7	958.1±608.0	0.000
Calories, kcal	2,081.0±767.1	1,787.7±716.5	0.000
Protein, g	70.9±35.1	58.9±29.6	0.000
Lipid, g	38.28±28.6	30.67±25.2	0.000
Carbohydrate, g	320.3±120.1	315.1±125.9	0.535

Table 1. Continued

Characteristic	Alcohol drinkers (n=525)	Non-alcohol drinkers (n=459)	p-value
Physical activity			
Activity limitation	43 (8.2)	58 (12.6)	0.064
Vigorous activity in the workplace	11 (2.1)	9 (2.0)	0.971
Vigorous activity for leisure	54 (10.3)	26 (5.7)	0.030
Cough over 3 months*	32 (6.1)	29 (6.3)	0.885
Sputum over 3 months†	75 (14.3)	60 (13.1)	0.581
Weight loss for a year	59 (11.2)	69 (15.0)	0.151

Values are presented as mean±standard deviation or number (%).
*Participants had to respond to the following question: "Have you had a cough on most days for 3 months or more during the past year?". †Participants had a response to the following question: "Have you had sputum almost every day for at least 3 consecutive months 1 year?".
BMI: body mass index; PFT: pulmonary function test; FEV_1: forced expiratory volume per 1 second; FVC: forced vital capacity; FEV1/FVC: forced expiratory volume per 1 second/forced vital capacity; CRF: chronic renal failure; LC: liver cirrhosis; TB: tuberculosis; AST: aspartate transaminase; ALT: alanine transferase; BUN: blood urea nitrogen.

ues were analyzed using the chi-square test or Fisher's exact test. Multiple logistic regression analysis was performed to evaluate factors associated with depressive mood and QOL. In all comparisons, a p-value of <0.05 was considered statistically significant. All statistical analyses were performed using SPSS version 25.0 (IBM Corporation, Armonk, NY, USA) for Windows (Microsoft Corporation, Redmond, WA, USA).

Results

1. Baseline characteristics of alcohol drinkers and non-drinkers

A total of 984 participants with OLD (695 males, 289 females, age 65.8±9.7 years) were enrolled in the study. A total of 525 alcohol drinkers and 459 non-alcohol drinkers were identified (Figure 1). Alcohol drinkers were younger than non-alcohol drinkers. Proportions of males and current smokers were higher in alcohol drinkers than in non-alcohol drinkers. Non-alcohol drinkers also had worse lung functions as assessed by FEV_1, FVC, and FEV_1/FVC ratio than alcohol drinkers. Regarding comorbid illnesses, they showed no significant difference between the two groups. Sputum production over 3 months was significantly higher in alcohol drinkers than in non-alcohol drinkers (14.3% vs. 5.5%). Nutritional intakes such as water, protein, lipid, and whole food were significantly higher in alcohol drinkers than in non-alcohol drinkers. In laboratory findings, serum glucose, aspartate transaminase, alanine transferase, hemoglobin, and hematocrit levels were significantly higher in alcohol drinkers than in non-alcohol drinkers (Table 1).

2. Comparison of QOL (EQ-5D index) and depressive mood (PHQ-9 score) between alcohol drinkers and non-alcohol drinkers in OLD patients

The EQ-5D index was significantly higher in alcohol drinkers than in non-alcohol drinkers (0.94±0.11 vs. 0.91±0.13, p=0.002). PHQ-9 scores were considerably lower in alcohol drinkers than in non-alcohol drinkers (2.15±3.57 vs. 2.78±4.13, p=0.014) (Figure 2). Among alcohol drinkers, PHQ-9 scores were significantly higher in high-risk alcohol drinkers than in light to moderate-risk alcohol drinkers (2.64±4.19 vs. 1.83±3.08, p=0.01). However, there were no significant differences in EQ-5D index score between high-risk alcohol drinkers and light to moderate-risk alcohol drinkers (0.94±0.1 vs. 0.93±0.12, p=0.342) (Table 2).

3. Factors associated with QOL (EQ-5D index) and depressive mood (PHQ-9 score) in OLD patients

Multiple logistic regression analysis evaluated factors associated with QOL (EQ-5D index) and depressive mood (PHQ-9 score) in OLD. Results showed that QOL, age, male sex, current smoking, activity limitation, sputum production for 3 months, and calorie intake per day were significantly associated with the EQ-5D index. Male sex, BMI, activity limitation, and sputum production were considerably associated with the PHQ-9 score. However, alcohol consumption was not associated with the EQ-5D index or PHQ-9 score (Table 3).

4. Comparison of metabolic syndrome-related factors between alcohol drinkers and non-alcohol drinkers in OLD patients

Results of assessing metabolic syndrome-related fac-

Figure 2. Comparison of (A) quality of life (EuroQol Five-Dimension Questionnaire [EQ-5D] index) and (B) depressive mood (Patient Health Questionnaire [PHQ-9] score) between alcohol drinkers and non-alcohol drinkers in chronic obstructive pulmonary disease.

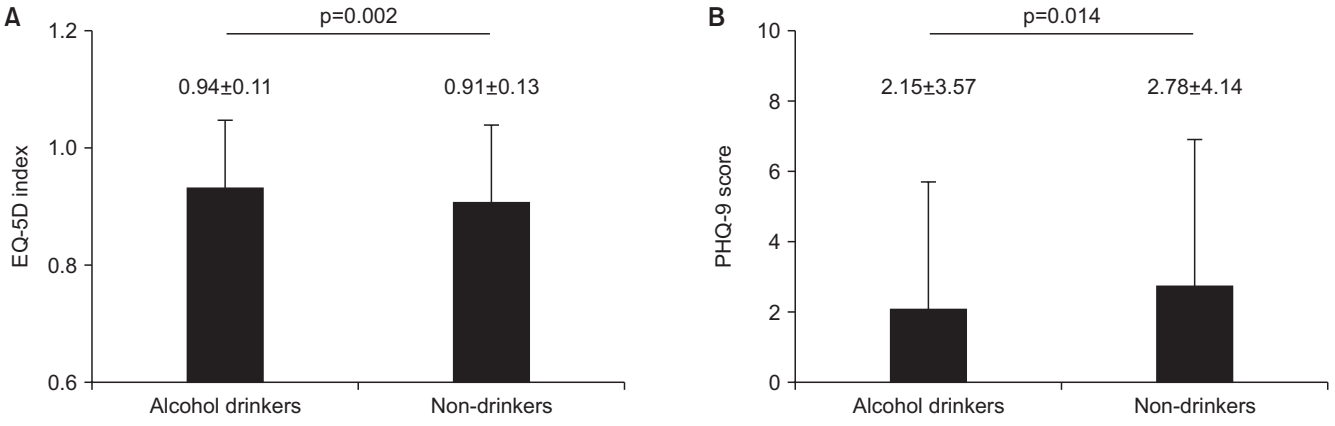


Table 2. Comparison of quality of life (EQ-5D index) and depressive mood (PHQ-9 score) between alcohol drinkers and non-alcohol drinkers in obstructive lung disease patients

	Alcohol drinkers (n=525)		Non-alcohol drinkers (n=459)	p-value
	Light to moderate-risk (n=318)	High-risk (n=207)		
EQ-5D index (n=954)	0.94±0.11		0.91±0.13*	0.002
	0.94±0.1	0.93±0.12*		0.342
PHQ-9 score (n=940)	2.15±3.57		2.78±4.14†,‡	0.014
	1.83±3.08†	2.64±4.19‡		0.01

Values are presented as mean±standard deviation.
*p=0.012. †p=0.002. ‡p=0.785.
EQ-5D: EuroQol Five-Dimension Questionnaire; PHQ: Patient Health Questionnaire.

tors with alcohol consumption showed that BMI ≥25 kg/m^2, TG ≥150 mg/dL, HDL-C <40 mg/dL in men and <50 mg/dL in women, and BP ≥130/85 mm Hg were significantly more common in alcohol drinkers than in non-alcohol drinkers (p=0.035, p=0.001, p=0.001, and p=0.002, respectively) (Table 4).

Discussion

This study evaluated associations of alcohol consumption with QOL and depressive mood in Korean adults with OLD. Results showed that alcohol consumption did not change the QOL or depressive mood in individuals with OLD. However, it might increase the risk of metabolic syndrome. In addition, high-risk alcohol drinkers showed more depressive moods than low to moderate alcohol drinkers.

Associations of alcohol consumption with QOL and depressive mood in the general population have been reported yet. One study from Korea showed that moderate drinkers (alcohol >28 g/week) exhibited lower depressive mood and higher QOL than non-drinkers and lower drinkers[9]. Another study using KNHANES data showed a higher perception of stress and depressive symptoms in high-risk drinkers than in low-risk drinkers[15]. In other countries such as Finland and the United Kingdom, binge or problematic drinkers have poor mental health such as poor satisfaction with life and high psychological stress[16,17].

In patients with mild to moderate COPD, psychiatric problems and alcohol abuse were more common than in age-matched controls, which might impair QOL[18]. A study predicting poor QOL showed that alcohol abuse and degree of airflow limitation might be associated with poor QOL in COPD patients[19]. In our study, alcohol drinkers among COPD patients also tended to have higher QOL and lower depressive moods. However, for those who were high-risk drinkers, this difference in de-

Table 3. Multiple logistic regression analysis for factors associated with quality of life (EQ-5D index) and depressive mood (PHQ-9 score)

Variable	Quality of life (EQ-5D index)		Depressive mood (PHQ-9 score)	
	β±SE	p-value	β±SE	p-value
Age, yr	−0.003±0.001	0.000	0.025±0.026	0.342
Male sex	−0.057±0.018	0.001	1.356±0.605	0.026
BMI, kg/m^2	0.000±0.002	0.886	−0.197±0.078	0.012
FEV_1, % predicted	0.000±0.001	0.693	0.018±0.031	0.573
Current smoking	−0.041±0.016	0.012	0.878±0.561	0.119
Alcohol drinking	0.016±0.014	0.282	0.351±0.497	0.480
Level of education, >12 years*	0.000±0.001	0.693	−0.012±0.040	0.775
Activity limitation by any cause	0.148±0.019	0.000	−3.979±0.656	0.000
Metabolic syndrome	−0.022±0.018	0.206	0.228±0.604	0.706
Weight change for a year†	−0.005±0.010	0.602	0.301±0.343	0.381
Cough over 3 months	−0.07±0.03	0.852	0.009±1.043	0.993
Sputum for 3 months	−0.004±0.023	0.021	1.821±0.788	0.022
Calories intake per day	−0.0002±0.000	0.036	0.000±0.000	0.124

*Weight change was defined by the following question: "Have there been any changes in your weight during the last year? If so, how much weight did you lose or gain?" Answers were categorized as "No change," weight loss of 3–6 or ≥6 kg, or weight gain of 3–6 or ≥6 kg. †Level of education >12 years was defined as an education period over 12 years, including elementary, middle, and high schools.
EQ-5D: EuroQol Five-Dimension Questionnaire; PHQ: Patient Health Questionnaire; SE: standard error; BMI: body mass index; FEV_1: forced expiratory volume per 1 second.

Table 4. Comparison of metabolic syndrome-related factors between alcohol drinkers and non-alcohol drinkers in obstructive lung disease patients

Variable	Alcohol drinkers (n=525)	Non-alcohol drinkers (n=459)	p-value
BMI, kg/m^2 (>25%)	235 (44.8)	175 (38.1)	0.035
Waist circumference, cm (>90 in men, >80 in women)	206 (39.2)	202 (44)	0.130
TG, mg/dL (>150)	205 (40.7)	132 (30.3)	0.001
HDL, mg/dL (<40 in men, <50 in women)	131 (26.1)	196 (46.1)	0.000
BP, mm Hg (>130 in systolic and 85 in diastolic)	74 (14.1)	35 (7.6)	0.001
FBG, mg/dL (>110)	151 (30)	110 (25.3)	0.111

Values are presented as number (%).
BMI: body mass index; TG: triglyceride; HDL: high-density lipoprotein; BP: blood pressure; FBG: fasting blood glucose.

pressive mood disappeared compared to non-alcohol drinkers. Moreover, the depressive mood was higher in high-risk alcohol drinkers than in low and moderated-risk alcohol drinkers. Therefore, low and modest alcohol consumption might not affect QOL or depressive mood. However, heavy alcohol consumption might be associated with increased depressive mood in COPD patients.

Metabolic syndrome is also commonly considered one of the systemic manifestations of COPD[2]. In one study, over 50% of COPD patients showed metabolic syndrome, which was more than 15% higher than that in BMI-matched healthy controls[20]. A national survey using data from KNHANES showed that the prevalence of metabolic syndrome was significantly higher in individuals with COPD than in those without COPD regardless of gender (33.0% vs. 22.2% in men and 48.5% vs. 29.6% in women)[21].

A cohort study in the general Korean population, including a national nutritional survey, showed that heavy

alcohol consumption was associated with a significantly higher ratio of high BP, higher TG and fasting blood glucose lvels, and lower HDL levels[10]. A prospective study in Korea showed that alcohol drinking was associated with the development of metabolic syndrome and that the risk was exacerbated by heavy alcohol consumption[13]. Consequently, alcohol consumption might increase the risk of metabolic syndromes in COPD patients. In our study, alcohol drinkers in the COPD population showed a higher incidence of BMI over 25 kg/m^2, higher fasting blood glucose and TG levels, lower HDL levels, and higher BP.

Total calorie intake was associated with a higher QOL in the COPD population in this study. Malnutrition is a common problem in COPD patients. It can lower QOL in COPD patients[22]. Nutritional support such as extra meals might increase the QOL in the COPD population[23]. Therefore, nutritional support might improve QOL in the COPD population.

In this study, sputum production, not cough, was associated with depressive mood and QOL in the COPD population. Several studies have shown that cough and sputum production are essential determinants of QOL in stable COPD patients[24]. A cross-sectional study showed that chronic sputum production could impair the QOL and worsen anxiety and depression, which was more in women than in men, regardless of lung function[25]. Findings in this study were consistent with those of previous studies. Cough and sputum production were associated with COPD exacerbation risk in previous studies[26,27], which might be associated with higher depressive mood and lower QOL in the COPD population[28].

This study has some limitations. First, our data did not include any post-bronchodilator spirometer measurement. In addition, the diagnosis of COPD was assessed only based on pre-bronchodilator spirometer measurement. Second, men had a higher proportion than women among alcohol drinkers and *vice versa*. Differences in male to female ratio might affect BMI. In a Korean study investigating the prevalence of metabolic syndrome between males and females, metabolic syndrome was found to be more common in older women than in middle-aged men[29]. Third, COPD patients usually have a high prevalence of depression. However, overall PHQ-9 scores were relatively lower in this study. This might be due to this study's cross-sectional design and the fact that the diagnosis of COPD was assessed by spirometric criteria. A prospective evaluation might be required to assess alcohol consumption and depressive mood in patients with COPD in the future.

Authors' Contributions

Conceptualization: Heo IR, Kim HC. Methodology: Heo IR, Kim HC. Formal analysis: Heo IR, Kim HC. Data curation: Kim HC. Software: Heo IR, Kim HC. Validation: Kim HC. Writing - original draft preparation: Heo IR, Kim HC. Writing - review and editing: Kim TH, Ju SM, Yoo JW, Lee SJ, Cho YJ, Jeong YY, Lee JD. Approval of final manuscript: all authors.

Conflicts of Interest

No potential conflict of interest relevant to this article was reported.

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