

BODY MASS INDEX AS A PROGNOSTIC FACTOR FOR GRAVITY AND PROGNOSIS IN PATIENTS WITH COPD.

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Rationale: In chronic obstructive pulmonary disease (COPD), loss of lean body mass could be a result of the systemic effects of the disease. For these reasons, body mass index (BMI), has been suggested as one of four parameters (BODE), suitable for staging COPD. Low body mass index is a marker of poor prognosis in COPD.

Objectives: We explored distribution of BMI and its association with gravity, accompanied diseases and prognosis in a population of patients with COPD.

Methods: We used data on 131 patients with COPD hospitalized in University Hospital for Pulmonary Diseases in Tirana, Albania, for a period of one year. BMI was calculated as weight/height² (kg/m²) and was categorized into four groups using World Health Organization guidelines: underweight (<18.5 kg/m²), normal weight (18.5–24.9 kg/m²), overweight (25–29.9 kg/m²) and obese (30+ kg/m²). Subjects with COPD were classified according GOLD guidelines into four stages. Association between BMI and the gravity of COPD was examined taking age, sex, smoking and lung function into account.

Results: The mean age was 65.9 ± 8.3 yr (min 45 yrs and max 84 yrs), men 66.09 ± 8.5 yr, women 64.3 ± 6.5 yr [p=0.834]. Subjects with BMI <18.5 kg/m² with age < 60 yr made up 8.7% meanwhile older than 70 yr made up 14.7%. About 25.5 % of patients with FEV1 < 1L had low BMI <18.5 kg/m², meanwhile 7.5% of patients with FEV1 > 1L. According to COPD staging 6.6% of patients in stage I-II were underweight comparing with 21.4% of patients in stage III-IV. Patients without comorbidity with BMI <18.5 kg/m² made up 9% of cases, comparing with 22.2% of patients with comorbidity.

Conclusions: Body mass index is an independent prognostic factor in chronic obstructive pulmonary

disease. There was a good association between decreasing body mass and gravity of COPD. Further weight loss increases the risk exacerbations and hospitalization in patients with COPD.

Keywords: Chronic obstructive pulmonary disease; Body mass index; Epidemiology; Lung function; Nutritional status.

Rationale:

Chronic obstructive pulmonary disease (COPD) is one of the leading causes of disability and mortality in the world. Patients with COPD often have exacerbations which lead to a more rapid decline in Forced expiratory volume in 1 second (FEV₁), impaired quality of life and higher mortality. Exacerbations also lead to an increase in the need for medical care and hospitalization, thereby causing increases in health-care costs [1, 2]. In COPD, loss of lean body mass could be a result of the systemic effects of the disease. Result of the systemic effects of the disease to reflect ongoing systemic inflammation poor nutritional status at birth or during early infancy is associated in adulthood with impaired lung function or the development of COPD. Malnutrition, which often occurs in COPD, causes respiratory muscle wasting. Deficits in cell-mediated immunity and circulating T-lymphocyte numbers that result from protein-energy malnutrition can cause increase susceptibility to infections.

Systemic effects are not merely believed to be consequences of loss of ventilatory capacity but rather to reflect ongoing systemic inflammation and to include changes in skeletal muscles [3, 4]. Data from epidemiologic studies have shown that the prevalence of COPD is higher in those patients with lower BMI. [5,6] In addition results from longitudinal studies have shown that low BMI is an important risk factor for subsequent development

of COPD in men, for increased FEV₁ decline in the same gender and for having a new exacerbation in patients hospitalized for severe exacerbation [7,8]. For these reasons, BMI has been suggested as one of four parameters suitable for staging COPD. Body mass index is an independent prognostic factor in chronic obstructive pulmonary disease. Low body mass index is a marker of poor prognosis in chronic obstructive pulmonary disease.

Objectives:

We explored distribution of BMI and its association with gravity, accompanied diseases and prognosis in a population of patients with COPD.

Methods and Patients:

We used data on 131 patients with COPD hospitalized in University Hospital for Pulmonary Diseases in Tirana, Albania, for a period of one year. BMI the **variable** of main interest was calculated as weight/height² (kg/m²) and categorized into four groups using World Health Organization guidelines: underweight (< 18.5 kg/m²), normal weight (18.5–24.9 kg/m²), overweight (25–29.9 kg/m²), and obese (30+ kg/m²); the two latter groups were combined in some subsequent analyses.

Subjects with COPD were classified according to Global Initiative for Chronic Obstructive Lung Disease (GOLD) guidelines: stage 1: FEV₁/FVC less than 0.7 and FEV₁ of 80% predicted or greater; stage 2: FEV₁/FVC less than 0.7 and FEV₁ of 50% predicted or greater but less than 80% predicted; stage 3: FEV₁/FVC less than 0.7 and FEV₁ of 30% predicted or greater but less than 50% predicted; and stage 4: FEV₁/FVC less than 0.7 and FEV₁ of less than 30% predicted. GOLD stages 1-2 and 3-4 have been combined because of small numbers. Subjects were classified as never smoker, ex-smoker and current smokers. Due to the small number of women with COPD n = 11(8%), statistical comparisons of women in this group with their male counterparts, were not performed. To determine the relationship of BMI with natural history of COPD the patients were classified in two groups: 1) control group: patients hospitalized for COPD for the first time in 12 past months and 2) patients with one or more exacerbation in 12 past months. The second group was divided also in two subgroups: patient with 1-2 exacerbations and patients with 3 or more exacerbations in 12 past months. Association between BMI and gravity of COPD was examined taking age, sex, smoking, and lung function into account.

Statistical Analyze.

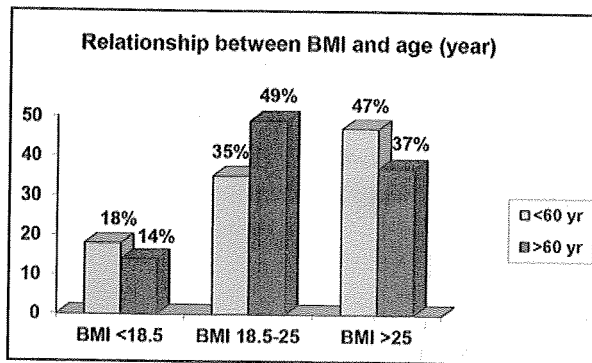
Data were analyzed using SPSS 12.0 for Windows. The results of regression analyses are given in terms of estimated Chi-square value to evaluate significance between comparisons of categorical independent groups. The level of significance was considered to be <0.05.

Results:

Of 131 patients enrolled in the study, most of them 120 (92%) were male; meanwhile female were only 11 (8.4%). The mean age was 65.9 ± 8.3 years (min 45 yrs and max 84 yrs), men 66.09 ± 8.5 years and women 64.3 ± 6.5 yr. Subjects with BMI < 18.5 kg/m² make up to 19 cases (14,5%) of them with age < 60 yr were 8.7% and older than 60 yr were 14.7%. Descriptions of subjects with COPD are presented in table 1:

Table 1- Baseline characteristic of patients

	Nr.	(%)
Total patients	131	100
Male	120	91.6
Female	11	8.4
Age, yr (mean ±SD)	65.9 ± 8.3	
BMI kg/m ² (mean ±SD))	23.3 ± 7.5	
BMI < 18.5 kg/m ²	19	14.5
FEV1 < 1L	50	38
FEV1 < 50% predicted	70	53
COPD stage I	21	16
COPD stage II	40	30
COPD stage III	34	26
COPD stage IV	36	28
Control group	105	80
≥ 1 exacerbation, (in 12 past months)	26	20
Never smokers	24	18
Curent smokers	107	82



The data of the schedule noted above that for ages > 60 years, with the largest number of cases has a BMI within the norme (49%), whereas for age <60 years there is a trend in growth projects the number of cases of those underweight, normoweight and overweight (18%, 35% and 47% respectively).

Although there is a slight tendency for underweight to patients under 60 years old (18%) versus those over 60 years old (14%), this difference is insignificant ($p=0,614$).

About $\frac{1}{4}$ (25.5 %) of patients with $FEV_1 < 1L$ had low BMI $<18.5 \text{ kg/m}^2$, comparing 7.5% of them with $FEV_1 > 1L$. According to COPD staging 6.6% of patients in stage I-II had a BMI $<18.5 \text{ kg/m}^2$ comparing with 21.4% of patients in stage III-IV. Patients without co morbidity with BMI $<20\%$ made up 9% of cases, comparing with 22.2% of patients with co morbidity.

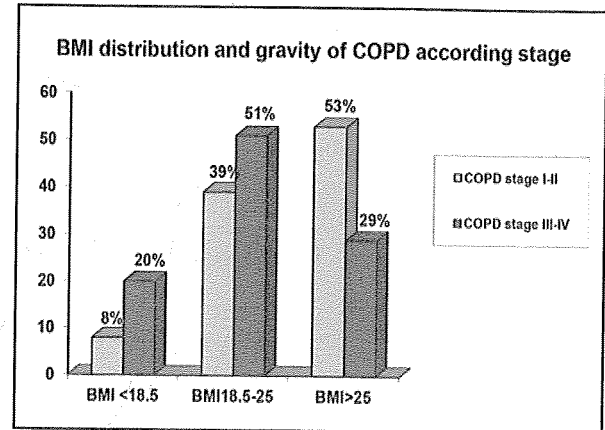
The following table (Table 2), is reflecting the relationship between BMI and pulmonary function estimated on the basis of data of Spirometry.

Table 2: Distribution of BMI(kg/m^2) and airflow obstruction ($FEV_1 L$;%)

BMI	$FEV_1 < 1L$	%	$FEV_1 > 1L$	%	P value
< 18.5	13	25.5	6	7.5	0.006
18.5-25	25	50	35	41.9	0.576
> 25	12	24.5	40	50.6	0.025
total	50	100	81	100	

The proportion of underweight COPD subjects ($BMI < 18.5 \text{ kg/m}^2$), significantly decreased from 25.5% in patients with $FEV_1 < 1L$ to 7.5% in patients with $FEV_1 > 1L$, ($p=0.006$). The proportion of subjects with $FEV_1 > 1L$ progressively increased from the underweight to obese categories (7, 5%, 41% and 50.6% respectively). There was a higher proportion of COPD subjects in the underweight and normal-weight categories when FEV_1 is under

1L compared to COPD subjects with $FEV_1 > 1L$. ($p=0.025$).



The chart shows that the incidence of underweight in the early stages of COPD, (I, II) are significantly lower compared with the very advanced stages III and IV (respectively 8% versus 20%, ($p=0.0012$), while the overweight cases are the most numerous in COPD stages I and II (53%), but with statistical insignificant difference (53% vs. 29% with stages I+II and IV of COPD respectively), [$p=0.058$].

Table 3: Relationship between BMI and COPD with co morbidity

BMI	Without comorbidity, nr.	%	With comorbidity, nr.	%	total	p-value
<18.5	7	9	12	22.2	19	0.050
18.5-25	43	56	17	32	60	0.040
> 25	27	35	25	46	52	0.324
total	77	100	54	100	131	

Only 9% (7/77) of cases with COPD and without comorbidity present underweight, versus 22.2% (12/54) cases with COPD and associated diseases. Yet for two groups noted that the number of cases obesity is less than 50% (35% and 46% respectively)

Table 4: BMI and frequency of exacerbations of COPD in the year

BMI	1-2 exacerb. /yr nr	%	≥ 3 exacerb. /yr. nr.	%	p-value
<18.5	9	8.6	10	38.4	0.004
18.5-25	47	45	9	34.6	0.462
> 25	49	46.4	7	27	0.160
total	105	100	26	100	

The table above, is reflecting the relationship between BMI exacerbation of COPD. The number of patients with 3 or more exacerbation/year is in inverse proportion with BMI, (38.4%, 34.6% and 27% respectively). Nine of 105 cases (8,6%) with 1-2 exacerbations/ year are presented as underweight estimated as BMI<18.5 kg/m², compared with 10/26 cases (38,4%) with 3 or more exacerbations [p=0.004].

Discussion

An association between COPD prevalence and low BMI has been reported in several studies [5, 6], but it is not clear whether a low BMI precedes or follows the onset of the disease. There is compelling evidence that poor nutritional status at birth or during early infancy is associated in adulthood with impaired lung function or the development of COPD.

All previous and recently studies found that incidence of COPD increased with age [9] and the prevalence is higher in subjects older than 40 years of age. In this study the mean age was 65.9 ± 8.3 yr, men 66.09 ± 8.5 yr and women 64.3 ± 6.5 yr. The finding of this study is that there is no significant difference according the age and men with low body weight, as measured by BMI [p=0.614], although there is a slight tendency for underweight to patients under 60 years old (18%) versus those over 60 years old (14%).

Tobacco smoke is the major risk factor for COPD, and the population-attributable risk of smoking for COPD has been estimated in the range of 50 to 70% [10]. Our data point out the predominance of male gender among the patients with COPD (92% v.s 8.4% respectively and 82% of which are current smokers).

In this study we show a clear association between decreasing body mass and increasing of gravity in patients with COPD undergoing clinical care. The

proportion of underweight COPD subjects (BMI<18.5 kg/m²), significantly decreased from 25.5% in patients with FEV1<1L to 7.5% in patients with FEV1 >1L, (p=0.006).

The incidence of underweight in the early stages of COPD (I, II) are significantly lower compared with the very advanced stages III and IV (respectively 8% versus 20%, (p=0.0012). This inverse relationship between baseline BMI and gravity of COPD is in agreement with the results of R.I. Harik-Khan et al. [7]

It appears that the associated diseases have a significant impact on the nutrition of patients with COPD. In the study 22.2% (12/54) cases with COPD and associated diseases present underweight, versus only 9% (7/77) of cases with COPD and without comorbidity[11] .

Further weight loss increases the risk exacerbations and hospitalization in patients with COPD. For patients underweight (BMI<18.5 kg/m²), cases with 1-2 exacerbations per year turns 8.6% (9/105) cases versus 38.4% (10/26) cases for those with 3 or more exacerbations/ year. The risk assessment shows that relation cases with more than two exacerbations per year.

Conclusions:

Body mass index (BMI) is an independent prognostic factor in chronic obstructive pulmonary disease (COPD), with a clear association between decreasing body mass and increasing of gravity in patients with COPD undergoing clinical care. Further weight loss increases the risk exacerbations and hospitalization in patients with COPD. There was a good association between decreasing body mass and gravity of COPD. The highest priority should be given to smoking prevention to reduce the occurrence of the disease.

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