P- 64

The Association of Pulmonary function and Physical activity in COPD patients in Korea

: The Korea National Health and Nutrition Examination Survey, 2014-2019

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Background

Chronic obstructive pulmonary disease (COPD) is a group of disease that cause airflow blockage and breathing-related problems, especially dyspnea, which leads to reduced physical activity. This study aimed to investigate pulmonary function in relation to physical activity in COPD as well as restrictive lung disease (RLD) patients.

Method

We enrolled 16,715 from the Korea National Health and Nutrition Examination Survey from 2014 to 2019. All participants the COPD, the RLD patients, and the normal group underwent a pulmonary function test (PFT), measured Forced expiratory volume in one second (FEV1), Forced vital capacity (FVC), Peak expiratory flow (PEF). Within those group, through a questionnaire about exercise intensity and exercise time, we further subdivided them into three categories: low, moderate, and high, based on their level of physical activity. According to the variables of each group, the continuous variables were analyzed using analysis of variance (ANOVA), while categorical variables were analyzed using the chi-square test (Table 1). The association between physical activity level and variables about pulmonary function has been analyzed using ANCOVA.

Results

Table 1 shows demographic and clinical characteristics of participants. There were statistically significant differences among the three groups, in all aspects except for depression (Table 1). In Table 2, Model 2 was adjusted for Age, Sex, BMI, Income, Education, Drinking, Smoking, and Model 3 further adjusted for DM, Hypertension, dyslipidemia. There were statistically significant differences in FEV1 according to physical activity levels: for Normal, p=0.003 (<0.05), and for COPD p=0.0257 (<0.05). In other words, higher levels of physical activity were associated with higher FEV1 values. However, there was no significant difference observed in RLD. FVC and PEF values also showed significant association with levels of physical activity in the normal and COPD groups.

Table 1. Demographic and clinical characteristics of participants.

	Normal	Lung disease		*p*-value
		RLD	COPD	
N	**12398**	**2017**	**2300**	
Age group				<.0001
40-49	40.04 (0.63)	22.28 (1.22)	11.7 (0.97)	
50-59	35.3 (0.55)	33.81 (1.29)	25.54 (1.22)	
60-69	17.02 (0.43)	24.95 (1.07)	32.67 (1.15)	
≥ 70	7.64 (0.27)	18.96 (0.99)	30.08 (1.07)	
Sex				<.0001
Male	43.77 (0.46)	59.28 (1.22)	74.92 (1.02)	
Female	56.23 (0.46)	40.72 (1.22)	25.08 (1.02)	
Dynapenia	5.84 (0.27)	9.41 (0.79)	8.34 (0.63)	<.0001
HGS (Hand grip strength)	32.08 ± 0.12	32.05 ± 0.29	34.61 ± 0.26	<.0001
Education				<.0001
Education years > 12	72.98 (0.6)	62.32 (1.34)	53.53 (1.35)	
BMI (Body mass index)	24.03 ± 0.03	25.65 ± 0.09	23.91 ± 0.07	<.0001
Smoking				<.0001
Non	61.25 (0.51)	50.35 (1.3)	31.8 (1.12)	
Ex	21.19 (0.43)	29.13 (1.18)	37.35 (1.22)	
Current	17.56 (0.45)	20.52 (1.1)	30.85 (1.21)	
Drinking				<.0001
Non	25.95 (0.47)	28.52 (1.21)	27.18 (1.08)	
Mild	65.58 (0.52)	59.91 (1.31)	59.97 (1.22)	
Heavy	8.47 (0.32)	11.57 (0.85)	12.84 (0.83)	
Physical activity				0.0005
Low	60.59 (0.54)	66.32 (1.27)	62.88 (1.23)	
Moderate	29.92 (0.48)	26.2 (1.16)	27.65 (1.14)	
High	9.48 (0.33)	7.48 (0.72)	9.47 (0.82)	
Hypertension	31.2 (0.52)	49.7 (1.39)	44.96 (1.21)	<.0001
DM	12.86 (0.36)	26.17 (1.14)	20.77 (0.96)	<.0001
Dyslipidemia	24.69 (0.48)	32.7 (1.22)	24.24 (1.05)	<.0001
Asthma	1.5 (0.13)	3.1 (0.42)	7.14 (0.6)	<.0001
CVD (Cerebrovascular disease)	2.77 (0.16)	7.37 (0.63)	6.59 (0.53)	<.0001
Depression	4.66 (0.21)	4.43 (0.51)	3.84 (0.5)	0.3454
FEV1	2.88 ± 0.01	2.32 ± 0.01	2.34 ± 0.02	<.0001
FVC	3.63 ± 0.01	2.95 ± 0.02	3.64 ± 0.03	<.0001
Peak expiratory flow	7.42 ± 0.02	6.67 ± 0.05	6.17 ± 0.05	<.0001

Table 2. The association between physical activity level and FEV1, FVC, and PEF in normal, RLD, and COPD groups.

Outcome		Physical activity	Model 1	p-value	Model 2	p-value	Model 3	p-value
FEV1	**Normal**	**Low**	2.84 ± 0.01		2.81 ± 0.01		2.8 ± 0.01	
		Moderate	2.88 ± 0.01	**<.0001**	2.82 ± 0.01	**0.0027**	2.8 ± 0.01	**0.0033**
		High	3.14 ± 0.02		2.86 ± 0.01		2.85 ± 0.01	
	RLD	Low	2.32 ± 0.02		2.26 ± 0.01		2.25 ± 0.01	
		Moderate	2.29 ± 0.03	**0.0003**	2.25 ± 0.02	**0.8237**	2.24 ± 0.02	**0.8168**
		High	2.5 ± 0.05		2.23 ± 0.03		2.22 ± 0.03	
	COPD	Low	2.28 ± 0.02		2.23 ± 0.02		2.22 ± 0.02	
		Moderate	2.38 ± 0.03	**<.0001**	2.3 ± 0.03	**0.0218**	2.29 ± 0.03	**0.0257**
		High	2.57 ± 0.06		2.3 ± 0.04		2.29 ± 0.04	
FVC	Normal	Low	3.58 ± 0.01		3.58 ± 0.01		3.56 ± 0.01	
		Moderate	3.63 ± 0.02	**<.0001**	3.59 ± 0.01	**<.0001**	3.57 ± 0.01	**<.0001**
		High	3.98 ± 0.03		3.66 ± 0.02		3.64 ± 0.02	
	RLD	Low	2.95 ± 0.02		2.87 ± 0.01		2.85 ± 0.01	
		Moderate	2.89 ± 0.03	**0.0005**	2.86 ± 0.02	**0.6517**	2.84 ± 0.02	**0.6378**
		High	3.16 ± 0.06		2.82 ± 0.03		2.8 ± 0.04	
	COPD	Low	3.57 ± 0.03		3.45 ± 0.02		3.43 ± 0.02	
		Moderate	3.7 ± 0.05	**<.0001**	3.54 ± 0.04	**0.0175**	3.52 ± 0.04	**0.0196**
		High	4 ± 0.07		3.61 ± 0.05		3.58 ± 0.05	
Peak expiratory flow	Normal	Low	7.31 ± 0.03		7.22 ± 0.03		7.2 ± 0.03	
		Moderate	7.42 ± 0.04	**<.0001**	7.26 ± 0.03	**0.0274**	7.24 ± 0.03	**0.031**
		High	8.16 ± 0.07		7.34 ± 0.05		7.32 ± 0.05	
	RLD	Low	6.63 ± 0.06		6.25 ± 0.05		6.24 ± 0.05	
		Moderate	6.57 ± 0.1	**0.0003**	6.29 ± 0.06	**0.7281**	6.27 ± 0.06	**0.7076**
		High	7.33 ± 0.17		6.35 ± 0.13		6.34 ± 0.13	
	COPD	Low	6.01 ± 0.06		5.59 ± 0.05		5.57 ± 0.05	
		Moderate	6.24 ± 0.09	**<.0001**	5.69 ± 0.08	**0.0302**	5.67 ± 0.08	**0.0365**
		High	6.99 ± 0.17		5.92 ± 0.14		5.9 ± 0.15	

Conclusion

These findings indicate that increased physical activity is associated with improved pulmonary function in COPD patients, emphasizing the necessity of incorporating exercise into the therapeutic regimen for COPD management.