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Association between Malnutrition and Health-Related Quality of Life in Patients with Chronic Obstructive Pulmonary Disease at the Yalgado Ouedraogo University Hospital, Ouagadougou, Burkina Faso

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Abstract

Introduction: Chronic obstructive pulmonary disease (COPD) is frequently complicated by malnutrition, which impairs respiratory muscle function, exercise tolerance and health-related quality of life. Our study assessed its association with health-related quality of life in patients followed for COPD at Yalgado Ouedraogo University Hospital. **Material and Methods:** This cross-sectional analytical study ran from 1 March to 30 June 2024 in the Department of Pulmonology and Phthisiology of Yalgado Ouedraogo University Hospital. Consenting patients with stable COPD (no exacerbation in the previous four weeks) attending outpatient follow-up were included consecutively. Nutritional risk was screened with the Malnutrition Universal Screening Tool, and body composition was measured by bioelectrical impedance analysis. Malnutrition was defined as a low fat-free mass index (FFMI), below 15 kg/m^2 in women and 16 kg/m^2 in men. Quality of life was assessed with the COPD Assessment Test (CAT) and the St George's Respiratory Questionnaire (SGRQ). Groups were compared with non-parametric tests and adjusted associations

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were explored; $p < 0.05$ was considered significant. **Results:** Sixty-nine patients were included (mean age 65 ± 13 years, range 40 - 94; sex ratio 3.9:1). Screening classified 42.0% of patients as at high nutritional risk, and 18 patients (26.1%) had a low FFMI. Compared with patients with a normal FFMI, they had higher SGRQ total (median 57.7 vs 39.0; $p = 0.024$) and SGRQ impact scores (45.5 vs 29.0; $p = 0.012$). The CAT score (18.5 vs 15.0; $p = 0.106$) and the SGRQ symptom score ($p = 0.102$) did not differ significantly. After adjustment for age and FEV1, low FFMI remained associated with a higher SGRQ impact score (+10.4 points; 95% CI 1.2 to 19.7), whereas the adjusted differences in the SGRQ total score (primary outcome) and the CAT score were not significant. FFMI correlated negatively with the SGRQ total ($\rho = -0.33$, $p = 0.005$), SGRQ impact ($\rho = -0.30$, $p = 0.013$) and CAT scores ($\rho = -0.26$, $p = 0.033$). In an exploratory model, arterial hypertension was associated with lower odds of low FFMI (adjusted OR 0.06; 95% CI 0.01 - 0.56). **Conclusion:** About one in four COPD patients had a low FFMI, which was associated with poorer quality of life, mainly in the SGRQ impact domain. Despite the cross-sectional design and small sample, these findings support routine nutritional screening, including body composition, in COPD follow-up.

Keywords

Bioelectrical Impedance Analysis, Burkina Faso, COPD, Malnutrition, Quality of Life

1. Introduction

Chronic obstructive pulmonary disease (COPD) is one of the leading causes of morbidity and mortality worldwide [1]. It is the third leading cause of death, with 3.4 million deaths in 2023 (approximately 6% of all deaths), and nearly 90% of COPD deaths in people under 70 years of age occur in low- and middle-income countries [1]. Although COPD primarily affects the lungs, it also has systemic consequences, such as changes in body composition, skeletal and muscular dysfunction, as well as cardiological and neurological effects [2]. In this regard, oxidative stress and increased secretion of pro-inflammatory cytokines induce an inflammatory state, both pulmonary and systemic, which contributes to COPD [3]. This inflammation is associated with weight loss, muscle wasting and tissue depletion [4]. The resulting malnutrition reduces muscle mass, particularly in the respiratory muscles, thereby exacerbating dyspnoea and reducing exercise tolerance in the course of COPD [2]. Regardless of other systemic comorbidities of COPD, malnutrition remains a major public health problem [5].

Malnutrition is a pathological condition caused by an imbalance between nutrient intake and requirements, leading to a reduction in metabolism and a change in body composition [6]. Malnutrition in all its forms affects every country; in 2022, about 390 million adults worldwide were underweight and 2.5 billion were overweight [7]. About 12.9% of the population of developing regions was under-

nourished in 2014-2016, with higher rates in sub-Saharan Africa (23.2%) and Southern Asia (15.7%) [8].

In developing countries, a meta-analysis reported a pooled prevalence of malnutrition of 47.6% in patients with COPD, with very heterogeneous estimates (9% to 99.4%), and of 36.9% in stable COPD [5]. In a recent Tunisian study using bioimpedance analysis, 20.2% of COPD patients had a low fat-free mass index (FFMI) [9]. The diagnostic criteria established in 2019 by the Global Leadership Initiative on Malnutrition (GLIM) combine a positive screening test with at least one phenotypic criterion (unintentional weight loss, low muscle mass, low body mass index) and at least one aetiological criterion (reduced food intake or digestive absorption, the burden of a disease or an inflammatory condition) [10] [11]. Malnutrition associated with COPD leads to a decline in respiratory and peripheral muscle function, reduced exercise capacity, increased mortality and impaired health-related quality of life [2]. These effects can be partly improved by nutritional support, particularly within pulmonary rehabilitation [12].

To our knowledge, no study has been conducted in West Africa, specifically in Burkina Faso, on the nutritional status and the quality of life of patients with COPD. The aim of this study was to assess the association between malnutrition and the quality of life of COPD patients followed in the Department of Pulmonology and Phthisiology of the Yalgado Ouedraogo University Hospital (CHU-YO) in Ouagadougou.

2. Methodology

2.1. Study Design

This cross-sectional, descriptive and analytical study was conducted from 1 March to 30 June 2024 in the Department of Pulmonology and Phthisiology at Yalgado Ouedraogo University Hospital, Ouagadougou.

2.2. Study Population

The study population consisted of patients followed for stable COPD. Eligible participants were patients with COPD seen during outpatient follow-up who provided written informed consent. Patients were excluded if they had experienced an acute COPD exacerbation during the four weeks preceding inclusion, another chronic respiratory disease (severe asthma, extensive bronchiectasis, pulmonary fibrosis or major sequelae of tuberculosis), contraindications to bioelectrical impedance analysis (pacemaker, implantable defibrillator or limb amputation), major oedema, cognitive or psychiatric disorders preventing questionnaire completion, active cancer under treatment, a chronic condition likely to cause malnutrition independently of COPD, or if they declined to participate or were unable to give informed consent.

Of the 70 patients assessed, one was excluded because of incomplete impedance data (fat mass, bone mass and lean mass not recorded), so 69 patients were included in the analysis (**Figure 1**).

2.3. Study Protocol

The variables studied comprised dependent variables assessing malnutrition and quality of life and independent variables describing epidemiological, clinical and anthropometric aspects. COPD was defined by a Tiffeneau index (FEV1/FVC) below 70% that was not reversible after administration of a bronchodilator. The severity of bronchial obstruction was classified according to the GOLD 2023 criteria [13], and patients were assigned to GOLD groups A, B or E. Dyspnoea was graded with the modified Medical Research Council (mMRC) scale (grades 0 - 1 mild, 2 - 3 moderate, 4 severe [14]), and patients with at least two exacerbations in the previous 12 months were considered frequent exacerbators. Data were collected during routine outpatient follow-up consultations. We used a specially designed individual questionnaire, as well as tools such as a mechanical scale with a height rod and a bioelectrical impedance analyser.

Nutritional risk was screened with the Malnutrition Universal Screening Tool (MUST), chosen because it is validated, quick and usable in outpatient settings without laboratory tests. It sums three components: body mass index (>20 kg/m^2 = 0, 18.5 - 20 kg/m^2 = 1, <18.5 kg/m^2 = 2), unintentional weight loss over the previous three to six months (<5% = 0, 5% - 10% = 1, >10% = 2) and the acute disease effect (2 points if the patient is acutely ill and has had, or is likely to have, no nutritional intake for more than five days). Patients were then classified as at low (score 0), medium (score 1) or high (score 2 or more) risk of malnutrition. Body mass index (weight in kilograms divided by height in metres squared) was categorised as underweight (<18.5 kg/m^2), normal weight (18.5 - 24.9 kg/m^2), overweight (25 - 29.9 kg/m^2) or obesity (≥30 kg/m^2).

Body composition was measured with a foot-to-foot, two-electrode bioelectrical impedance scale (INTEY "Body Fat Scale", model NY-H02, made in China). Measurements were taken in the morning, with the patient barefoot and in underwear, after checking for metal objects and a pacemaker, and after the patient had emptied their bladder. Overnight fasting was not required, but measurements were taken at least three hours after the last meal or drink. Patients were asked to avoid strenuous exercise for 8 to 24 hours before the measurement; diuretic use was not recorded. In women, measurements were taken at least 3 days before or after menstruation. Height was measured standing, without shoes and with heels together, using the height rod of the mechanical scale. Body mass index (BMI) was generated automatically by the device. Fat-free mass was calculated as body weight minus the fat mass given by the device. The fat-free mass index (FFMI) was fat-free mass in kilograms divided by height in metres squared.

Spirometry was not performed specifically for the study: we used the most recent post-bronchodilator spirometry available for each patient, performed in different laboratories, provided that the test was acceptable and interpreted according to GOLD criteria.

Low FFMI was defined as below 15 kg/m^2 in women and below 16 kg/m^2 in

men, the cut-offs used by Luo *et al.* [15]. The European Respiratory Society statement [2] proposes 17 kg/m^2 for men. Following the GLIM framework, malnutrition was defined by the combination of a phenotypic criterion, low muscle mass assessed by a low FFMI, and an aetiological criterion, COPD as a chronic disease with an inflammatory component [10]. MUST was used to screen nutritional risk, and GLIM severity grading was not applied.

All assessments took place during the same routine consultation. Health-related quality of life was assessed with the COPD Assessment Test (CAT), whose score ranges from 0 to 40; the impact of the disease was classified as low (<10), medium (10 - 19) or high (≥20) [16]. The St George's Respiratory Questionnaire (SGRQ) was also used. It yields a total score and three domain scores, each ranging from 0 to 100: symptoms (frequency and severity of respiratory symptoms), activity (activities limited by breathlessness) and impact (the social and psychological disturbance caused by the disease). The impact domain carries just over half of the weight in the total score. Higher scores indicate poorer quality of life, and a total score ≥ 20 was considered to reflect impaired quality of life. The French versions of the CAT and SGRQ were administered by a trained interviewer, with oral translation into local languages when needed.

2.4. Statistical Analysis

Statistical analysis was performed with IBM SPSS Statistics version 23. Qualitative variables are presented as numbers and percentages. Quantitative variables are presented as means ± standard deviation for the whole sample and as medians with interquartile ranges (IQR) for group comparisons, because several distributions were skewed. Patients with a low FFMI and those with a normal FFMI were compared with the Fisher exact test for qualitative variables (Fisher-Freeman-Halton exact test when there were more than two categories) and the Mann-Whitney test for quantitative variables. The trend across education levels was tested with the chi-square test for linear trend, and SGRQ scores across BMI categories were compared with one-way analysis of variance. For the quality-of-life scores we also report the difference in means with its 95% confidence interval (Student t test). Correlations between FFMI and quality-of-life scores were assessed with Spearman's coefficient in the 69 patients.

The primary exposure was low FFMI, and the primary outcome was the SGRQ total score. Associations with quality of life were examined with linear regression models (outcomes: SGRQ total, CAT and SGRQ impact scores) that included low FFMI, age and FEV1 (% of predicted). Factors associated with low FFMI were explored with a logistic regression model limited to three variables, because only 18 patients had a low FFMI (about six events per variable). Age and FEV1 were chosen as clinically relevant covariates, and arterial hypertension was retained post hoc because it was the only clinical factor associated with low FFMI in the initial analyses. Collinearity was checked with variance inflation factors and model

fit with the Hosmer-Lemeshow test. The analyses were not prespecified and are exploratory. No sample size calculation was made, since all eligible patients seen during the study period were included. No correction for multiple testing was applied. The significance level was set at $p < 0.05$ (two-sided).

2.5. Ethical Considerations

The study complied with the principles of the Declaration of Helsinki. Written informed consent was obtained from each patient before inclusion. Participants were assured of the anonymity and confidentiality of the information collected throughout data collection, analysis and dissemination, and data collection forms were coded. Administrative authorisation to collect the data was obtained from the Director General of CHU-YO before any patient was approached.

3. Results

All COPD patients seen in outpatient follow-up at the Department of Pulmonology and Phthisiology, CHU-YO, between 1 March and 30 June 2024, who met the eligibility criteria and gave consent were assessed consecutively (n = 70).

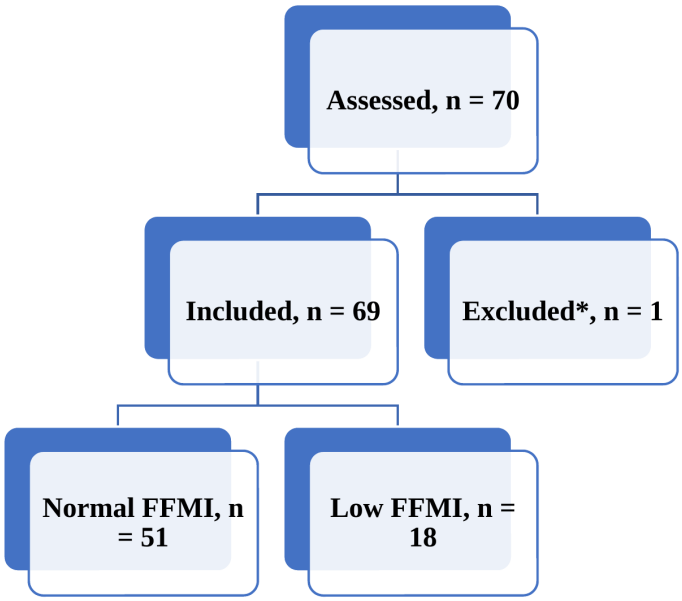

Figure 1. Flow of participants. *Incomplete impedance data (fat mass, bone mass and lean mass not recorded); FFMI, fat-free mass index.

3.1. Sociodemographic Characteristics

The mean age was 65 ± 13 years (range 40 - 94), with 53.6% of patients aged 60 to 79 years and 15.9% aged 80 years or older. Men predominated, accounting for 79.7% of the sample (sex ratio 3.9:1). Most patients resided in urban areas (65.2%). Just over half had received no formal education (52.2%) and 70% worked in the informal sector (Table 1).

Table 1. Sociodemographic characteristics by FFMI group (N = 69).

Variable	Normal FFMI (n = 51), n (%)	Low FFMI (n = 18), n (%)	p
Female sex	9 (17.6)	5 (27.8)	0.496
Rural residence	16 (31.4)	8 (44.4)	0.391
Education			
None	22 (43.1)	14 (77.8)	0.106*
Primary	16 (31.4)	2 (11.1)	
Secondary	6 (11.8)	1 (5.6)	
Higher	7 (13.7)	1 (5.6)	
Marital status			
Married	40 (78.4)	12 (66.7)	0.350
Widowed	8 (15.7)	3 (16.7)	
Single	2 (3.9)	1 (5.6)	
Divorced	1 (2.0)	2 (11.1)	
Occupational status			
Farmer	11 (21.6)	4 (22.2)	1.000
Trader	10 (19.6)	1 (5.6)	0.266
Retired	5 (9.8)	3 (16.7)	0.421
Housewife	2 (3.9)	4 (22.2)	**0.036**

Values are n (column %). p: Fisher exact test for variables with two categories; Fisher-Freeman-Halton exact test for education and marital status. FFMI, fat-free mass index. *Chi-square test for linear trend across education levels: p = 0.043.

3.2. Clinical and Functional Characteristics

Clinical and functional characteristics are presented in Table 2. Smoking was the most common risk factor, reported in 49.3% of patients, followed by biomass smoke (27.5%) and occupational exposure (14.5%; Table 2). Most patients had at least moderate dyspnoea and 68.1% were classified GOLD E. Post-bronchodilator spirometry showed a mean FEV1 of 45.6% ± 17.8% of the predicted value (range 12% - 93%), a mean FVC of 65.7% ± 21.0% (range 22% - 130%) and a mean FEV1/FVC ratio of 54.4% ± 9.7% (range 35.6% - 69.7%). Airflow obstruction was severe in 47.8% of patients and very severe in 18.8%.

Table 2. Clinical and exposure characteristics by FFMI group (N = 69).

Characteristic	Normal FFMI (n = 51), n (%)	Low FFMI (n = 18), n (%)	p
Current or former smoker	26 (51.0)	8 (44.4)	0.785
Biomass exposure	15 (29.4)	4 (22.2)	0.761
Occupational exposure	8 (15.7)	2 (11.1)	1.000

Continued

Previous respiratory infection	4 (7.8)	3 (16.7)	0.366
Hypertension	21 (41.2)	1 (5.6)	0.007
Type 2 diabetes	2 (3.9)	1 (5.6)	1.000
Pulmonary hypertension	15 (29.4)	5 (27.8)	1.000
Cor pulmonale	7 (13.7)	2 (11.1)	1.000
HIV infection	3 (5.9)	1 (5.6)	1.000
GOLD 1 - 2 (mild to moderate)	19 (37.3)	4 (22.2)	0.384
GOLD 3 - 4 (severe to very severe)	32 (62.7)	14 (77.8)	
mMRC mild	5 (9.8)	2 (11.1)	
mMRC moderate	36 (70.6)	9 (50.0)	0.238
mMRC severe	10 (19.6)	7 (38.9)	
GOLD group A	7 (13.7)	2 (11.1)	
GOLD group B	10 (19.6)	3 (16.7)	1.000
GOLD group E	34 (66.7)	13 (72.2)	
Exacerbator phenotype	29 (56.9)	12 (66.7)	0.581
More than 2 hospitalisations	3 (5.9)	2 (11.1)	0.600

p: Fisher exact test for 2 × 2 tables, Fisher-Freeman-Halton exact test for variables with more than two categories. GOLD, Global Initiative for Chronic Obstructive Lung Disease; mMRC, modified Medical Research Council; HIV, human immunodeficiency virus; FFMI, fat-free mass index.

3.3. Nutritional Status

As classified by the MUST, 42.0% (n = 29) of patients were at high risk of malnutrition. Bioelectrical impedance analysis showed a low FFMI in 18 of the 69 patients (26.1%; 95% CI 17.2 - 37.5), the mean FFMI being 17.0 ± 3.4 kg/m^2. According to body mass index, 37.7% of patients were underweight, and 94.4% of those with a low FFMI were at high MUST risk (Table 3). Health-related quality of life was impaired in 88.4% of patients (n = 61) according to the SGRQ, while the CAT indicated a medium impact of the disease in 43.5% and a high impact in 36.2%. Quality-of-life scores according to FFMI group are shown in Table 4.

Table 3. Nutritional characteristics by FFMI group (N = 69).

Characteristic	Normal FFMI (n = 51)	Low FFMI (n = 18)	p
Nutritional status			
BMI normal (18.5 - 24.9)	34 (66.7)	0	<0.001
BMI < 18.5	8 (15.7)	18 (100)	

Continued

BMI 25 - 29.9	7 (13.7)	0	
BMI ≥ 30	2 (3.9)	0	
MUST low risk	27 (52.9)	1 (5.6)	
MUST medium risk	12 (23.5)	0	<0.001
MUST high risk	12 (23.5)	17 (94.4)	

Values are n (column %). p: Fisher-Freeman-Halton exact test. BMI and MUST both depend on body weight, as does the FFMI, so their difference between groups is expected. BMI, body mass index (kg/m^2); MUST, Malnutrition Universal Screening Tool; FFMI, fat-free mass index.

3.4. Quality of Life and Body Composition According to FFMI

Table 4 compares the 51 patients with a normal FFMI and the 18 patients with a low FFMI. Metabolic age was higher in patients with a low FFMI (median 76.5 vs 67 years; p = 0.018), while chronological age did not differ significantly (69 vs 66 years; p = 0.245). FEV1 tended to be lower in patients with a low FFMI (median 41% vs 45% of predicted), but the difference was not significant (p = 0.182). As expected, fat-free mass, FFMI, fat mass, bone mass, total body water and basal metabolic rate were all lower in patients with a low FFMI (p ≤ 0.004).

The SGRQ total score was higher in patients with a low FFMI (median 57.7 vs 39.0; difference in means 11.1 points, 95% CI 1.2 to 21.0; p = 0.024). Specifically, among the SGRQ domains, only the impact score differed significantly (45.5 vs 29.0; difference 13.0, 95% CI 3.3 to 22.7; p = 0.012) whereas the symptom (p = 0.102) and activity (p = 0.388) scores did not (Table 4). The CAT score was 3.1 points higher in patients with a low FFMI (95% CI −1.2 to 7.4), which was not significant (p = 0.106; Table 4).

FFMI was negatively correlated with the SGRQ total score ($\rho = -0.33$, p = 0.005), the SGRQ impact score ($\rho = -0.30$, p = 0.013), the SGRQ activity score ($\rho = -0.26$, p = 0.028) and the CAT score ($\rho = -0.26$, p = 0.033). According to body mass index category, the SGRQ total score tended to be higher in underweight patients (mean 48 ± 19) than in patients of normal weight (39 ± 17) or with overweight or obesity (38 ± 21), but the difference was not significant (one-way analysis of variance, p = 0.132).

Table 4. Quality of life and body composition according to FFMI.

Variable	Normal FFMI (n = 51), median [IQR]	Low FFMI (n = 18), median [IQR]	Difference in means (95% CI)	p
Chronological age (years)	66 [51 - 74]	69 [59 - 80]	4.8 (−2.5 to 12.1)	0.245
Metabolic age (years)	67 [54 - 75]	76.5 [64 - 84]	8.8 (1.4 to 16.2)	**0.018**
FEV1 (% of predicted)	45 [36 - 60]	41 [28 - 50]	−7.3 (−16.9 to 2.4)	0.182
CAT score	15 [9 - 22]	18.5 [14 - 23.5]	3.1 (−1.2 to 7.4)	0.106
SGRQ total score	39.0 [28.0 - 49.0]	57.7 [36.3 - 66.8]	11.1 (1.2 to 21.0)	**0.024**

Continued

SGRQ symptoms score	45.0 [31.0 - 57.0]	53.5 [34.8 - 66.0]	8.1 (−2.0 to 18.1)	0.102
SGRQ activity score	54.0 [41.0 - 83.0]	70.0 [43.3 - 86.3]	6.4 (−8.6 to 21.5)	0.388
SGRQ impact score	29.0 [16.0 - 43.0]	45.5 [32.3 - 60.0]	13.0 (3.3 to 22.7)	**0.012**
Fat-free mass (kg)	53.5 [49.2 - 59.5]	36.1 [32.8 - 42.2]	−18.8 (−23.6 to −13.9)	**<0.001**
FFMI (kg/m²)	18.1 [16.9 - 19.4]	13.9 [11.9 - 14.6]	−5.8 (−7.0 to −4.5)	**<0.001**
Fat mass (kg)	6.2 [3.5 - 10.9]	2.7 [2.2 - 6.7]	−2.6 (−6.8 to 1.6)	**0.004**
Body fat (%)	10.1 [5.9 - 15.5]	6.1 [5.0 - 15.2]	1.6 (−5.0 to 8.1)	0.290
Bone mass (kg)[a]	2.3 [2.2 - 2.5]	1.8 [1.4 - 1.9]	−0.6 (−0.7 to −0.4)	**<0.001**
Total body water (kg)	35.1 [33.6 - 40.1]	28.3 [23.0 - 30.5]	−9.1 (−11.7 to −6.4)	**<0.001**
Basal metabolic rate (kcal/day)	1321 [1171 - 1580]	1045 [964 - 1271]	−270.3 (−400.9 to −139.7)	**<0.001**

Values are medians [interquartile range]. p values are from the Mann-Whitney test. Differences in means (low minus normal FFMI) with 95% CI are from the Student t test and are given for all parameters; for skewed variables such as fat mass, the interval for the mean difference can include zero although the Mann-Whitney p value is significant. [a]n = 50 in the normal-FFMI group (one implausible value excluded). CAT, COPD Assessment Test; SGRQ, St George's Respiratory Questionnaire; FFMI, fat-free mass index; CI, confidence interval.

3.5. Quality of Life after Adjustment

Table 5 shows linear regression models for the SGRQ total score (primary outcome), the CAT score and the SGRQ impact score, each adjusted for age and FEV1. After adjustment, a low FFMI remained associated with a higher SGRQ impact score (+10.4 points; 95% CI 1.2 to 19.7; p = 0.028). The adjusted differences for the SGRQ total score (+7.3 points; 95% CI −1.9 to 16.4) and the CAT score (+2.5 points; 95% CI −1.9 to 6.8) were no longer significant. FEV1 was the strongest determinant of all three scores. Variance inflation factors were at most 1.06. When FFMI was entered as a continuous variable in place of the group, each 1 kg/m2 increase was associated with a 1.5-point lower SGRQ total score (95% CI −2.6 to −0.4; p = 0.010; adjusted R^2 = 0.29).

Table 5. Adjusted associations of low FFMI, age and FEV1 with quality-of-life scores (linear regression).

Outcome	Low vs normal FFMI	Age (per year)	FEV1 (per 1 point of % predicted)	Adjusted R^2
SGRQ total score	7.3 (−1.9 to 16.4); p = 0.119	0.07 (−0.23 to 0.36); p = 0.655	−0.48 (−0.71 to −0.26); p < 0.001	0.24
CAT score	2.5 (−1.9 to 6.8); p = 0.264	−0.03 (−0.17 to 0.12); p = 0.723	−0.11 (−0.21 to −0.001); p = 0.049	0.05
SGRQ impact score	10.4 (1.2 to 19.7); p = 0.028	−0.09 (−0.39 to 0.21); p = 0.540	−0.41 (−0.64 to −0.18); p = 0.001	0.22

Values are regression coefficients (points of score) with 95% CI. **FEV1**, forced expiratory volume in one second; **CAT**, COPD Assessment Test; **SGRQ**, St George's Respiratory Questionnaire; **FFMI**, fat-free mass index.

3.6. Factors Associated with Low FFMI

On bivariate analysis, 1 of 22 patients with arterial hypertension (4.5%) had a low

FFMI, against 17 of 47 patients without hypertension (36.2%) (odds ratio 0.08; 95% CI 0.01 - 0.68; Fisher exact test p = 0.007). In the logistic model with age, FEV1 and hypertension (Table 6; 69 patients, 18 events), hypertension remained associated with lower odds of a low FFMI (adjusted OR 0.06; 95% CI 0.01 - 0.56; p = 0.013). Older age and lower FEV1 showed non-significant trends. The model fitted acceptably (Hosmer-Lemeshow p = 0.62; Nagelkerke R^2 = 0.29) and collinearity was low (variance inflation factors below 1.1).

Table 6. Factors associated with low FFMI (exploratory logistic regression, n = 69, 18 events).

Variable	Adjusted OR	95% CI	p
Age (per year)	1.05	1.00 - 1.10	0.057
FEV1 (per 1 point of % predicted)	0.97	0.94 - 1.01	0.161
Arterial hypertension (yes vs no)	0.06	0.01 - 0.56	**0.013**

OR, odds ratio; **CI**, confidence interval; **FEV1**, forced expiratory volume in one second.

4. Discussion

4.1. Characteristics of the Study Population

The mean age of patients in our study was 65 ± 13 years, very close to that reported by Mjid *et al.* [9] in Tunisia (65.9 years) and by Mounguengui *et al.* [17] in Gabon (66 years), respectively in 2021 and 2016.

In our series, male sex and smoking were the principal risk factors, in agreement with the results observed in other studies on COPD [17] [18]. The historical predominance of smoking among men, particularly in sub-Saharan Africa, probably explains their over-representation in our study. The absence of programmes dedicated to the prevention and control of smoking combined with the low education of the population about respiratory health may contribute to the high prevalence of COPD among men in our country.

4.2. Spirometric Characteristics

In our study, the 18 patients with a low FFMI had a slightly lower median post-bronchodilator FEV1 than the 51 patients with a normal FFMI (41% versus 45% of the predicted value), but the difference was not significant (p = 0.182). Our results differ from those of Fekete *et al.* [19] in 50 Hungarian patients, who observed in malnourished patients (defined by a low FFMI on impedance analysis) a significantly lower FEV1 (38.9% vs 48.6% of the predicted value, p = 0.023) and a higher CAT score (28.5 vs 19.1, p = 0.003). The absence of statistical significance in our study probably reflects its limited statistical power. To our knowledge, no comparable data on body composition and lung function in COPD are available from Burkina Faso or elsewhere in West Africa, which limits regional comparison.

4.3. Malnutrition in COPD Patients

The 37.7% prevalence of underweight in our patients is consistent with figures

reported in the African and international literature [5]. Fekete *et al.* [19] reported malnutrition confirmed by BIA in 28% of patients, close to our 26.1%. In Tunisia, Mjid *et al.* [9] likewise reported a low FFMI on impedance analysis in 20.2% of COPD patients, slightly lower than our 26.1%. This convergence of results suggests that underweight represents a frequent systemic complication in patients with COPD, highlighting the importance of monitoring nutritional status in the management of this pathology.

The mean FFMI was also similar to that reported by Fekete *et al.* [19] (16.8 ± 2.4 versus 17.0 ± 3.4 kg/m^2). Malnutrition, particularly muscle loss, is common in COPD, mainly because of reduced nutritional intake and the chronic systemic inflammation related to the disease [4] [5].

In addition, combining MUST for clinical screening with BIA for body composition analysis provides complementary information, as each method has its own sensitivity and specificity.

Screening figures diverged from those of Fekete *et al.* [19]: a high nutritional risk was more than twice as frequent in our series (42.0% versus 18%), and Luo *et al.* [15] reported an even higher prevalence of low fat-free mass index (48.5%). Three factors may account for these differences: the screening tool weights recent involuntary weight loss, which is frequent in patients who present late in the course of the disease, as in our setting; the fat-free mass index thresholds used to define malnutrition differ across series; and our sample of 69 patients yields imprecise estimates.

4.4. Low FFMI and Quality of Life of COPD Patients

Low FFMI was associated with poorer quality of life, more clearly with the SGRQ than with the CAT (**Table 4**), in line with the higher CAT scores reported by Fekete *et al.* in patients with a low FFMI [19]; in Turkish patients, by contrast, a low body mass index was not associated with a different SGRQ symptom score [20], which agrees with the absence of difference in our symptom score, whereas in Filipino patients a low FFMI was associated with a lower CAT score [3], contrary to our finding. The impact domain captures the social and psychological burden of COPD and carries just over half of the weight in the SGRQ total score, which is why the total followed it. This matters in practice, because the impact domain reflects what patients live with from day to day. The symptom score did not differ significantly, which suggests that the difference concerns the daily-life burden of the disease more than respiratory symptoms alone.

The adjusted analysis tempers this finding. After accounting for age and FEV1, only the impact difference remained significant, and airflow limitation was the stronger determinant of all scores (**Table 5**). The adjusted differences for the SGRQ total and CAT scores had wide confidence intervals, compatible both with no effect and with a clinically relevant one. FFMI analysed as a continuous variable stayed associated with the SGRQ total score after adjustment, which points to a gradient rather than a threshold effect, although this needs confirmation in larger samples.

Outside COPD, a systematic review and meta-analysis in older people found that malnourished individuals were more likely to report poor quality of life (OR 2.85; 95% CI 2.20 - 3.70), although the included studies were heterogeneous and of limited quality [21].

FFMI was negatively correlated with the SGRQ and CAT scores (Section 3.4), and the higher metabolic age and lower basal metabolic rate of patients with a low FFMI suggest a global metabolic depletion. These results are compatible with a link between low muscle mass and poorer quality of life in COPD.

Our results are consistent with international literature data. Fekete *et al.* [19] reported in Hungarian patients negative relationships between FFMI and CAT score ($\rho = -0.4906$, $p = 0.0003$) as well as with the mMRC dyspnoea scale ($r = -0.537$, $p < 0.001$), and a strong positive correlation between FFMI and the distance covered in the 6-minute walk test ($r = 0.531$, $p < 0.001$). These relationships are similar to ours between FFMI and the SGRQ and CAT scores (ρ from −0.26 to −0.33). Luo *et al.* [15] had already suggested that FFMI may be a useful predictor of COPD severity, particularly in group D of the former GOLD classification (now merged into group E), with a malnutrition prevalence of 48.5% defined by low FFMI; this fits our series, in which two thirds of patients were in group E. Finally, Schols *et al.* [22] had already emphasised that weight loss constituted an independent but reversible prognostic factor: in patients receiving nutritional therapy, weight gain was associated with a lower mortality risk, a gain of more than 2 kg over 8 weeks defining response to treatment, which supports a nutritional approach in patients like ours.

This link is also consistent with the ATS/ERS statement by Maltais *et al.*, which established that limb muscle dysfunction in COPD is associated with poorer quality of life and increased mortality [23].

Although muscle strength and exercise capacity were not measured in our study, the literature indicates that this alteration of quality of life is mediated by reduced respiratory and peripheral muscle strength, increased dyspnoea and reduced exercise tolerance [23]. In our sub-Saharan context, where access to respiratory rehabilitation remains limited, these data argue for systematic screening of malnutrition (MUST combined with bioelectrical impedance analysis) from the initial management onwards, as recommended by European learned societies for more than ten years [2].

By showing that malnutrition is associated with poorer health-related quality of life in COPD patients, our results suggest that nutritional status may be a modifiable target. Previous work indicates that rehabilitation combining nutritional intake, adapted physical activity and psychological support can limit muscle wasting [12]; whether such management improves quality of life in our setting should be tested prospectively.

4.5. Arterial Hypertension Associated with Low FFMI in COPD Patients

In the exploratory model, arterial hypertension was the only factor associated with

a low FFMI (adjusted OR 0.06; 95% CI 0.01 - 0.56). Only one of the 22 hypertensive patients had a low FFMI, so the estimate rests on a single patient and the confidence interval is wide. Hypertension is more frequent in people with a higher body weight and lean mass, and hypertensive patients may be followed more closely, so the result may reflect confounding by body build rather than a protective effect. It should be regarded as a hypothesis to be confirmed.

4.6. Strengths and Limitations of the Study

To our knowledge, this is the first study of malnutrition and quality of life in patients with COPD in Burkina Faso. Another strength is its methodological approach: nutritional status was assessed both by a validated screening tool (MUST) and by an objective measurement of body composition (bioelectrical impedance analysis), and quality of life by two validated instruments (CAT and SGRQ). The main limitation is the small sample (n = 69, with 18 patients having a low FFMI), which is not representative of the whole COPD population in Burkina Faso and limits statistical power. Exposure and outcome were measured at a single visit, so we can describe associations but not temporal or causal relationships. Reverse causation is possible, since patients with poorer quality of life may eat less. Fat-free mass was estimated with a foot-to-foot impedance scale whose proprietary equations have not been validated specifically in COPD, without overnight fasting or control of hydration status, to which impedance is sensitive. We used a cut-off of 16 kg/m^2 in men, whereas the European Respiratory Society statement proposes 17 kg/m^2 [2], so the number of men with a low FFMI may be underestimated. The analyses were not prespecified and no correction was made for multiple testing. With 18 events, the adjusted models give wide confidence intervals. Spirometry was not performed centrally, since we used the results available from different devices and laboratories, so the FEV1 values may be less comparable between patients. Despite these limitations, this pilot study provides useful first data.

To better understand the interaction between malnutrition and COPD in our context, a larger cohort study could identify the factors associated with the quality of life of patients with COPD in Burkina Faso. A population-based cohort study, beyond hospital recruitment, would also help to overcome the biases inherent in hospital-based studies and to estimate the effect of undernutrition on COPD outcomes in the sub-Saharan context.

5. Conclusion

A low fat-free mass index, our marker of malnutrition, was frequent among COPD patients followed at Yalgado Ouedraogo University Hospital. It was associated with poorer health-related quality of life, mainly in the impact domain of the SGRQ, including after adjustment for age and airflow limitation. Airflow limitation remained the stronger determinant of quality-of-life scores. Lower FFMI was correlated with worse SGRQ and CAT scores, which suggests that body composition deserves attention in COPD care. The hospital-based design, the single visit and

the small sample limit these conclusions. This pilot study supports nutritional screening in COPD care in Burkina Faso, and whether early nutritional intervention improves quality of life remains to be tested. A multicentre prospective cohort of newly diagnosed COPD patients, followed over time with systematic nutritional screening, is needed to estimate the effect of malnutrition on quality of life and prognosis.

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Author Contributions

Conceptualization: Tiendrebeogo, A.J.F., Essaga Eloundou, C., Bonsa, E. and Ouedraogo, M.; methodology: Tiendrebeogo, A.J.F., Bonsa, E. and Essaga Eloundou, C.; investigation: Essaga Eloundou, C., Tiendrebeogo, A.J.F. and Bonsa, E.; data curation: Essaga Eloundou, C., Tiendrebeogo, A.J.F. and Bonsa, E.; formal analysis: Tiendrebeogo, A.J.F. and Bonsa, E.; writing original draft preparation: Essaga Eloundou, C., Tiendrebeogo, A.J.F. and Bonsa, E.; writing review and editing: all authors; supervision: Diaw, M., Sow, A.K., Ouedraogo, N. and Ouedraogo, M. All authors have read and agreed to the published version of the manuscript.

Data Availability

The dataset analysed in this study is available from the corresponding author on reasonable request.

Abbreviations

ATS, American Thoracic Society; **BIA**, bioelectrical impedance analysis; **BMI**, body mass index; **CAT**, COPD Assessment Test; **CHU-YO**, Yalgado Ouedraogo University Hospital; **CI**, confidence interval; **COPD**, chronic obstructive pulmonary disease; **ERS**, European Respiratory Society; **FEV1**, forced expiratory volume in one second; **FFMI**, fat-free mass index; **FVC**, forced vital capacity; **GLIM**, Global Leadership Initiative on Malnutrition; **GOLD**, Global Initiative for Chronic Obstructive Lung Disease; **HIV**, human immunodeficiency virus; **IQR**, interquartile range; **mMRC**, modified Medical Research Council; **MUST**, Malnutrition Universal Screening Tool; **OR**, odds ratio; **SGRQ**, St George's Respiratory Questionnaire.

Conflicts of Interest

The authors declare no conflicts of interest and state that they received no specific funding from public, commercial or not-for-profit organisations regarding the publication of this article.

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