



The relation of Brinkman index and body mass index with spirometry result of chronic obstructive pulmonary disease (COPD) outpatients in the pulmonology and respiratory medicine department of Zainoel Abidin general hospital

Received 4 May 2021
Accepted 4 January 2022
Published: 28 February 2022

Link to DOI:
[10.25220/WNJ.V05.i2.0002](https://doi.org/10.25220/WNJ.V05.i2.0002)

Citation: Muzlifa R, Mulyadi, Husnah. The relation of Brinkman index and body mass index with spirometry result of chronic obstructive pulmonary disease (COPD) outpatients in the pulmonology and respiratory medicine department of Zainoel Abidin general hospital. World Nutrition Journal.2022 Feb 28, 5(2): 1-7.



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Website :
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Abstract

Background: chronic obstructive pulmonary disease (COPD) is one of the major health problems worldwide. Smoking is the main risk factor of the COPD development. Not only COPD has clinical manifestations in the lungs, it also manifest outside lungs called systemic effects. One of systemic effects found in COPD patients is weight loss leading to declining lung function. This study aims to determine the relation of Brinkman Index and Body Mass Index (BMI) with spirometry result of COPD outpatients in RSUDZA.

Methods: The study was held in lung outpatients department in RSUDZA Banda Aceh on December 5th until 28th with cross sectional design The sampling method is nonprobability sampling with accidental sampling technique. Respondents consisted of 30 patients who had agreed to informed consent given. Medical record used to obtain Brinkman index, BMI, and spirometry result of the patients.

Results: The results of analysis shows majority of respondents are male (83,3%), dominated by 56-65 years age range (40,0%) and had moderate Brinkman Index (46,7%). The majority of respondents (53,3%) had an abnormal BMI (severe underweight (13,3%), underweight (6,7%), overweight (23,3%), and obese (10,0%)) and severe spirometry result (53,3%). The data was analyzed by the Spearman Correlation. With the Spearman Correlation, there was no association between Brinkman Index and spirometry result with p value 0,412 (p value >0,05). Meanwhile, there was an association between the BMI and spirometry result with p value 0,006 (p < 0,05). The strength of the correlation is moderate (rs =-0,488).

Conclusion: The lower the BMI, the more severe the spirometry result.

Keywords: Brinkman index, body mass index, spirometry result, lung function, FEV₁, COPD

Introduction

Chronic obstructive pulmonary disease (COPD) is one of a major problem in the health sector worldwide. Its prevalence and mortality increases every year. COPD is the fourth leading cause of

death in the world and is expected to be the third cause by 2020. This is related to the lack of intervention in risk factors, especially smoking and exposure to fuel fumes and air pollution. COPD not only manifests in the lungs, but also manifests outside the lungs called systemic effects. One of the systemic effects found in COPD patients is weight loss.¹⁻³

Smoking is the main risk factor for the development of COPD. The World Health Organization (WHO) shows 84% (1.09 billion

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people) of all smokers in the world are in developing countries. ⁽⁴⁾ In Indonesia, data obtained from 10-year follow-up interviews with residents show the prevalence of smokers in 2013 was 29.3%. The province with the highest prevalence of smokers is Riau (30.7%). The prevalence of smokers in Aceh is 29.3%.⁵

The Global Burden of Disease (GBD) estimates that the approximate number of COPD patients in the world is 328 million people. The prevalence of men is higher (168 million), while women are 160 million.¹ Studies conducted in the European population for 40 years showed that the prevalence of COPD varies between 15-20% and is found to be higher in men than women.² Based on Riset Kesehatan Dasar (RISKESDAS) 2013, the prevalence of COPD in Indonesia was 3.7%. The province with the highest prevalence was Nusa Tenggara Barat at 10.0%. The prevalence of COPD in Aceh was 4.3%.³

COPD patients often show significant weight loss as the disease progresses.⁸ It is well known that 25-40% of all COPD patients losing weight. Body Mass Index (BMI) is an important predictor of mortality and morbidity of COPD patients.⁹ Results of the study by Guo et al.⁸ showed that underweight COPD patients increase the risk of mortality by 40%. Underweight patients are more likely experience a faster decrease in pulmonary function.⁶ Assal and Kamal.⁷ showed a positive relationship between BMI and prediction of forced expiratory volume in 1 second (VEP₁).⁹

Spirometry is a gold standard examination for the diagnosis of COPD and is objective in measuring airflow resistance.⁷ Spirometry is performed to assess the mechanical function of the lungs, chest wall, and respiratory muscles by measuring the amount of air exhaled from total lung capacity to residual volume.⁸ Mitra et al.¹ study showed an association between BMI and the severity of COPD patients' airway obstruction as measured by spirometry. Patients with low BMI tend to have a greater risk of accelerating disease severity.⁹

Study on the relation of the Brinkman index and body mass index with the results of spirometry of COPD patients has never been done in Aceh. In fact,

patients' nutritional status is very important to be considered by health workers to prevent worsening of the disease. Based on the facts described above, the researchers wanted to conduct a study on the relationship between Brinkman index and body mass index with spirometry results of patients with chronic obstructive pulmonary disease (COPD) in the Pulmonology and Respiratory Medicine Department of Zainoel Abidin Regional Hospital.

Methods

This is an analytic observational study with cross-sectional design. The study was conducted in the Pulmonology and Respiratory Medicine Department of Zainoel Abidin Regional Hospital in Banda Aceh. The data were collected on 5th to 28th December 2018. The study population includes all COPD outpatients who had fulfilled the inclusion and exclusion criteria. The sampling method used is non probability sampling with accidental sampling technique. The total sample is obtained based on a preliminary study and in accordance with the context of the research conducted. The minimum sample needed is 30 samples. The instrument used in this study is a questionnaire to assess the degree of smoking based on the Brinkman index and medical records to obtain body mass index and spirometry results of COPD patients. An ordinal measuring scale is used for the Brinkman index, body mass index, and spirometry results.

Results

Research was conducted in the Pulmonology and Respiratory Medicine Department of Zainoel Abidin Regional Hospital in Banda Aceh on 05 to 28 December 2018. The study sample was 30 respondents who met the inclusion criteria.

Characteristics of respondents include the distribution of gender, age, education history, and smoking history. The following will present the distribution data of the characteristics of the respondents in **Table 1**.

Results in **Table 1** show that the majority of respondents were male as many as 25 (83.3%). The female respondents numbered 5 (16.7%). The results

of this study are in line with the study of Muthmainnah, et al.¹² on COPD patients in the Lung Department of Arifin Achmad Hospital in Riau showed the number of male COPD patients are higher as many as 57 respondents (80.28%) and 14 women respondents (19.71%). Smoking is a major risk factor for COPD. Men are at greater risk of developing COPD because there are more male smokers than women. This is related to the influence of association and the existence of norms in society in Aceh, which is the negative perception of women who smoke.^{10,11}

Table 1. Characteristics

Characteristics of Respondents	Frequency	Percentage (%)
Gender		
Male	25	83,3
Female	5	16,7
Age		
17-25 years	1	3,3
26-35 years	4	13,3
36-45 years	2	6,7
46-55 years	7	23,3
56-65 years	12	40,0
>65 years	4	13,3
Educational Background		
Uneducated	1	3,3
Elementary School	3	10,0
Junior High School	10	33,3
Senior High School	10	33,3
College	6	20,0
Smoking History		
Yes	23	76,7
No	7	23,3
Total	30	100

In this study, the respondent's age range was 18-70 years. The majority of respondents are at the age of 56-65 years with a total of 12 respondents (40.0%). This result is in line with the study of Rohmah (2018) on COPD patients in the Physiotherapy Pediatric Clinic of the Surakarta

Lung Health Center shows the majority of respondents were at age 55-65 years as many as 8 respondents (66.70%).¹²

The results of the study showed that the education of respondents was dominated by secondary schools (junior high school and senior high school) as many as 10 respondents (33,3%), college 6 respondents (20.0%), elementary school 3 respondents (10.0%), and the lowest was uneducated 1 respondent (3.3%).

This result is in line with the study of Sidabutar et al.¹⁵ on COPD patients in Adam Malik General Hospital Medan showed that the highest education was junior high school students 68 respondents (61.8%) and senior high school 17 respondents (15.5%).¹³ The result is possible because there is an influence on the level of education of knowledge about the danger of smoking for health. Individuals who have good education know the adverse effects of smoking on health so that they can avoid it. The education level of COPD patients is also closely related to the ability to utilize health services available in the surrounding environment.^{14,15}

The results showed that as many as 23 respondents had a smoking history (76.7%), 7 people had not smoked (23.3%). This result is in line with the study of Laode, et al.²⁵ on COPD patients in Kendari showed that the majority of respondents had a smoking history as many as 32 (68.1%). The results supported by the literature showed the most important COPD risk factors were smoking.¹⁶

Table 2. Brinkman Index

Brinkman Index	Frequency	Percentage (%)
Mild	7	23,3
Moderate	14	46,7
Severe	9	30,0
Total	30	100,0

The results from **Table 2** showed the majority of respondents have a moderate Brinkman index as many as 14 people (46.7%).

Table 3. Body Mass Index

Body Mass Index	Frequency	Percentage (%)
Severe underweight	4	13,3
Underweight	2	6,7
Normal	14	46,7
Overweight	7	23,3
Obese	3	10,0
Total	30	100,0

The results of **Table 3** showed the majority of respondents had abnormal body mass index as many as 16 people (53.3%) (severe underweight 4 respondents (13.3%), underweight 2 respondents (6.7%), overweight 7 respondents (23.3%) and obese 3 respondents (10.0%).

Table 4. Spirometry Result

Spirometry Result	Frequency	Percentage
Mild	2	6,7
Moderate	6	20,0
Severe	16	53,3
Very Severe	6	20,0
Total	30	100,0

The results of **Table 4** show the majority of respondents had a severe spirometry as many as 16 (53.3%).

Based on the results of **Table 5**, respondents with a mild Brinkman index as many as 3 respondents (42.9%) had severe spirometry result. Respondents with a severe Brinkman index as many as 2 respondents (22.2%) had mild spirometry result. The results of the statistical test with the Spearman correlation showed a p value of 0.412 (p value > 0.05) which means that there is no relationship.

The results of this study are not in accordance with several studies which state that the Brinkman index has a significant effect on lung function in COPD patients. Naser, et al.¹⁸ conducted a study of COPD patients in the Pulmonary Department of M. Djamil General Hospital showed that there is a relationship between the Brinkman index with severity of COPD with p value = 0.025.¹⁷

Chronic obstructive pulmonary disease (COPD) is an irreversible respiratory disease that can generally be prevented and treated which is characterized by obstructed air flow and persistent respiratory symptoms due to abnormalities that occur in the airway or alveoli or both.¹⁸ Smoking is a risk factor and the main cause of COPD. The possibility for an individual to suffer from COPD depends on the smoking dose, the number of cigarettes smoked in one day, and the duration of smoking that can be measured using the Brinkman index. The Brinkman Index can be calculated by multiplying the number of cigarettes smoked per day with the duration of smoking in the year.¹⁹

Based on the results in **Table 6**, respondents with severe underweight BMI tend to be more dominant in patients with severe spirometry results as many as 3 respondents (75%) and very severe as many as 1 respondent (25.0%). Respondents with underweight BMI had 1 respondent (50%) with severe spirometry result and 1 respondent (50%) with very severe spirometry result. Respondents with normal BMI had moderate spirometry results as many as 3 respondents (21.4%), severe 7 respondents (50.0%), and very severe as many as 4 respondents (28.6%). Respondents with obese BMI had mild spirometry results as many as 1 respondent (14.3%), moderate as many as 2 respondents (28.6%), and severe as many as 4 respondents (57.1%). Respondents with overweight BMI had mild spirometry results of 1 respondent (33.3%), moderate as many as 1 respondent (33,3%), and severe as many as 1 respondent (33.3%). Respondents with overweight and obese BMI were not found in patients who had very severe spirometry results. The results of the statistical test using the Spearman Correlation test shows p value of 0.006 (p value < 0.05), which means that there is a relationship between the two variables. The value of the Coefficient Correlation (rs) is -0.448 which indicates a moderate correlation, and the direction of the relationship is negative (-), which means that the lower the BMI the worse the results of the spirometry.

The results of this study are in line with the research of Assal and Kamal.⁷ of 154 COPD patients in Cairo, Egypt, showing that there was a relationship between BMI and VEP1 values (r =

Table 5. The Relation Between Brinkman Index and Spirometry Result

Brinkman Index	Spirometry Result										r _s	P Value
	Mild		Moderate		Severe		Very Severe		Total			
	n	%	n	%	n	%	n	%	n	%		
Mild	0	0	3	42,9	3	42,9	1	14,3	7	100	0,155	0,412
Moderate	0	0	3	21,4	9	64,3	2	14,3	1	100		
Severe	2	22,2	0	0	4	44,4	3	33,3	9	100		

Table 6. The Relation between Body Mass Index and Spirometry Result

Body Mass Index	Spirometry Result										r _s	P Value
	Mild		Moderate		Severe		Very Severe		Total			
	n	%	n	%	n	%	n	%	n	%		
Severe underweight	0	0	0	0	3	75,0	1	25,0	4	100	-0,488	0,006
Underweight	0	0	0	0	1	50,0	1	50,0	2	100		
Normal	0	0	3	21,4	7	50,0	4	28,6	14	100		
Overweight	1	14,3	2	28,6	4	57,1	0	0	7	100		
Obese	1	33,3	1	33,3	1	33,3	0	0	3	100		

Table 7. GOLD Classifications of Spirometry Result

Category	FEV ₁
Mild	FEV ₁ ≥ 80% prediction
Moderate	50% ≤ FEV ₁ < 80% prediction
Severe	30% ≤ FEV ₁ < 50% prediction
Very Severe	FEV ₁ < 30% prediction

Table 8. Classifications of Brinkman Index

Category	Value
Mild	0-200
Moderate	200-600
Severe	>600

0.295, P < 0.05). Nadifah.²⁰ conducted a study of 34 respondents of COPD patients in Tugurejo Hospital Semarang showed that there was a relationship between BMI and VEP1 values of COPD patients

Table 9. Classifications of Body Mass Index

Category	IMT (kg/m ²)
Severe Underweight	< 17,0
Underweight	17,0 - 18,4
Normal	18,5 - 25,0
Overweight	25,1 - 27,0
Obese	> 27,0

with p value 0.044 with a correlation coefficient of 0.348 indicating a weak relationship.

One important management of COPD patients is adequate nutrition since COPD patients generally will experience weight loss so that lung function decreases due to decreased ventilation capacity and strength of respiratory muscles.²¹ Changes in physiological aspects that characterize in patients with COPD it is suspected that this is a cause of weight loss experienced by patients so that patients experience malnutrition.

Conclusion

The majority of respondents have moderate Brinkman index as many as 14 people (46.7%). For body mass index, The majority of respondents had abnormal body mass index as many as 16 people (53.3%), severe underweight 4 respondents (13.3%), underweight 2 respondents (6.7%), overweight 7 respondents (23.3%), and obese 3 respondents (10.0%). For the spirometry result, the majority of respondents had severe spirometry as many as 16 (53.3%). Respondents with a mild Brinkman index as many as 3 respondents (42.9%) had severe spirometry result. Respondents with a severe Brinkman index as many as 2 respondents (22.2%) had mild spirometry result. In conclusion, there was no relation between body mass index and spirometry result with a p value of 0.412 (p value > 0.05). However, respondents with severe underweight BMI tend to be more dominant in patients with severe spirometry results as many as 3 respondents (75%) and very severe as many as 1 respondent (25.0%). In conclusion, there was a correlation between body mass index and spirometry result with p value 0,006 (p value < 0.05), which means that there is a relationship between the two variable.

Conflict of Interest

Authors declared no conflict of interest regarding this article.

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