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Research Article

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Body Mass Index (BMI) Assessment and its Impact on Severity and Prognosis of Patients with COPD

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Abstract

Introduction

Chronic obstructive pulmonary disease (COPD) is responsible for impaired quality of life and a limitation of daily activity. Some studies have concluded that obese subjects have better respiratory function and thus a better quality of life. The aim of our work was to determine the impact of obesity and overweight on functional parameters, six-minute walking test (6MWT) performance, and severity and prognosis of COPD in this population.

Methods

Sixty-one consecutive stable COPD patients were included after obtaining written informed consent. Demographic and clinical data, spirometric values, 6-minute walking distance, BMI and fat mass were collected for analysis.

Two groups were compared: G1 group of patients with BMI > = 25 kg/m2; G2 group of patients with BMI < 25 kg/m2 . The statistical study was carried out using SPSS 20.0 software.

Results

The population in our study is almost exclusively male ,1 woman/60 men, the average BMI is 24.12 +/- 4.83 kg/m2 with extremes ranging from 14.6 to 36.9 kg/m2, the means of Fat mass (%) 21,75%,11.5% of our patients were obese, while 13.1% are lean 47.5% of our patients in the G1,doc group are overweight or obese, while 52.5% are in the G2 group strong correlations were observed between the body mass index and the various variables studied.

Conclusions

Contrary to expectations, obesity is not necessarily associated with adverse effects during COPD. As our results show, The data from our work are consistent with those of the literature showing that overweight and obesity in patients followed for COPD are associated with better tolerance to effort and has less severe airway obstruction

1. Introduction

GOLD 2023 defines COPD as a heterogeneous lung condition characterized by chronic respiratory symptoms (dyspnea, cough, expectoration and/or exacerbations) due to airway abnormalities (bronchitis, bronchiolitis) and/or alveoli (emphysema) that cause persistent, often progressive, airflow obstruction, COPD Is a major public health problem and is a leading cause of chronic morbidity and mortality worldwide [1].

Prevalence of COPD is difficult to assess because it requires patient cohorts representative of the entire population using spirometric measurements [2].

Studies have shown a wide geographic disparity in COPD prevalence [3]. This is due to differences in survey methods, diagnostic criteria and target populations. An estimated 384 million people had COPD in 2010 and the global prevalence is estimated at 11.7% (8.4% - 15.0%) in 2015 [4]. According to the BOLD study:10.1% of people over 40 have COPD [5].

Global Burden of Diseases (GBD) data, compiled by the World Health Organization (WHO), shows that 175 million people have

chronic obstructive pulmonary disease (COPD), which represents 2.48% of the world's population, including 70 million women. COPD was responsible for 3.2 million deaths in 2015, representing 5.71% of all deaths [6].

In Algeria, according to the results of the Breathe study, COPD prevalence is estimated at 4% in the general population and 25% among smokers [7].

COPD and obesity are two diseases whose prevalence has been increasing in recent years. Obesity is also a disease that affects the ventilatory function [8]. The literature generally suggests a prevalence of obesity in COPD ranging from 23% to 43%. This prevalence varies from country to country, and data on the impact of COPD on the disease (COPD) is still very limited.

• According to O. Bouroubi et al, the prevalence of obesity in COPD at the Constantine wilaya in 2019 was 7.4% for obesity and 31.9% for overweight (WHO definition) [9].
• The proportion of overweight people has increased considerably in the early twentieth century in the world.
• In 2016, there were 1.9 billion overweight people (BMI over 25) and approximately 600 million overweight (BMI over 30).
• The pathophysiology of increased obesity in COPD is unclear, it is possible that poor lung function increases the risk of obesity. This may be due to the following three causes:
➢ Breathing difficulties in exercise-related COPD patients often result in lower levels of physical activity and therefore fewer calories burned during exercise
➢ One common side effect of long-term glucocorticosteroid drugs is weight gain [10].
➢ Due to their hypoxaemia at rest and exercise, COPD patients are unable to use oxygen for beta-oxidation fatty acid degradation. Several studies support the hypothesis that obesity exposes individuals to a greater risk of COPD [11].

2. Méthodes

Patients with confirmed COPD with a FEV1/FVC ratio <70% after bronchodilator and followed up in the Pulmonology Department of the Constantine Regional Military University Hospital (HMRUC) [1].

Sixty-one consecutive stable COPD patients were included after obtaining written informed consent. Demographic and clinical data, spirometric values, 6-minute walking distance, BMI and fat mass were collected for analysis.

Two groups were compared: G1 group of patients with BMI > = 25 kg/m2; G2 group of patients with BMI < 25 kg/m2 . The statistical study was carried out using SPSS 20.0 software.

2.1. Objective of the Study

The aim of our work was to determine the impact of obesity and overweight [based on body mass index (BMI) and fat percentage (% FM) on:
• the six-minute walking test (TM6) performance of patients followed for COPD.
• lung function .
• the severity and prognosis of COPD in this population.

This is a prospective descriptive observational study conducted in the HMRUC's pulmonology department, 61 patients participated in the study.Inclusion criteria:
All patients with COPD, aged over 40 years old, in a stable state.

➢ Inclusion criteria All patients with COPD, over 40 years of age. Whatever their gender.
Stable (outside of exacerbation, with a minimum of 2 months between the last episode of clinical aggravation and the time of study).

➢ Criteria for non-inclusion: Restrictive respiratory pathology. Progressive cardiovascular disease. Recent surgery less than 3 months.
• The impact of COPD on patient life is assessed by the standardized questionnaire "COPD Assessment test" (CAT).

- COPD classification according to GOLD 2022.
- Weight in kilograms: The weight of lightly dressed patients was estimated using a scale.
- Waist in cm: The waist was measured with a toise. The measurement is made on standing subjects, barefoot, heels joined, back straight.
- Body mass index (BMI): BMI = weight (kg)/height2 (m).

2.2. Spirométrie

-FVC in litres and as a percentage of the predicted value.
- EMV in litres.
- FEV1/ FVC as a percentage.
- Obstructive ventilatory disorder was defined by a FEV1/CVF ratio <70% [1].
- Functional vital capacity (FVC) and maximum expiratory volume per second (FEV1) will be measured by a spirometer.
– Theoretical values and criteria for acceptability of measurements are those of the European Respiratory Society (ERS-1995) [12].

2.3. Fat Masse

There are several methods to do this. The method we used requires the use of a special scale with plates at the feet acting as electrodes. An imperceptible current is sent through the body. It is thanks to the degree of resistance encountered that it is possible to measure the percentage of body fat and its various components (water, muscles, bones) through extrapolation of the measurements obtained which are compared with reference methods [13].

2.4. The Six-Minute Walking Test

Performed according to the recommendations of the American Thoracic Society/European Respiratory Society statements [14]. The goal is to cover the longest distance possible in 6 minutes by going back and forth in a 30-meter corridor.

2.5. The Gas

The pH, blood pressure in O2 (PaO2) and CO2 (PaCO2) are measured using an arterial gas analyzer from a blood sample taken at the radial artery. Arterial gas pressure values are measured in mm Hg.

2.6. Statistical Techniques

Data was captured and analyzed using IBM SPSS 24.

Many procedures of control at the time of entry have been established to avoid errors as much as possible.

We have implemented the following statistical methods:

- Frequencies and percentages for qualitative data.
- The means, standard deviation, maximum and minimum for quantitative data.
- The normality of quantitative variables was investigated by the Shapiro-Wilk test.
- Comparisons of summer averages performed by the Student t test or ANOVA test according to the number of modalities of the variable.
- Comparisons between categorical or nominal variables were made by the Chi2 test or, where appropriate, by the exact Fisher test.
- The study of relationships between quantitative variables was analyzed by the Pearson or Spearman correlation coefficient as a function of the statistical distribution of variables.

The statistical tests used were considered significant when p 0.05 (degree of significance).

2.7. The Results

Between January 1, 2022 and June 30, 2023, a total of 80 patients with COPD were enrolled in the study protocol. However, 19 patients were excluded for the following reasons:

- Four patients had completely reversible obstructive ventilatory disorder after confirmatory spirometry.
- Three patients were diagnosed with COPD-asthma overlap syndrome.
- Four patients were uncooperative, making it impossible to perform a correct spirometry to confirm the diagnosis of COPD.
- Six patients had interstitial lung pathology revealed by CT scan.
- Two patients have been lost from view.

This allowed us to build a cohort of 61 patients (n = 61).

The data from our work are consistent with those of the literature showing that overweight and obesity in patients followed for COPD are associated with better tolerance to exercise. In our series the minimum age is 43 years, the maximum age is 84 years, this gave an average age of 68.72 ± 9.97 years. (Table: 1).

effective	61
average	68,72
standard deviation	9,8
minimum	43
maximum	84

Table 1: Age Distribution

The median CAT score of our population is 14 +/-6.75 with extremes ranging from 4 to 30, 67.2% of our patients have a CAT score greater than or equal to 10 (Table: 3).

Our study found an average consumption of 41.54 +/- 17.93 packets/year. It is 42.29 +/- 10.32 for current smokers versus 43.16 +/- 18.05 p/year for former smokers (Table: 3).

A female patient, the rest of our series is exclusively male (Table: 2) In this cohort, an IMC was calculated using the following formula: IMC = weight/tail2 expressed in kg/m2, Based on our results, the average BMI is 24.12 +/- 4.83 kg/m2 with extremes ranging from 14.6 to 36.9 kg/m2, the means of Fat mass (%) 21,75% (Table: 3) The average FEV1 in % was 66.52%+/- 21.60, overall our sample was not obstructive (Table:4).

	frequency	**Percentage**
male	60	98,36
female	1	1,6
total	61	100

Table 2: Distribution by Gender

	Average	**Standard deviation**
Quantification of smoking (PA)	41,54	17,93
Number of emergency room visits in previous year	1,10	1,85
Impact of COPD on life (CAT)	14,25	6,75
Body mass index (kg/m2)	24,12	4,83
Fat mass (%)	21,75	7,69

Table 3: General Parameters

	Average	Standard deviation
CVF pré (l)	3,52	0,92
VEMS pré (l/s)	1,91	0,69
VEMS/CVF pré (%)	53,57	10,56
PH	7,41	0,03
PaO2(mmHg)	73,20	9,08
PaCO2(mmHg)	36,57	4,62
SaO2(%)	95,25	2,14

Table 4: Spirometric and Gas Parameters

62,3 % n(38) patients in our series have a PH between 7,38 et 7,42, 34,4 % n(21) ont un pH > 7,42 et 3,3 % n(2) ont un pH < 7,38 ,45,9% n(28) Patients in our series have a PaO2 between 75 et 100 mmHg, 52,5% n(32) ont une PaO2 < 75 mmHg (Table: 4)

Patients belonging to categories B and D represent two-thirds of our series with respectively 26.2% and 39.3% of cases (figure :1).

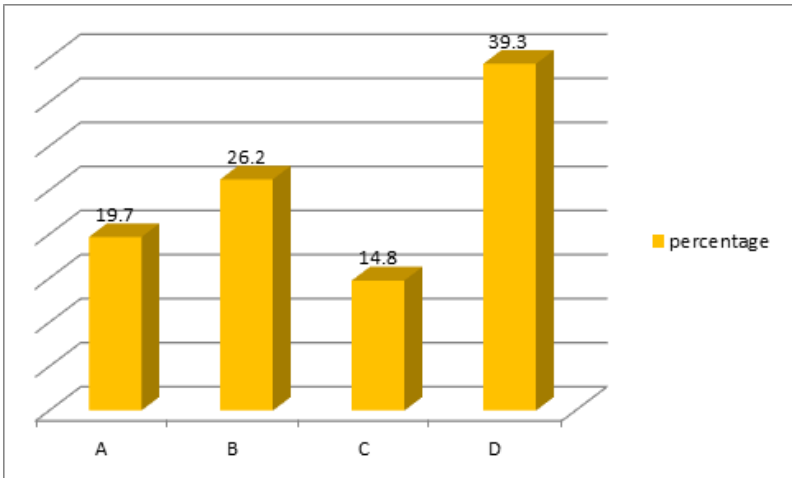

Figure 1: Patients Repair According to GOLD Classification 2O22 (%)

11.5% of our patients were obese, while 13.1% are lean (figure :2), 47.5% of our patients in the G1, doc group are overweight or obese, while 52.5% are in the G2 group (figure :3).

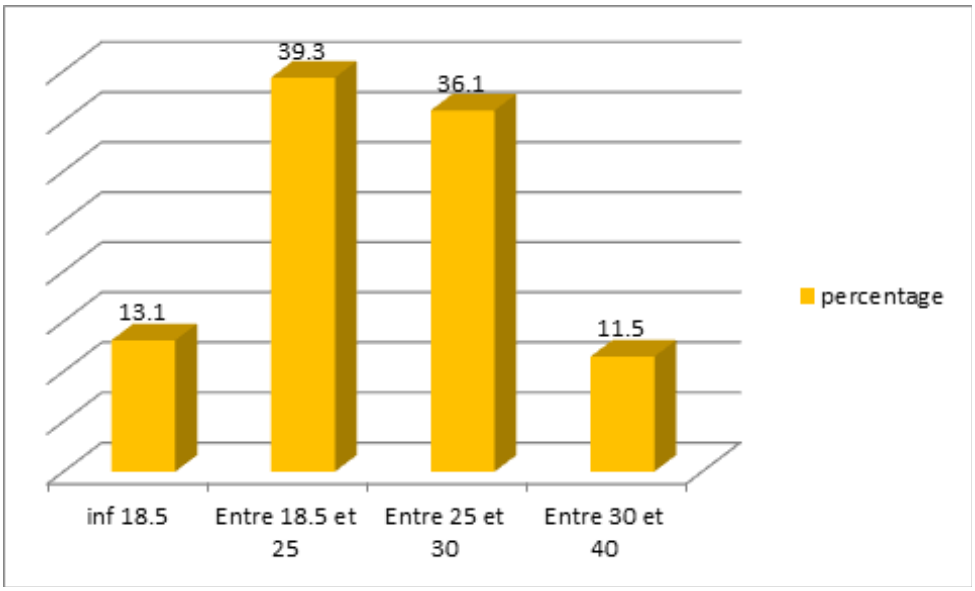

Figure 2: Patient Reparations by Obesity Oms Classification (%)

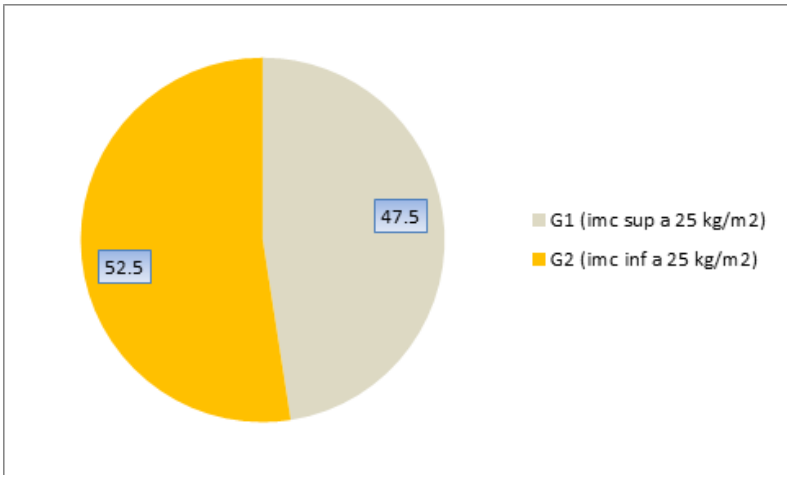

Figure 3: Percentage of Patients in both groups G1, G2

On'observed a significant positive correlation the of comorbidities is BMI , so the weight increases the more the number of comorbidities increases. Also a significant negative correlation was observed between the presence of emphysema and IMC, so obese patients present less emphysema The same finding found by the respiratory physiology team (Pr martani and these collaborators) With a P= 0.070 a positive correlation between the TM6 and the two groups G1, G2 was noted so obese patients walk one distance longer than lean and normal patients but it is not significant since P is sup a 0.05(tabl :5).

	G1	G2	
	(n = 29)	(n = 32)	p
Age, mean standard deviation	67,8 ± 8,6	69,6 ± 11,1	-0,470
Smoking(PA) standard deviation	41,5 ± 19,2	41,6 ± 17,0	-0,992
Number of standard deviation comorbidities	1,5 ± 1,1	0,9 ± 0,9	0,016
Corticosteroid treatment	14	10	0,199
Presence of emphysema	18	28	-0,036
Dyspnea evaluation according to MMRC standard deviation	1,5 ± 0,7	1,8 ± 0,9	-0,273
TM6 (m) standard deviation	501,9 ± 107,9	441,5 ± 141,7	0,070

Table 5: Correlation between G1, G2 and the General Parameters

When we compared the 02 groups G1 and G2 with the severity class of COPD according to GOLD 2022, we noticed that patients belonging to the most severe stages (stage D) are in the G2 or with BMI lower than 25,therefore the most obese patients present with less severe COPD (fig :4).

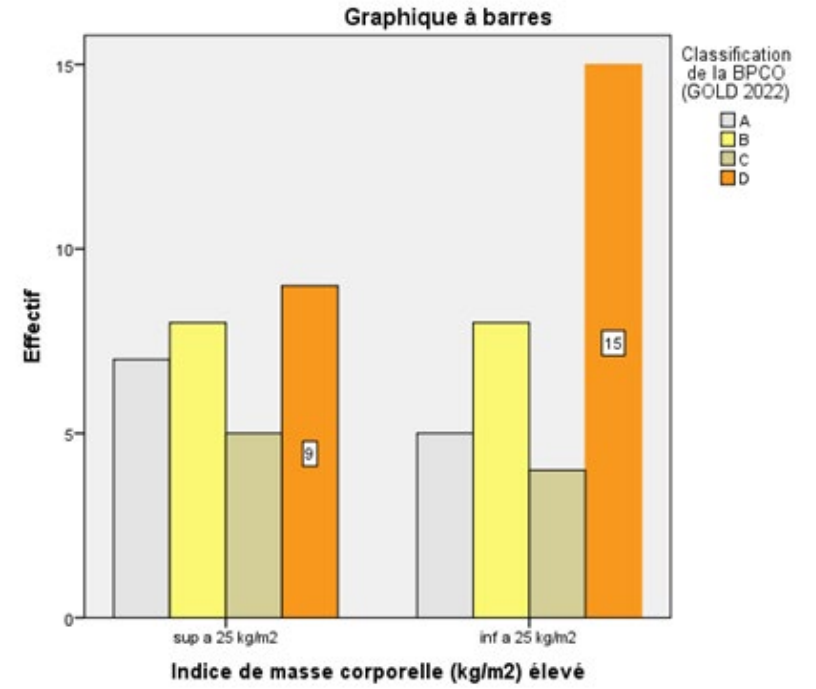

Figure 4 : Correlation between G1, G2 and Severity of COPD (2022)

The same findings were observed for severity stages according to GOLD 2007. The most obese subjects (BMI = 25.18) present a less severe COPD (FEV1 greater than 80%) (fig :5).

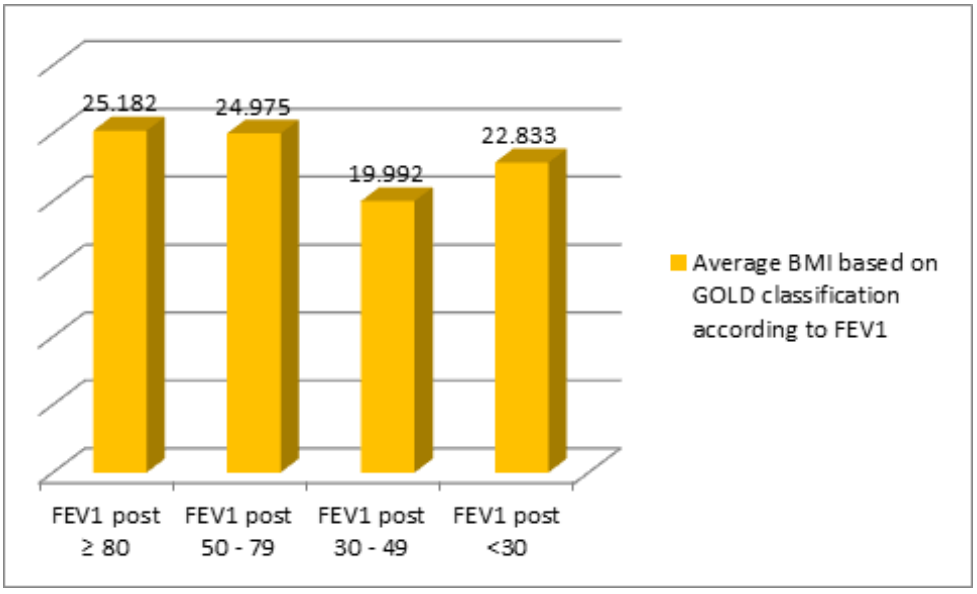

Figure 5: Correlation between G1, G2 and Severity of COPD (2007)

Same for FVC Patients in the lean groups had lower FVC (2.5 L) per dose to subjects in the normal weight or obese groups (fig :6), ANOVA (P=0,009).

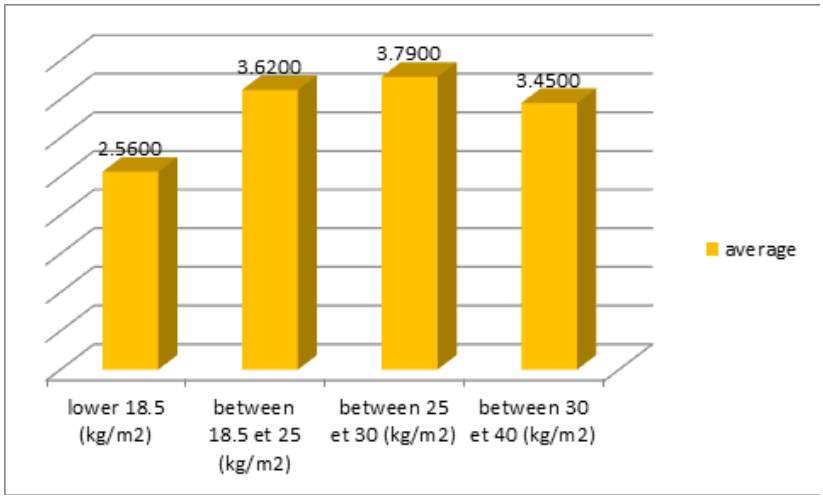

Figure 6: FVC Pre (l) Averages according to the OMS Classification of Obesity

Regarding the tiffenau index and BMI, A significant positive correlation was observed between these two parameters, A lower tiffeneau is present in the most lean subjects (fig :7), ANOVA (P=0,031).

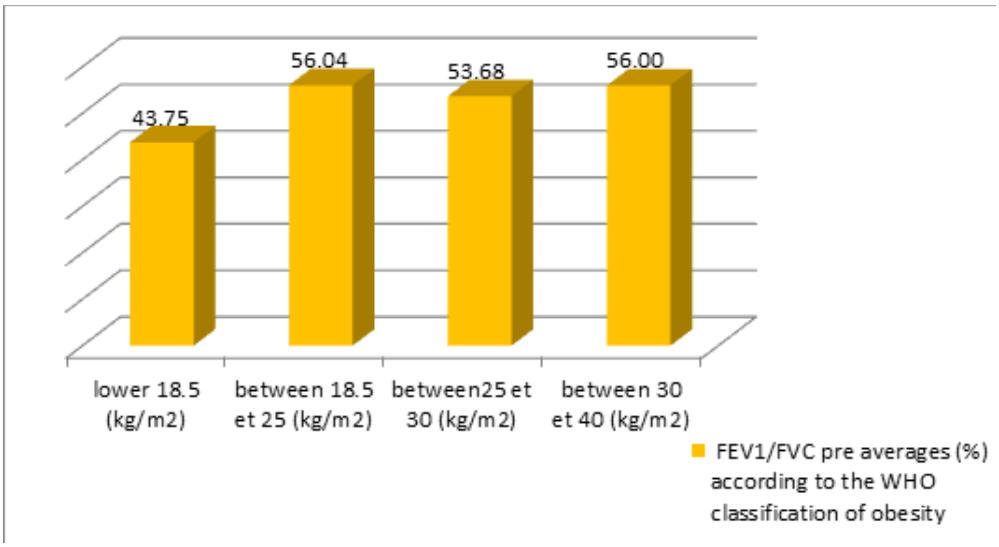

Figure 7: FEV/FVC Averages according to the OMS classification of Obesity

3. Discussion

The results obtained in our study show an average BMI of 24.12 4.83 kg/m 2, with extreme values ranging from 14.60 to 36.90 kg/m 2. This average is comparable to that observed in the Tunisian cohort studied by Snène [15]. Where the average BMI was 23.41 4.8 kg/m 2. Other international studies reported similar or divergent results. For example, El Gazzar,AG.et al., in Egypt found an average BMI of 25.32 2.57 kg/m 2, while Yamada, T. et al., In Japan reported a slightly lower average of 22.5 2.9 kg/m 2 [16,17]. Our results are close to those of O. Bouroubi et al [9]. The prevalence of obesity in COPD at Constantine's wilaya in 2019 was 7.4% for obesity and 31.9% for overweight.

In our series, a negative correlation was observed between BMI and the presence of emphysema. Patients with emphysema generally had lower BMI, as shown by our statistical analysis (Student's test: t = -3.112, p =0.003). This relationship was also reported by Papaioannou et al., who showed that pulmonary emphysema is associated with a decrease in BMI and lean mass [18]. This relationship can be explained by the direct or indirect effect of systemic inflammation.

Some studies, such as those by Katz, P. and Ben Sassi, S., suggest that significant weight gain may lead to increased co-morbidities, which reinforces our findings [19,20]. We observed a significant correlation between the average number of comorbidities and the different stages of the WHO classification for obesity, with a p-value of 0.039.

In our study, the mean BMI was higher in patients with less symptoms (groups A and C) (p = 0.014), a result that is consistent with the study by Radovanovic, D. et al. [21]. It should be noted that for some authors, obesity is not necessarily associated with adverse effects in COPD. A Tunisian study, involving 95 patients,

showed that obesity in COPD patients was linked to less severe airway obstruction [22].

Our study also showed that the mean values of BMI, expressed in kg/m 2, varied according to the severity of COPD assessed by the FEV1. Patients with mild COPD had a mean BMI of 25.13 3.30, those with moderate COPD of 24.97 5.39, those with severe COPD of 19.99 4.09, and finally those with very severe COPD of 22.83 4.40. These results are in agreement with those of Chailleux, E. et al. and Talamo, C. et al., who also found a positive correlation between the severity of COPD and a lower BMI [23,24].

Our study also found a significant correlation between BMI and distance travelled in the six-minute walking test (MV6), with a correlation coefficient r = 0.318(p = 0.013). Guenette et al. observed that obese patients with COPD were not disadvantaged compared to patients who were slimmer when exercising [25].

4. Conclusion

Obese COPD do not have lung distension, unlike non-obese COPD. In patients with COPD, obesity was associated with less severe airway obstruction.

Contrary to expectations, obesity is not necessarily associated with adverse effects during COPD. As our results show, The data from our work are consistent with those of the literature showing that overweight and obesity in patients followed for COPD are associated with better tolerance to effort and has less severe airway obstruction.

During COPD, weight loss is a factor in poor prognosis. Overweight or obesity, a common situation in these patients, could be a protective factor.

More research is needed to better understand the underlying mechanisms of this complex interaction between obesity and COPD.

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