Risk of malnutrition in adult patients with chronic obstructive pulmonary disease

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Abstract:

Background: Chronic obstructive pulmonary disease is considered a major public health problem in the world. Weight loss, muscle and fat mass depletion are common nutritional problems in chronic obstructive pulmonary disease patients. In the present study, we assessed nutritional status in chronic obstructive pulmonary disease patients.

Objectives: For the assessment of nutritional status in patient with chronic obstructive pulmonary disease, assessment the risk of malnutrition, determine the relation between severity of Chronic obstructive pulmonary disease and risk of malnutrition and determine the atherogenic index as a risk factor for atherosclerosis and its relation with risk of malnutrition in patient with Chronic obstructive pulmonary disease.

Patients and methods: A descriptive Cross-sectional study of 90 patients diagnosed with chronic obstructive pulmonary disease (64 males and 26 females) from the age of 35 years. conducted in Al-Hila city, in Merjan medical city. Data collection was carried out during the period from 1st of March to 30th of May 2014.

Data obtained included questionnaires, anthropometric measurements (weight, height, body mass index, waist circumference, height circumference, and waist hip ratio), pulmonary function test, Biochemical investigations (includes glycated hemoglobin (HbA1c) and atherogenic index) were analyzed by statistical package for social sciences program version 18.

Results: A ninety patients with chronic obstructive pulmonary disease were enrolled in this study with a mean age 59.2±6.0, range 35-65 years. 92.2% of study population were present with (50-65) years age, 97.3% of them had high risk of malnutrition and 88.7% had low risk of malnutrition, and71.1% were male and 28.9% were female.

There was significant association between sever or low risk of malnutrition and marital status, residence, duration of chronic obstructive pulmonary disease, smoking history, intensity of cigarette smoking(pack-year) and alcohol ingestion, coronary artery diseases, eating alone and physical inability to shop, cook and/or feed self, Severity of chronic obstructive pulmonary disease and Atherogenic index.

But there were no significant association with age group, gender, education, occupation, water pip, diabetes, hypertension, thyrotoxicosis, chronic kidney disease and carcinoma of lung, body mass index, waist-hip ratio and glycated hemoglobin, changed kind and or amount of food due to chronic obstructive pulmonary disease, number of meals per day and history of mouth or tooth problems that make you hard to eat.

Conclusion: The study found that chronic obstructive pulmonary disease patients had high risk of malnutrition and those patients also had raiser values of atherogenic index that may lead to atherosclerosis and coronary artery diseases.

Keywords: Chronic obstructive pulmonary disease, malnutrition, nutritional assessment, atherogenic index of plasma.

Introduction:

Chronic obstructive pulmonary disease (COPD) is a disease state characterized by airflow limitation that is not fully reversible, it is preventable and treatable disease and the limitation of airway is usually progressive and associated with an enhanced chronic inflammatory response in the airways and the lung to noxious particles or gases[1].

The increasing prevalence of disease morbidity and mortality is a significant and alarming public health problem in the world and will be the third cause of death and the fifth cause of disability by 2020 worldwide[2].It was estimated that there are approximately 23.6 million men and women with COPD in the U.S. and more than 52 million sufferers around the world[3]. It is the third-ranked cause of death in the United States, killing more than 120,000 individuals each year[4].

COPD is a costly disease with both direct costs (value of health care resources devoted to diagnosis and medical management) and indirect costs (monetary consequences of disability, missed work, premature mortality, and caregiver or family costs resulting from the illness),morbidity measures traditionally include physician visits, emergency department visits, and hospitalizations[5].Comorbid conditions such as heart disease, heart failure, osteoporpsis, anemia, depression, and diabetes can occur in patients with COPD at any grade. These conditions can potentiate the morbidity of patients by increasing hospitalizations, mortality, and health care costs[6].

The presence of symptoms compatible with COPD (eg, dyspnea at rest or on exertion, cough with or without sputum production, progressive limitation of activity) are suggestive of the diagnosis. Spirometry is the hallmark of the diagnosis of COPD[7].

Dyslipidemia has been identified as one of the most important risk factor associated with CAD

by the inter heart- South Asia study[8].It has been suggested that the different combinations of the lipid profile parameters can be used to identify such high risk individuals, by calculating the Atherogenic Index of Plasma (AIP), we studied in predicting the risk of CAD, atherogenic Index of Plasma (AIP) is based on two important parameters TG and HDLc, both of which are independent risk factors for CAD. Atherogenic Index of Plasma (AIP) = log TG/HDLc[9].

COPD produces significant systemic consequences such as weight loss and muscle dysfunction. It was contribute significantly to morbidity, disability, and handicap in COPD patients, Skeletal muscle wasting is commonly present in patients with COPD and may also be present in patients with a stable weight[10].

Patients with COPD may also be experience weight gain (due to activity limitations). Weight loss generally reflects more advanced disease and is associated with a worse prognosis. However, the majority of COPD patients are overweight or obese[11].

The current study aims at, assessment the nutritional status of patient with COPD, assessment the risk of malnutrition in COPD patients, determine the relation between severity of COPD and risk of malnutrition, and determine the atherogenic index as a risk factor for atherosclerosis and its relation with risk of malnutrition in COPD patient.

Patients and methods:

Study design, setting, and data collection time:

A cross sectional study was conducted in Merjan medical city at Al-Hilla city. Data collection was carried out during the period from 1st of March to 30th of May 2014.

Study population:

The total patients collected were 90 patients diagnosed with COPD (64 males and 26 females) with age of more than 35 years old.

Inclusion criteria for patient:

1. All the patients with COPD which were diagnosed according to criteria of diagnosis Of COPD and are attending to Merjan medical city during the time of study who accepted to participate in the study.
2. Those patients` age 35-65years old.

Exclusion criteria for the patients:

1. Any patient with history of asthma or other allergic bronchitis.
2. The patients who refuse to participate in the study.
3. The patients with advanced disease like those with type2 respiratory failure who cannot give information about their disease or cannot do the pulmonary function test.

Data collection tools:

A specially designed data sheet was used; to assess the nutritional status in COPD patients attending the Merjan Medical City and this sheet contain:

1. Questionnaires.
2. anthropometric measurements (weight, height, BMI, WC,HC, and WHR).
3. pulmonary function test.
4. Biochemical investigations.

Construction of the questionnaire:

A questionnaire form was prepared by researcher and supervisor, following a review of related literature and our reference to assess the nutritional status in COPD patients&these questions include the following:-

Age of patient, gender, marital status, educational status, occupation, residence, duration of disease, smoking history, water pipe history, alcoholic history, BMI, WHR, history of weight changes, unplanned wt. loss in last 6months,history of acutely ill in more than 5days,history of no food intake for>5days,change the kind and/or amount of food duo to COPD,no. of meals/day, hx. of mouth or tooth problems that make you hard to eat, did you have enough money to buy food, hx. of eating alone, no. of drugs/day, physical ability to shop, cock and/or feed yourself, hx. of comorbidities.

Anthropometric measurements:

Pulmonary function test:

by a All subjects had COPD which was diagnosed by pulmonary specialist and on the basis of clinical presentation and spirometry test, COPD severity for all subjects was determined and they were divided into groups(1,2,3,4)stages of disease[12].

The spirometer machine (model Mir, made in American).The spirometry test is a simple and is the most common of the Pulmonary function tests, and it measures lung function using a device called a spirometer.

All patients were studied in a sitting position. Data from the highest amount of flow-volume curve Forced Vital Capacity (FVC) and Forced Expiratory Volume in 1 Second (FEV 1).Were used for calculations. FEV 1 was expressed as FEV 1 % predicted, based on gender, height and age, using the reference of the American Thoracic Society, and then severity of disease in accordance to GOLD guidelines was determined as follows:

Spirometric classification of COPD severity based on post bronchdilator FEV1

Stage1:(Mild)FEV1/FVC<%70 & FEV1≥%80 ،
Stage2:(Moderate)FEV1/FVC<%70 & 50%≤FEV1<80% ،
Stage3:(Sever)FEV1/FVC<%70 & 30%≤FEV1<50% ،
Stage4:(Very sever)FEV1/FVC<%70 & FEV1<30% .

Biochemical investigations:

Use of Glycated Haemoglobin (HbA1c) in the diagnosis and control of Diabetes Mellitus.by using (hemoglobin testing system, made in united states, Bio-Rad laboratories, Inc. Hercules, CA94547, France, Bio-Rad, Marnes-la-Coquette)

HbA1c was introduced into clinical use in the 1980s and subsequently has become a cornerstone of clinical practice. HbA1c reflects average plasma glucose over the previous eight to 12 weeks. It can be performed at any time of the day and does not require any special preparation such as fasting.

An HbA1c of 6.5% is recommended as the cut point for diagnosing diabetes. A value less than 6.5% does not exclude diabetes diagnosed using glucose tests.

After 12 hour of overnight fast, 3 ml blood samples were drawn in the morning before breakfast from the patients. Total cholesterol, HDL and triglycerides were directly analyzed by using (spectrophotometer, type shimadzu, made in japan, model uv-1800 2407, cat. No. 206-25400-38.

After that we calculate the value of Atherogenic Index by the following equation (AIP = Log(TG/HDL_C)) and determine whether the result is high, intermediate, or low risk according to the following values

AIP<0,11 - low risk

AIP (0.11 – 0.21) intermediate risk

AIP>0,21 increased risk.

Malnutrition Universal Screening Tool (MUST):

'MUST' is a screening tool to identify adults, who are malnourished, at risk of malnutrition, (undernutrition), or obese. This guide contains:

Step1 (BMI score): measure height and weight to get a BMI score using chart provided. (BMI kg/m^2 if >20,18.5-20 and<18.5 take score 0,1 and 2 respectively)

Step2 (weight loss score): Note percentage unplanned weight loss in the past 3-6 months and score using tablets provided. (<5% score 0, 5%-10% score 1, >10% score 2). If recent weight loss cannot be calculated, use self-reported weight loss (if reliable and realistic). By: 1-Clothes and/or jewelry have become loose fitting (weight loss) 2-History of decreased food intake, reduced appetite or swallowing problems over 3-6 months and underlying disease or psycho-social/physical disabilities likely to cause weight loss.

Step3 (acute disease affect score): If patient is acutely ill and there has been no nutritional intake for>5 days is score 2.

Step4 (overall risk of malnutrition): Add scores together to calculate overall risk of malnutrition. Score o low risk, score≥1 medium and high risk[13].

Limitations

1.Limited time for data collection.

2.The findings of this study are limited by the use of the sample of patients from just one hospital.

3.Some data are based on self-reports of the patients, possibly leading to under or over answering therefore, information bias cannot be excluded.

Data Analysis:

Recording information was checked for missing values and data entry errors. Statistical analysis was performed using Statistical Package for Social Science software (SPSS, version 18). Variables were described using frequency distribution and percentage for the patients according to their characteristics and mean ($\bar{x}$); standard deviation (SD) for continuous variable, also Chi-squared test and Fisher exact test were used for the assessment of association between the variables studied. The p- value of less than 0.05 was significant statistically.

Results:

This study resulted in the enrollment of 90 patients with COPD. Age varied from (35 to 65) years and the mean age was (59±6.0) years. Males were 64. (71.1%), and females were 26. (28.9%). Male to female ratio was 2.5:1.0.

Table 1: Distribution of COPD patients according to demographic characteristics:

The present study shows that (92.2%)of study population were present with (50-65) years age, (97.3%) of them had high risk of malnutrition and (88.7%) had low risk of malnutrition, and (71.1%) were male and (28.9%) were female.

The highest percentage (67.8%) were married, and (51,4%) of them reported high risk of malnutrition but (79.2%) of them reported low risk of malnutrition, (65.6%) of them were illiterate, (73.3%) of them were unemployed, and (61.1%) of them came from urban area; of them (81.1%) exposed to high risk of malnutrition (p=0.001*).

There was significant association between the risk of malnutrition and marital status and residence, mean while there were no significant association with age group, gender, education and occupation. As show in table1.

Table 2: Distribution of COPD patients according to duration of COPD, smoking history and alcohol intake:

The present study shows that regarding the duration of disease, (34.4%) the duration of disease of them was between 5-10 years, (51.4%)of them had high risk of malnutrition and (22.6%) had low risk, (68.9%) were smoker and (31.1%)of them were ex-smoker, only (2.2%) of them had positive history of water pip, and (13.3%) had positive history of alcohol intake.

There was significant association between malnutrition and (duration of COPD, smoking history, intensity of cigarette smoking (pack-year) and alcohol ingestion, but not significant association with water pip. As show in table 2.

Table 3: Distribution of COPD patients according to presence of co-morbid diseases:

The present study shows that (20.0%) study population had diabetes, (40.0%) had history of hypertension, (33.3%) had coronary artery diseases (of them 45.9% had high risk of malnutrition and 24.5% had low risk), only (2.2%) had thyrotoxicosis, (1.1%) had chronic renal failure, and (1.1%) had carcinoma of lung.

There was significant association between malnutrition and coronary artery diseases, and no significant association with diabetes, hypertension, thyrotoxicosis, chronic kidney disease and carcinoma of lung. As show in table 3.

Table 4: Distribution of risk of malnutrition of COPD patients according to body mass index, waist-hip ratio and glycated hemoglobin:

A small proportion of this study sample 5 (5.6%) was under weight, the majority 51 (56.7%) were either overweight or obese and from them (51.4%) had high risk of malnutrition and (60.4%) had low risk of malnutrition, and the majority of our study sample 75 (83.3%) had high risk related to waist-hip ratio (≥1 for male and ≥o.8 for female) and from them 31 (83.8%) had high risk of malnutrition and 44 (83.0%) had low risk of malnutrition, and there was no significant association between malnutrition and glycated hemoglobin (Hba1c) and that (χ^2=0.177, df=1, p-value=0.168),

Table 5: Distribution of COPD patients according to history related to eating ability:

The present study shows that (12.2%) were eating <3 meals per day, but (87.8%) were eating 3-6 meals per day, (53.3%) had history of mouth or tooth problems that make them hard to eat, (37.8%) eating alone and of them (54.1%) exposed to high risk of malnutrition and (26.4%) exposed to low risk, and (24.4%) had positive history of physical inability to shop, cook and/or feed self.

There was significant association between malnutrition and (eating alone and physical inability to shop, cook and/or feed self), but no significant association with (Changed kind and or amount of food due to COPD, Number of meals per day and History of mouth or tooth problems that make you hard to eat). As show in tab.5.

Table 6: Distribution of malnutrition's risk in COPD patients according to severity of COPD by pulmonary function test and atherogenic index:

The present study shows that (47.8%) of patients had sever degree of COPD, of them (64.9%) had high risk of malnutrition but only (35.8%) had low risk, and (57.8%) have increased risk of atherogenic index, and the (χ^2=10.930, df=1, p value=0.001*), there was significant association between malnutrition and (Severity of COPD and Atherogenic index). As show in tab.6.

Table 1: The distribution of COPD patients according to demographic characteristics:

Variables	Risk for Malnutrition			χ^2	df	P value
	Low risk	High risk	Total			
	No.=53(%)	No.=37(%)	No.=90(%)			
Age Group (y)						
35-49	6(11.3)	1(2.7)	7(7.8)	0.134	1	0.233[a]
50-65	47(88.7)	36(97.3)	83(92.2)			
Gender						
Male	41(77.4)	23(62.2)	64(71.1)	2.449	1	0.118
Female	12(22.6)	14(37.8)	26(28.9)			
Marital Status						
Married	42(79.2)	19(51.4)	61(67.8)	7.763	1	0.005*
Single, divorced, widow	11(20.8)	18(48.6)	29(32.2)			
Education						
Illiterate	37(69.8)	22(59.5)	59(65.6)			
Primary	6(11.3)	11(29.7)	17(18.9)	5.175	2	0.075
Secondary &high Education	10(18.9)	4(10.8)	14(15.6)			
Occupation						
Governmental employer	6(11.3)	2(5.4)	8(8.9)			
self employed	10(18.9)	6(16.2)	16(17.8)	1.071	2	0.595[a]
unemployed/housewife	37(69.8)	29(78.4)	66(73.3)			
Residence						
Urban	25(47.2)	30(81.1)	55(61.1)	10.543	1	0.001*
Rural	28(52.8)	7(18.9)	35(38.9)			

*P value≤0.05 was significant [a]. Fisher exact test.

Table 2: The distribution of COPD patients according to duration of COPD, smoking history and alcohol intake.

Variables	Risk for Malnutrition			χ^2	df	P value
	Low risk	High risk	Total			
	No.=53(%)	No.=37(%)	No.=90(%)			
Duration of COPD (y)						
1-5	38(71.7)	3(8.1)	41(45.6)			
5-10	12(22.6)	19(51.4)	31(34.4)	37.809	2	<0.0001*
>10	3(5.7)	15(40.5)	18(20.0)			
Smoking history						
Smoker	30(56.6)	32(86.5)	62(68.9)			
Ex-smoker	23(43.4)	5(13.5)	28(31.1)	9.078	1	0.003*
Non smoker	0(0.0)	0(0.0)	0(0.0)			
Intensity of cigarette smoking(pack-year)						
<50	34(64.2)	7(18.9)	41(45.6)			
50-100	10(18.9)	13(35.1)	23(25.6)	18.369	2	<0.0001*
>100	9(17.0)	17(45.9)	26(28.9)			
Water pip						
Yes	1(1.9)	1(2.7)	2(2.2)		1	1.000[a]
No	52(98.1)	36(97.3)	88(97.8)			
Alcohol ingestion						
Yes	11(20.8)	1(2.7)	12(13.3)		1	0.013*[a]
No	42(79.2)	36(97.3)	78(86.7)			

*P value≤0.05 was significant [a]: Fisher exact test.

Table 3: The distribution of COPD patients according to presence of co-morbid diseases:

Variables	Risk for Malnutrition			χ^2	df	P value
	Low risk	High risk	Total			
	No.=53(%)	No.=37(%)	No.=90(%)			
Diabetes						
Yes	9(17.0)	9(24.3)	18(20.0)	1.348		0.667[a]
No	44(83.0)	28(75.7)	72(80.0)			
Hypertension						
Yes	21(39.6)	15(40.5)	36(40.0)	0.008	1	0.930
No	32(60.4)	22(59.5)	54(60.0)			
Coronary artery diseases						
Yes	13(24.5)	17(45.9)	30(33.3)	4.498	1	0.034*
No	40(75.5)	20(54.1)	60(66.7)			
Thyrotoxicosis						
Yes	0(0.0)	2(5.4)	2(2.2)	0.531	1	0.166[a]
No	53(100.0)	35(94.6)	88(97.8)			
Chronic kidney disease						
Yes	1(1.9)	0(0.0)	1(1.1)	0.589	1	1.000[a]
No	52(98.1)	37(100.0)	89(98.9)			
Carcinoma of the lung						
Yes	0(0.0)	1(2.7)	1(1.1)	0.411	1	0.411[a]
No	53(100.0)	36(97.3)	89(98.9)			

*P value≤0.05 was significant [a]: Fisher exact test.

Table 4: The distribution of risk of malnutrition of COPD patients according to body mass index, waist-hip ratio and glycated hemoglobin(Hba1c):

Variables	Risk for Malnutrition			χ^2	df	P value
	Low risk	High risk	Total			
	No.=53(%)	No.=37(%)	No.=90(%)			
BMI class						
Under weight	1(1.9)	4(10.8)	5(5.6)			
Normal weight	20(37.7)	14(37.8)	34(37.8)	3.437[a]	2	0.179
Overweight &obesity	32(60.4)	19(51.4)	51(56.7)			
Waist-Hip Ratio						
high risk	44(83.0)	31(83.8)	75(83.3)	0.009	1	0.924
low risk	9(17.0)	6(16.2)	15(16.7)			
HBA1C group						
5-7%	15(28.3)	12(32.4)	27(30.0)	0.177	1	0.168
≥ 7%	38(71.7)	25(67.6)	63(70.0)			

*P value≤0.05 was significant

Table 5: The distribution of COPD patients according to history related to eating ability:

Variables	Risk for Malnutrition			χ^2	df	P value
	Low risk	High risk	Total			
	No.=53(%)	No.=37(%)	No.=90(%)			
Changed kind and/or food amount due to COPD						
Yes	32(60.4)	15(40.5)	47(52.2)			
No	21(39.6)	22(59.5)	43(47.8)	3.436	1	0.064
Number of meals per day						
<3	4(7.5)	7(18.9)	11(12.2)	0.099	1	0.189[a]
3-6	49(92.5)	30(81.1)	79(87.8)			
History of mouth or tooth problems that make patient hard to eat						
Yes	24(45.3)	24(64.9)	48(53.3)	3.357	1	0.067
No	29(54.7)	13(35.1)	42(46.7)			
Eating alone						
Yes	14(26.4)	20(54.1)	34(37.8)	7.081	1	0.008*
No	39(73.6)	17(45.9)	56(62.2)			
Physical inability to shop, cook and/or feed self						
Yes	7(13.2)	15(40.5)	22(24.4)	8.814	1	0.003*
No	46(86.8)	22(59.5)	68(75.6)			

*P value≤0.05 was significant [a]: Fisher exact test.

Table 6: The distribution of malnutrition's risk in COPD patients according to severity of COPD by pulmonary function test and atherogenic index:

Variables	Risk for Malnutrition			χ^2	df	P value
	Low risk	High risk	Total			
	No.=53(%)	No.=37(%)	No.=90(%)			
Severity of COPD						
Mild	16(30.2)	2(5.4)	18(20.0)			
Moderate	18(34.0)	11(29.7)	29(32.2)	10.652	2	0.005*
Severe	19(35.8)	24(64.9)	43(47.8)			
Atherogenic index						
Low (<0.11)	30(56.6)	8(21.6)	38(42.2)	10.930	1	0.001*
Increase (≥0.11)	23(43.4)	29(78.4)	52(57.8)			

*P value≤0.05 was significant

Discussion:

Chronic obstructive lung disease can cause malnutrition by produces significant systemic consequences such as weight loss and muscle dysfunction. It was contribute significantly to morbidity, disability, and handicap in patients, Skeletal muscle wasting is commonly present in patients with COPD and may also be present in patients with a stable weight[10].

Distribution of sociodemographic characteristic in COPD patients

The average age of all participant in this study was (59 ±6 years), that was younger than what found in other study in India that reported the average age for male patients was 63.32 ± 10.73 years and for female was 63 ± 10.18 years[14]. This could be due to increasing smoking habit in our country, also could be due to the presence of other comorbidities leading to poor health care facility in compare to other counters.

In table 1 shows 64(71.1%) of all COPD patients were male of them 41(77.4%) had low risk of malnutrition and 23(62.2%) had high risk of malnutrition and only 26(28.9%) were female of them 12(22.6%) had low risk of malnutrition and 14(37.8%) had low risk of malnutrition. COPD affects men more frequently than women, reflecting lower prevalence of smoking in women[15].The predominance of male gender in patients with COPD is also found by study done in India(Fifty cases of COPD were studied and out of 50 cases studied 44 were males and 6 were females)[14].

In the present study 61(67.8%) of patients were married from them only 19(51.4%) had high risk of malnutrition and the 42(79.2%) had low risk of malnutrition, the explanation was that increasing risk of nutritional problems in patients with COPD in those living alone, this significant finding like with what found in a similar study in Sweden that stated who lives alone may be at an increased risk of nutritional problems[16]. In other study found that from 168 patients with COPD, (70.2%) were married,(3.6%) single and (26.2%) were widows[17].

The educational status of COPD patients included in present study shows that high percentage of patients were illiterate and primary school education, while secondary and high education school constitute (15.6%) of them (18.9%) had low risk of malnutrition and (10.8%) had high risk of malnutrition and there was no significant association between educational status and risk of malnutrition, these results similar to results of study done in Sweden in 2007 that reported(low education in 42%, high education 6.5%[18].

In this study, there was no significant association between type of occupation and risk for malnutrition in COPD (p-value= 0.595), and shows high percentage of non-employment (73.3%)from them(78.4%) had high risk of malnutrition,and those who are self-employed (17.8%) from them (16.2%) had high risk of malnutrition, though occupational exposure (vapor, gases, dust or smoke) was prevalent in 48% of COPD patients in a study in Sweden[18].

Out of 90 patients 55(61.1%) live in urban area from them 30(81.1%) had high risk of malnutrition compared with 35(38.9%)lived in rural area, from them only 7(18.9%)exposed to high risk of malnutrition with significant association between residence and risk of malnutrition, this could be attributed to increase smoking habit among people living in urban area also could be due to the exposure to other pollution, other study in India that take patients with COPD at 35 years old and about,52% belonged to urban and 48% to rural[19].

Distribution of COPD patients according to duration of COPD, smoking history and alcohol intake

In the present study there was significant relation between risk of malnutrition and duration of COPD(p-value=0.000),41(45.6%) of patients had a disease for 1-5 years from those 38(71.7%) had low risk of malnutrition and from 18(20.0%)of patients had history of COPD for>10 years, from them 15(40.5%) had high risk of malnutrition. Considering that prolonged exposure of the patients to the disease means prolonged exposure to the factors that predispose to malnutrition. Changes in nutritional status, such as weight loss and malnutrition, are a very common complication in patients with chronic obstructive pulmonary disease (COPD). Malnutrition in these patients is due to multiple factors including increases in resting energy expenditure, decreased food intake, the effects of certain drugs, and, perhaps most importantly, a high systemic inflammatory response[20].

The association between history of cigarette smoking and risk for malnutrition among COPD patients was found to be significant in this study ($\chi 2$=9.078,df=1,p-value=0.003) and 62(68.9%)of patients were current smoker from them(56.6%) had low risk of malnutrition and (86.5%) had high risk of malnutrition, compare with 28(31.1%) of patients had history of smoking in the past years, from them (43.4%) had low risk of malnutrition and (13.5%) had high risk of malnutrition and no one of all the participant in the present study were not smoker even the women, these results were similar to results done by Journal of Human Nutrition and Dietetics, 2011 reported that 32% of current smokers at risk of malnutrition (who accounted for 19% of the total COPD population). In comparison, 19% of ex-smokers were likely to be malnourished. The close association between smoking status and malnutrition risk in COPD suggests that smoking is an important consideration in the nutritional management of malnourished COPD patients[21].This study high lights the potential importance of combined nutritional support and smoking cessation in order to treat malnutrition.

In the present study there was significant association between risk for malnutrition and

intensity of cigarette smoking (pack-year) (p-value=0.000), and (28.9%) of patients who had history of smoking>100 (pack-year), from them (45.9%) had high risk of malnutrition and (17.0%) had low risk of malnutrition and those with history of <50(pack-year) were (45.6%) from them (18.9%) had high risk of malnutrition and(64.2%) had low risk of malnutrition, that explained by with increase intensity of cigarette smoking (pack-year) that lead to increase high risk of malnutrition, other study in Italy found that the mean of pack-year of current smokers (67 ± 29) and of ex-smokers (73 ± 45)[22].

There was no significant association between water pipe smoking and risk for malnutrition in COPD patients in this study(p-value=1.000), and 2(2.2%) of patients had positive history of water pipe smoking from them (2.7%) had high risk of malnutrition and (1.9%) had low risk of malnutrition and (97.8%) had negative history from them (97.3%) had high risk of malnutrition and(98.1%) had low risk of malnutrition, anyhow, this study did not go into depth taking detailed history of dose, frequency and duration of use of Argila.

This study found that alcohol ingestion is significantly associated with risk for malnutrition(p-value=0.013), Those who had positive history of alcohol ingestion in the participants in the present study(13.3%) from them(20.8%) had low risk of malnutrition and (2.7%) had high risk of malnutrition, and those who had no history of alcohol ingestion (86.7%), from them (79.2%) had low risk of malnutrition and (97.3%) had high risk of malnutrition. These results were disagree with other study that found that pulmonary function was lower in non-drinkers compared with occasional and light drinkers in Finland and the Netherlands and lower in very heavy (> 12 drinks per day) compared with moderate-to-heavy drinkers in Italy[23], this may attributed to that our study did not distinguish alcohol users according to their level of drinking alcohol. Our observation of this significant relation between alcohol ingestion and risk for malnutrition could be attributed to the like between nutritional status and pulmonary function that is enhanced by alcohol ingestion; the better the pulmonary function, the better the nutritional status.

Distribution of COPD patients according to presence of comorbid diseases

The present study reported no significant association between risk of malnutrition and comorbidities (diabetes, hypertension, thyrotoxicosis, chronic kidney diseases and carcinoma of lung) and the p-value was (0.667,0.930,0.166,1.000 and 0.411) respectively, these results agree with other study shows that extrapulmonary comorbidities though they have no evident physiopathological relationship with COPD; they influence the prognosis of patients with COPD since they potentiate the morbidity of COPD, leading to increased hospitalizations. They can frequently cause death, independently of respiratory failure. Comorbidities make the management of COPD difficult and need to be evaluated and treated adequately[24].

Diabetes was more common among COPD patients than in age and gender matched controls, other study in Egypt shows that diabetic COPD patients had lower pulmonary function values than non-diabetic COPD patients[25]. Malnutrition complicates chronic kidney disease. Hypoalbuminaemia may be a reflection of chronic inflammation rather than of nutrition in itself. Spontaneous intake of protein begins to decrease when the glomerular filtration rate falls below 50 ml/min. Progressive decline in renal function causes decreased appetite, thereby increasing the risk of malnutrition[26].

But there was significant association between risk of malnutrition and coronary artery diseases(p-value=0.034), 30(33.3%) of patients had positive history of CAD, from them(45.9%) had high risk of malnutrition and (24.5%) had low risk of malnutrition. COPD and coronary heart disease share tobacco abuse as a major risk factor. Thus, these two disorders commonly coexist. In addition, CVD is a leading cause of death among patients with COPD.

Distribution of risk of malnutrition of COPD patient according to body mass index, waist-hip ratio and glycated hemoglobin:

This study indentified 59% of COPD patients as having low risk for malnutrition,and 41% of them having high risk for malnutrition.and we go to the three independent criteria used in MUST; (1) Current weight status using BMI, (2) Unintentional weight loss, (3) Acute disease effect producing or likely to produce no nutritional intake for more than 5 days[27], it is consistent to find the large proportion (59%) of enrolled COPD patients in this study are at low risk for malnutrition because the independent criteria used to calculate risk are not yet affected compared to those of advance disease - malnutrition complicates COPD[20].

In our study there was no significant association between risk of malnutrition and body mass index (p-value=0.179), and only a small proportion of this study sample 5(5.6%) was under weight, the majority 51(56.7%) were either overweight or obese and from them (51.4%) had high risk of malnutrition and (60.4%) had low risk of malnutrition [figure 1], this is could be due to that Patients with COPD may be experience weight gain (due to activity limitations) and weight loss generally reflects more advanced disease and therefore the majority of COPD patients are overweight or obese[11], other study in Malaysia found that nutritional status of the subjects with COPD based on BMI and showed that about 45% of the subjects had normal body weight, followed by overweight/obese (37.6%) and underweight (17.4%)[28].

Our study reported no significant association between risk of malnutrition and waist-hip ratio (p-value=0.924), and those with high risk related to waist-hip ratio were 75(83.3%), of them 31(83.8%) had high risk of malnutrition. Waist-hip ratio is an indicator of central obesity, these results were similar to (Behrens G,2014) study that reported higher waist-hip ratio was associated with central obesity in COPD[29].

In the present study there was no significant association between risk of malnutrition and glycated hemoglobin (p-value=0.168) [Table 4]. Rather than association with malnutrition, poor glycemic control is usually associated with excess weight[30].

COPD and eating ability

The present study did not encounter significant associations between risk for malnutrition in COPD with changed kind and/or amount of food (p-value=0.064), and 47(52.2%) of study population were changed kind and/or amount of food, from those (40.5%) had high risk of malnutrition and (60.4%) had low risk of malnutrition, there was no significant association between risk of malnutrition and number of meals per day and history of mouth or teeth problems and p-value (0.189 and 0.067) respectively, but found significant association with history of eat alone (p-value=0.008), (37,8%) had positive history, from them(54.1%) had high risk of malnutrition and (26.4%) had low risk of malnutrition, a relationship was shown between malnutrition and inability to shop, cook and/or feeding self, (p-value=0.003), 22(24.4%) had physical inability, from them (40.5%) had high risk of malnutrition and only (13.2%) had low risk of malnutrition, these results similar to results of study done in Italy (those who had major limitation constitute 41.6%, and those with sever limitation constitute 31.1%)[31].

Distribution of malnutrition risk in COPD patients according to severity of COPD by pulmonary function test and atherogenic index

In our study 43(47.8%) of patients had sever degree of decrease pulmonary function that measured by spirometry, from them (64.9%) had high risk of malnutrition and (35.8%) had low risk of malnutrition and there was significant association between risk of malnutrition and severity of COPD(p-value=0.005), in other study was done in oxford university shows that the mean lies within the mild degree of COPD, The actual mean of FEV1 was 1.12±0.34 litres, and the expected mean of FEV1 would be 2.30± 0.35 litres[32],hence recruited patients were just diagnosed with COPD.

In another study done in Iran shows that Sixty three COPD patients, (28.6%)were classified in moderate degree,(50.8%) in sever degree and (20.6%) in very sever degree[33].In our study we measure the atherogenic Index of Plasma (AIP),which is based on two important parameters TG and HDLc, both of which are independent risk factors for CAD[34].

AIP increases with increasing BMI[35],in our study we found that increased atherogenic index is significantly associated with risk for malnutrition in COPD patients(p-value=0.001),this is consistent with (Bhardwaj S *et al*, 2013) study[34].

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