Effect of Implementing Nutritional Support on Expected Clinical Outcomes of Patients with Chronic Obstructive Pulmonary Disease on Mechanical Ventilator

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Abstract

Background: Chronic obstructive pulmonary disease (COPD) is a chronic inflammatory lung disease that causes obstructed airflow from the lungs. Symptoms include breathing difficulty, cough, mucus (sputum) production and wheezing. **Aim of the study:** was to determine the effect of implementing nutritional support on expected clinical outcomes of patient with chronic obstructive pulmonary disease on mechanical ventilator. **Research design:** A quasi experimental research design was used. **Subjects**: A purposeful sample of 60 adult patients were selected according to inclusion and exclusion criteria and randomly divided alternatively into two equal groups; 30 in each group: Study group (I) received nutritional support as prescribed by the treating physician. Control group (II) received ordinary hospital diet. **Setting:** The study was conducted in chest intensive care units (ICU) at Ain Shams university hospital. **Tools of the study**: Four tools were used for data collection. 1- Nutritional assessment tool, 2- COPD Ventilator Parameters, 3- Respiratory assessment tool: It included two parts: Part 1. It assessed respiratory rate, breathing sound, and sputum, use of accessory muscles chest expansion, cyanosis, and cough. Part 2: Dyspnoea Analogue Scale and tool 4 was used to assess laboratory study. **Results:** There were a high proportions of patients of both study and control groups; slightly about two third of patients were in the age group of 50 to 60 years. Over half of each patient of both groups were males with no significant difference. Married patients constituted the majority of both study and control groups. Also, slightly more than two third of study group was illiterate as compared to one third of control group. There were statistical significant improvements among the study group as regard expected clinical outcomes; in the mean daily caloric intakes, the total energy intake from protein, carbohydrates fibre, vitamins and trace elements, and oxygenation than the control group. **Conclusion:** The study concluded that nutritional support proved to be an important aspect of patient care that improved oxygenation among the study than the control group. **Recommendations:** Continuing educational health guidance for nurses are needed to increase awareness of positive effect of nutritional support for patients with COPD on the improvement of their clinical outcomes, dietician must be included within the health staff in the ICU, and the hospital menu must be adapted according to patient needs and replication of the study on a larger probability sample to attain more generalizable area.

Key words: Chronic obstructive pulmonary disease, COPD Ventilator Parameters, dyspnoea, Oxygenation, Nutritional support.

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Introduction

Chronic obstructive pulmonary disease (COPD) is a progressive, respiratory disease characterized by persistent airflow limitation due to damage caused by significant exposure to noxious particles or gases. The chronic airflow limitation is caused by a mixture of small airways disease, such as obstructive bronchitis, and parenchymal

destruction seen in emphysema **(GOLD, 2019).**

Chronic obstructive pulmonary disease (COPD) remains a major public health problem. It is the fourth leading cause of chronic morbidity and mortality in the United States and is projected to rank fifth in 2020 in burden of disease caused worldwide, according to a study published by the world health organization. Yet, COPD remains relatively unknown or ignored by the public as well as public health government (**Talwar, 2014)**. It is a preventable and treatable disease with some significant extra pulmonary effects. COPD includes the following common diseases: chronic bronchitis, emphysema, bronchiectasis, and cystic fibrosis (**Poole, 2015).**

A clinical diagnosis of COPD should be considered in any patients who have dyspnea, cough and/or sputum production. Due to the increased work of breathing in COPD, even the act of eating has been observed to adversely impact hemoglobin saturation and increase dyspnea **(Schols, et al., 2010)**. These symptoms are also frequently accompanied by functional (reduced exercise tolerance) and nutrition impact symptoms (e.g., anorexia and early satiety). factors for the disease. The diagnosis should be confirmed by spirometry assessment of symptoms: dyspnoea is the hallmark symptom of COPD and COPD the reason that most patients seek medical attention, and is a major cause of disability **(Burgel, 2019).**

Nutritional support for patients with COPD is especially important in the form of enteral and parenteral nutrition. It should be considered for patients who are difficult to wean from mechanical ventilation in the ICU. Specific nutritional deficiencies, such as hypophosphatemia and impaired lipid synthesis, can also be associated with acute respiratory failure and with an abnormal increase in fat mass respectively **(Morgan, et al., 2012).**

The oral dietary intake should be carefully evaluated in long term ventilated patients, especially for those who often report swallowing dysfunction due to tracheostomy and/or multiple associated factors, such as acute illness, medications, as steroids, neuromuscular blocking agents and general sedatives, prolonged inactivity of swallowing muscles and injury arising from endotracheal intubation. In some patients, meals may increase respiratory frequency, end-tidal carbon dioxide tension and dyspnoea **(American Thoracic Society, 2004& European Respiratory Society,2009).**

Oral or tube feeding enables nutritional intake to be maintained or increased when the normal intake is in adequate. In COPD patients, enteral nutrition in combination with exercise and anabolic pharmacotherapy has the potential to improve nutritional status and function. It can be administered through a number of routes. The route chosen depends on anticipated duration of feeding, condition of the GI tract, and potential for aspiration. Nasogastric tube is the most common route of enteral feeding. Small frequent meals are preferable, in order to avoid postprandial dyspnoea. Optimal amount of carbohydrate, protein and fat should be provided **(Gross, 2019).**

Assessment of nutritional status for mechanically ventilated patients is done by four major techniques; physical findings, vital signs, anthropometric measurements, laboratory data and diet history. Physical assessments include measuring and evaluating vital signs and

use of accessory muscle of respiration which is a criterion for early weaning from ventilator **(Heymsfild,2017).**

The role of nurse is very important in nutritional assessment, in collaboration with other health team members. The nurse must conduct daily rounds with the team to see and discuss the nutrition/feeding plan for patients. Also, must implement specialized care plan; coordinates the follow up care on the tube feeding regimes, performs feeding tube changes and care, help to coordinate and manage the assignment of acute and chronic nutritional access devices (**Kramer, 2015).**

Significance of the Study

Malnutrition is considered a major health problem among hospitalized patients especially COPD **(Coxson, et al., 2014)**: nonetheless, it is a key component in the long-term management of underweight COPD patients whose muscular dysfunction may rapidly turn to peripheral muscle waste. Since long-term mechanical ventilation (LTMV) is usually prescribed in end-stage respiratory diseases with poor nutritional status, nutrition and dietary intake related problems need to be carefully assessed and corrected in these patients. It received little attention especially among mechanically ventilated patients which is a major factor in the failure of certain patients to wean from the ventilator. Assessment and nutritional support can help those patients to identify problems that can be addressed**. (Creutzberg, et al., 2013)** Hence the study aimed to determine the effect of implementing nutritional support on expected clinical outcomes for Patients with COPD on Mechanical Ventilator.

Aim of the study

The aim of this study was to determine the effect of implementing nutritional support on expected clinical outcomes for Patient with COPD on Mechanical Ventilator.

Research Hypothesis

1-Patients who receive nutritional support exhibited improvement in respiratory rate more than control group.

2-The result of arterial blood gases analysis will be improved among patients who receive the nutritional support than the control group.

3-The pulmonary function test improve among patients who receive the nutritional support as compared to their control group.

4-Patients who receive nutritional support exhibited normal anthropometric measurements than control group.

5-Patients who receive nutritional support exhibited no signs of malnutrition than control group.

Operational Definitions:

1. Expected clinical outcomes

For the purpose of this study, expected clinical outcomes were measured by arterial oxygen tension (PaO2), arterial carbon dioxide tension (PaCO2), oxygen saturation (SaO2), pH, Hco3, FiO2, respiratory rate and pulmonary function test.

2. Nutritional support:

Means adjunctive therapy prescribed by the physician and given to

the patients in the study group according to patients' needs with a main goal, of preventing, correcting signs of malnutrition.

Subjects and method

Design:

A quasi experimental research design was utilized.

Setting:

The study was conducted in the chest intensive care unit (ICU), at Ain Shams University Hospitals.

Subjects:

A purposeful sample of 60 mechanically ventilated adult patients with COPD. They were selected and divided alternatively into two equal groups 30 patients in each:

Group [1] Study group: Patients in this group received nutritional supports tailored according to their needs based on the assessment by the researcher and agreed upon by the treating physician.

Group [2] control group: Patients received their formula according to the routine hospital diet.

Inclusion criteria: Conscious adult of both sexes, non-invasive mechanically ventilated patients diagnosed with COPD, admitted within 24 hours to ICU, and expected to stay on the ventilator not less than 14 days.

Exclusion criteria: Any other associated disorders as cardiovascular, immune compromised, diabetes or any other injury or trauma.

Tools of data collection:

Four tools were used in this study to collect the necessary data and to fulfil the study aim:

Tool (1) Structured interview questionnaire: This questionnaire was developed by the researchers based on relevant literature review except part two that was developed by" Nutritional Research Group (1996)" and used by the researchers to assess patient nutritional status. It includes the following four parts:

Part (I): Patients' demographic data as age, gender, level of education and marital status.

Part (II): Clinical and physical signs of nutritional deficiency. It was developed by **(Rosdable & Kowalski, 2013)** and used by the researchers for detection of clinical signs and symptoms of nutritional deficiency in the skin, eyes, lips, hair, gums, tongue, and nails.

Part (III): Nutritional assessment: It was used to illicit data about: 1. Patient dietary history, 2. Assessment of dietary intake, 3. Anthropometric measurements which included: Body mass index (BMI), measurement of triceps skin folds' thickness (TST), mid arm circumference (MAC) and mid arm muscle circumference (MAMC).

Scoring system for dietary intake; *The nutritional study is calculated as following Total cal.=basal energy expenditure x 1.2 or 30bal/kg, fat=30% of total cal., protein=1gm/kg/d, CHO=the remainder of the total caloric requirement, sodium=not exceed 2 g/day

Part (VI): Biochemical measurements: It includes the following

laboratory tests; Haemoglobin, haematocrit, Blood urea, serum creatinine, serum albumin, the researchers compare the patient's result with the normal range values **(Lide, 2015)**.

Tool (2) COPD Ventilator Parameters Assessment Tool: It was developed by the researchers and was used to assess the ventilator parameters which obtained from the readings of the ventilator settings. It includes duration of mechanical ventilation, mode of ventilation, tidal volume (TV) normal value is 500ml or7ml/kg body weight. minute volume (VE) the normal value of minute volume 5–8 litres per minute, positive end-expiratory pressure (PEEP)where normal value is 5-15 cmh2o and fraction of inspired oxygen (Oxygen concentration) (FIO2) were also the normal value40%-100**. (Michael, et al., 2019).**

Tool (3) Respiratory Assessment Tool: It was used by the researchers to assess respiratory status based on literature review and it was comprised of two parts:

Part 1: Used to assess respiratory rate, breathing sound, sputum, use of accessory muscles, chest expansion, cyanosis, cough **(Boggs, &king, 2017)**.

Part 2: Dyspnoea Analogue Scale: It was developed by **(Borg,2016)** and was used by the researchers to assess dyspnoea. Responses ranged from zero to ten where zero indicated no dyspnoea. (1&2) indicate mild dyspnoea, (3&4) indicate moderate dyspnoea while (5&6) indicate severe dyspnoea and tell10 indicate maximum dyspnoea.

Tool (4) Laboratory studies: It was developed by the researchers to assess progress of patient's respiratory status and oxygenation & establish base line data about lung function as pulmonary function test (spirometry) & arterial blood gases measurement (ABGs) patients' respiratory responses were identified against normal value where PH normal range: 7.35 -7.45, PaO2 normal range: 80-100 mm hg, PaCO2 normal range: 35-45 mm hg, HCO3 normal range: 22-26meq/l, So2 normal range: 92-100%

Methods

Written approval: Permissions to carry out the study was obtained from the responsible authorities to conduct the study.

Validity: All tools were tested for content validity by five experts in the field of critical care nursing, medical surgical nursing a nutritionist and medical specialist in the field to ascertain relevance and completeness Reliability

Protection of human rights: A written consent was obtained from patient's family after explaining the nature and aim of the study and the dietary intervention. Protections of human rights were considered, confidentiality and privacy of information were ascertained.

Pilot study: It was carried out on 6 patients to test the feasibility and applicability of the developed tool; accordingly, the needed modifications were done. Patients of the pilot study were excluded from the study.

The study was conducted in the following phases:

Assessment phase:

1- Immediately within 24 hours of admission, patients of both groups were

assessed using the four tools **(I, II, III, IV)** to collect base line of data.

2-Specific food, beverages in the form of formula received, the amount, type of formula and food intake problems as vomiting were recorded daily for 2 weeks from admission to ICU for both groups using the nutritional assessment tool.

Planning phase:

Based on the assessment of the study group, the researchers identified the priorities, expected outcome criteria, immediately and long term goals for nutrition, route of administration of nutritional support, amount, and mode. A plan of care for nutritional support was developed and revised by the treating physician and the hospital dietician to be tailored and implemented for patients in the study group. The routine hospital diet was given for the control group as usual without interference.

Implementation phase:

Data collection from patients for this study started from August 2019 to Jan 2020.

Group (I) study group: In this phase, the study group received individually the developed formula in the intensive care unit from the first day of admission till 14 days of hospitalization based on analysis of needs of each patient using computer program for Food Analysis Program, Faculty of Home Economics, Ain Shams University(2006), and compared with National Dietary Reference Intake (DRI) (2011).This formula included the following nutrients: protein, carbohydrates, fat, fibre, sodium, potassium, calcium, vitamin A and vitamin C and it was administered orally or through Ryle tube based on physician's prescription.

Evaluation phase:

Patients of both groups were immediately assessed on admission and post nutritional support implementation and at the end of the first week and second week; using 3 tools, **tool I, II, and III** to determine the effect of implementing nutritional support on expected clinical outcomes for Patient with COPD on mechanical ventilator. After two weeks from receiving the dietary program, each patient in the study group and control group was finally re-assessed (post- test) to determine the effectiveness of implementing nutritional support on expected clinical outcomes for Patient with COPD on Mechanical Ventilator.

Statistical analysis:

After data collection, raw data was coded and scored and a coding instruction manual was prepared. Data were fed to the computer using Epi-Info (version 3.0) and statistical analysis was performed using Statistical Package for Social Sciences (SPSS version 18.0). Significance of the obtained results was judged at the 5 % level of significance. Descriptive statistics were computed on all variables. Comparison between patients of the study and control groups was formulated. Differences in terms of general profile (demographic, socio-economic, and clinical), nutritional assessment parameters, and clinical outcomes of the nutritional intervention were tested using the $\chi 2$, Monte Carlo test, Fisher's Exact and Student-t tests of significance. (**Steve, 2014**).

Results

Table 1 showed the demographic characteristics of both study and control groups undergoing mechanical ventilation. The table showed that a high proportions of patients of both study and control groups (70.0% and 63.3%respectively) were in the age group of 50 to 60 years. Married patients constituted the majority of both study groups (96.7%, 76.7%). Also, 66.7% of study group was illiterate as compared to 33.3% of their controls.

Fig. 1 illustrated that over half of each patient of both groups (53.3%) were males.

Table 2 illustrated the food daily intake for patients of both groups based on the implemented nutritional support. The study group received 96.4% of the adequate energy requirements, 98.2% of adequate protein, carbohydrates requirements and 92.0% of adequate fat requirements. While the control group received almost less than two thirds 61.4% of their daily requirements of nutrients. The table clarified statistical significant differences between the means of the study and control group in all nutrients of daily food intake.

Table 3 showed a comparison between patients of both study and control groups in relation to anthropometric parameters 2 weeks post nutritional support implementation. The table revealed that anthropometric parameters of study group were higher than that of the control group after two weeks of implementation of the nutritional support. The mean weight of the study group (62.86 ± 9.07 kg) was highly significant than that for the control group (58.72 ± 10.49 kg) **p = 0.018**.

The mean BMI was significantly higher for the study group (26.36 ± 37 kg/m2) than the control group (22.55 ± 3.75 kg/m2), **p = 0.001.**

The mean triceps skin fold thickness (TST) of the study patients (10.65 ± 1.74 cm) was significantly higher than that for the control group (8.82 ± 2.93 cm), **p = 0.005**.

A statistical significant difference was observed between **the mean mid-arm muscle circumference (MAMC)** of the study group (26.24 ± 4.32 cm) compared to that for the control group (22.37 ± 3.74 cm), **p = 0.000.**

Table 4 illustrated the percentage distribution of COPD patients of both groups (study and control) related to clinical signs of malnutrition on admission. The table showed the presence of malnutrition among the two groups in all signs of malnutrition except for skin where the study group had more loss of skin turgor than the control group.

Table 5 presented the percentage distribution of COPD patients of both groups (study and control) in relation to clinical signs of malnutrition 2 weeks post nutritional support implementation. The table illustrated high statistical significant improvement among the study group than that of the control regarding the clinical signs of malnutrition except for the clinical signs of tongue and skin.

Table 6 revealed the baseline biochemical tests for both study and control groups. The table showed no statistical significant differences between the two groups at the base line assessment.

Table 7 illustrated the biochemical tests for both study and control groups 2 weeks post nutritional support

implementation. The table also showed statistical significant improvement among the study group than the control in all levels of haemoglobin, haematocrit, blood urea, serum creatinine, and serum albumin.

Table 8 showed the percent distribution of COPD patients of both study and control groups related to respiratory assessment before nutritional support implementation. The tables showed no statistical significant differences were found between the two groups. The majorities of patients in the two groups had shallow respiratory rate, air hunger, productive cough and inter costal retraction.

Tables 9 presented the respiratory assessment of COPD patients of both study and control groups two-weeks post nutritional support implementation. Moreover, the table showed that high statistical significant improvement was found among the study group in all parameters of respiratory assessment two weeks' post implementing the nutritional support than the control group.

Table 10 illustrated a comparison between the degree of dyspnoea among the study and control groups two-weeks post nutritional support implementation. The table clarified that 43.3% of the study group had no dyspnoea and 56.7% had slight dyspnoea and none of them had sever dyspnoea, compared to 3.4% of the control group who complained of sever dyspnoea and 63.4% who had moderate dyspnoea. The differences were highly significant.

Table (1) Number and percentage distribution of the patients in the study and control groups according to demographic characteristics

Demographic Characteristic		Study group (n=30)		Control group (n=30)		X^2	P-value
		No.	%	No.	%		
Age group (years)	20-	1	3.3	3	10.0	1.100	(0.77)
	30-	1	3.3	1	3.3		
	40-	7	23.4	7	23.4		
	50-60	21	70.0	19	63.3		
Marital Status	Single	1	3.3	3	10.0	7.286*	(0.026)
	Married	29	96.7	23	76.7		
	Widow	0	0.0	4	13.3		
Educational level	Illiterate	20	66.7	10	33.3	3.675	(0.452)
	Read &write	10	33.3	20	66.7		

* Significant of 0.05 Level

Fig. (1) Number and percentage distribution of the patients in the study and control groups according to their gender.

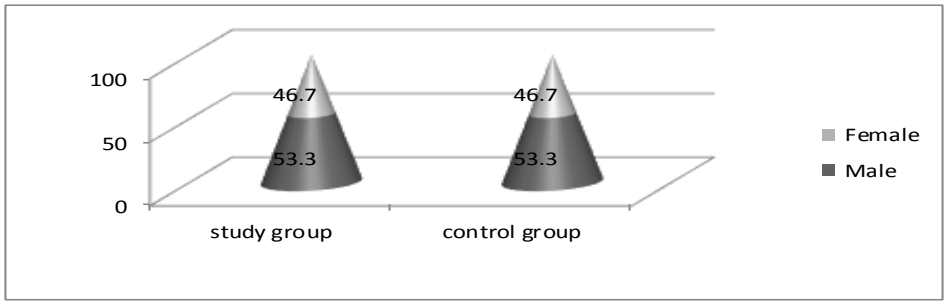

Table (2) Food daily intake for patients of both groups based on the implemented nutritional support.

Nutrient	Average Dietary Reference Intake Nutrient (DRI)	Study group (n=30)		Control group(n=30)			
		Mean ± SD	% of DRI	Mean ± SD	% of DRI	X^2	P-value
Total energy (Kcal/d)	2204	2124.80± 0.000	96.4	1352.51 ± 204.83	61.4	**5.239 ***	(0.000)
Protein	56	55.00 ± 0.00	98.2	37.72 ± 14.36	65.4	**3.852 ***	(0.003)
Carbohydrates (g/hg/d	130	128.00 ± 0.00	98.2	123.92 ± 52.73	95.3	**2.345***	(0.021)
Total fat (g/d)	25	23.00 ± 0.00	92.0	32.31 ± 6.34	129.2	**3.081***	(0.008)
Fibre (g/d)	30	30.00 ± 0.000	100.0	6.42 ± 2.39	21.4	**5.824***	(0.000)
Sodium	1.5	1.481.48 ± 0.00	98.7	2.13 ± 0.83	142.0	**2.428***	(0.036)
Potassium (g/d)	4.7	4.2 ± 0.00	98.4	1.37 ± 0.72	29.1	**3.026***	(0.007)
Calcium (mg/d)	1.2	1.10 ± 0.31	91.7	0.80 ± 0.23	66.7	**2.346***	(0.037)
Vitamin a(mg/d)	700	679.00 ± 0.00	97.0	337.59 ± 227.46	48.2	**4.582**	(0.000)
Vitamin c (mg/d)	75	73.00 ± 0.00	97.3	16.63 ± 4.82	22.2	**5.061***	(0.000)

*Values are expressed as mean ± standard deviation
*Significant at 0.05 level of significance.

Table (3) Comparison between patients of both study and control groups in relation to anthropometric parameters 2 weeks post nutritional support implementation

Anthropometric parameter	Study group (n=30)	Control group (n=30)	T-test	P-value
	Mean ± SD	Mean ± SD		
Weight (kg)	62.86 ± 9.07	58.72 ± 10.49	2.245 *	(0.018)
BMI (kg/m^2)	26.36 ± 37	22.55 ± 3.75	3.657 *	(0.001)
TST (cm)	10.65 ± 1.74	8.82 ± 2.93	2.934*	(0.005)
MAMC (cm)	26.24 ± 4.32	22.37 ± 3.74	3.706 *	(0.000)

-BMI= body mass index (kg/m^2).
-TST= triceps skin fold thickness (mm) -MAMC=mid muscle circumference (cm) - Values are expressed as means and standard deviations. * H-Significant at 0.001

Table (4) Percentage distribution of COPD patients of both groups (study and control) related to clinical signs of malnutrition on admission.

Clinical Signs of malnutrition		Study groups (n= 30)		Control group (n=30)		X^2	P -value
Site	Signs	NO	%	NO	%		
Head and neck	Normal	8	26.7	2	6.7		
Hair	Lake of natural shine	7	23.3	14	46.7	6.763	(0.056)
	Dry	15	50.0	13	43.3		
	Sparse	0	0.0	1	3.3		
Eyes	Normal	7	23.3	6	20.0	0.100	0.951
	Dry pale membranes	21	70.0	22	73.3		
	Redness	2	6.7	2	6.7		
Lips	Normal	2	6.7	2	6.7	1.613	0.656
	Redness	1	3.3	0	0.0		
	Swelling	4	13.3	0	0.0		
	Cracked	23	76.7	25	83.3		
	Normal	24	80.0	28	93.3		
Tongue	Scarlet	2	6.7	0	0.0	3.360	0.452
	Raw tongue	4	13.3	1	3.3		
	Purplish colour	0	0.0	1	3.3		
	Normal	7	23.3	3	10.0		
Teeth	Cavities	4	13.3	4	13.3	3.675	0.542
	Tender	17	56.7	22	73.3		
	Decay	2	6.7	1	3.3		
	Normal	14	46.7	13	43.3		
Gums	Spongy , bleeds easily	10	33.3	15	50.0	3.137	0.219
	Inflamed	6	20.0	2	6.7		
	Normal	3	10.0	2	6.7		
Skin	Depigmentation	2	6.7	0	0.0	10.737*	0.013
	Loss of skin turgor	23	76.7	17	56.7		
	Flakiness of skin under eyes	2	6.7	11	36.7		
	Normal	3	10.0	0	0.0		
Muscles	Weakness	27	90.0	29	97.7	5.617	0.607
	sparse	0	0.0	1	3.3		

* Significant at 0.05 level

Table (5) Percentage distribution of COPD patients of both groups (study and control) in relation to clinical signs of malnutrition 2 weeks post nutritional support implementation

Clinical Signs of malnutrition		Study groups (n= 30)		Control group (n=30)		X^2	P - value
Site	Signs	NO	%	NO	%		
Head and neck	Normal	21	70.0	5	16.7		
hair	Lake of natural shine	3	10.0	10	33.3	19.241*	0.000
	Dry	6	20.0	14	46.7		
	Sparse	0	0.0	1	3.3		
	Normal	28	93.3	7	23.3		
eyes	Dry pale membranes	2	6.7	21	70.0	34.559*	0.000
	Redness	0	0.0	2	6.7		
	Normal	28	93.3	14	46.7		
lips	Redness	1	3.3	0	0.0	26.938*	0.000
	Swelling	1	3.3	1	3.3		
	Cracked	0	0.0	15	50.0		
	Normal	29	96.7	26	86.6		
Tongue	Scarlet	1	3.3	0	0.0	4.176	0.124
	Raw tongue	0	0.0	2	6.7		
	Purplish colour	0	0.0	2	6.7		
	Normal	12	40.0	2	6.7		
teeth	Cavities	3	10.0	4	13.3	16.305	0.000
	Tender	12	40.0	24	80.0		
	Decay	3	10.0	0	0.0		
	Normal	27	90.0	15	50.0		
gums	Spongy , bleeds easily	1	3.3	14	46.7	17.263*	0.000
	Inflamed	2	6.7	1	3.3		
	Normal	14	46.7	9	30.0		
skin	Depigmentation	1	3.3	0	0.0	4.521	0.210
	Loss of skin turgor	6	20.0	12	40.0		
	Flakiness of skin under eyes	9	30.0	9	30.0		
	Normal	16	53.3	3	10.0		
muscles	Weakness	14	46.7	25	83.3	15.683*	0.000
	Sparse	0	0.0	2	6.7		

* Significant at 0.05 level

Table (6) Baseline biochemical tests for both study and control groups on mechanical ventilation

Biomoglobin (g/dl)	**Study groups (n=30)** Mean ±SD	**Control groups (n=30)** Mean ±SD	**T-test**	**P-value**
Haemoglobin (g/dl)	12.86±0.79	13.06±1.68	0.623	0.313
Haematocrit (%)	42.11±14.69	43.56±5.28	0.509	0.613
Blood urea (mg/dl)	11.70±5.41	12.63±4.28	1.706	0.169
Serum albumin (mg/dl)	3.27±0.31	3.33±0.17	1.457	0.239
Serum creatinine (mg/dl)	0.78±0.17	0.81±0.18	0.732	0.467

* Significant at 0.05 level of significance

Reference range	**MALE**	**FMALE**
Haemoglobin (g/dl)	13-18 g/dl	12-16 g/d
Haematocrit (%)	42-54%	38-46%
Blood urea	7-20 mg/dl	7-20 mg/d
Serum albumin	3.5-5 mg/dl	3.4-5 mg/dl
Serum creatinine	0.8-1.3 mg/dl	0.8-1.1 mg/dl

Table (7) Biochemical tests for both study and control groups 2 weeks post nutritional support implementation.

Biomoglobin (g/dl)	**Study groups (n=30)** **Mean ±SD**	**Control groups (n=30)** **Mean ±SD**	**T-test**	**P-value**
Haemoglobin (g/dl)	12.94±1.03	11.76±1.10	4.294*	0.000
Haematocrit (%)	42.42±2.68	37.97±2.46	6.717*	0.004
Blood urea (mg/dl)	8.58±4.21	11.67±2.82	7.090*	0.002
Serum albumin (mg\di)	4.39±0.56	3.36±0.16	4.084*	0.019
Serum creatinine (mg\di)	0.87±0.20	1.39±0.37	2.513*	0.018

* Significant at 0.05 level

Table (8) Precent distribution of COPD patients of both study and control groups related to respiratory assessment before nutritional support implementation.

Respiratory Item	Sub-item	signs	Study groups (n=30) No	%	Control groups (n=30) No	%	X2	P-value
1-respiratory rate	**Rate**	mean± SD	38.47±7.94		31.37±8.04		T=0.496	0.000
	Rhythm	Regular	16	53.3	14	46.7	0.469	0.518
		Irregular	14	46.7	16	53.3		
	Depth	deep	2	6.7	1	3.3	0.895	0.395
		Shallow	28	93.3	29	96.7		
2-chest expansion		Normal	8	26.7	6	20.0	2.963	0.085
		Limited	22	73.3	24	80.0		
3-air hunger		Yes	28	93.3	30	100.0	1.581	0.692
		No	2	6.7	0	0.0		
4-cough		Dry	3	10.0	2	6.7	0.216	0.639
		Productive	27	90.0	28	93.3		
Sputum	Colour	White	19	63.3	17	56.7	3.052	0.052
		Blood Stained	6	20.0	5	16.7		
		Yellow Green	5	16.7	8	26.6		
	Odder	No odder	19	63.3	23	76.7	1.206	0.272
		Foul	11	36.7	7	23.3		
	Consistency	Thin	8	26.7	10	33.3	4.737	0.113
		Thick and tenacious	22	73.3	20	66.7		
5-inter costal retraction		Yes	28	93.3	28	93.3	0.395	0.895
		No	2	6.7	2	6.7		
6-Use accessory muscles		Yes	29	96.7	30	100.0	0.007	0.992
		No	1	3.3	0	0.0		
7-cyanoisis		Absent	27	90.0	30	100.0	3.051	0.051
		Peripheral	3	10.0	0	0.0		
8-body temperature		Normal	13	43.3	12	40.0	1.017	0.313
		hyperthermia	13	43.3	15	50.0		
		hypothermia	4	13.3	3	10.0		
9-breathing sound	On right side of the lung	Normal	11	36.7	9	30.0	1.017	0.313
		Absent	0	0.0	2	6.7		
		Diminished	6	20.0	8	26.7		
		Wheezes	2	6.7	5	16.6		
		Crepitation	11	36.7	6	22.2		
	On left side of the lung	Normal	15	50.0	10	33.3	3.675	0.425
		Absent	0	0.0	1	3.3		
		Diminished	3	10.0	8	26.7		
		Wheezes	2	6.7	4	13.3		
		Crepitation	10	33.3	7	23.3		

P value of fisher exact test

Tables (9) Respiratory assessment of COPD patients of both study and control groups two-weeks post nutritional support implementation

Item	Respiratory Sub-item	signs	Study patient (n=30) No	%	Control patient (n=30) No	%	X^2	P-value
1-respiratory rate	**Rate**	mean± SD	**19.57±4.11**		**29.20±7.82**		T=5.971*	0.000
	Rhythm	Regular	30	100	28	93.3	0.006	0.923
		Irregular	0	0.00	2	6.7		
	Depth	Normal	28	93.3	24	80.0	4.686*	0.038
		deep	0	0.00	4	13.3		
		Shallow	2	6.7	2	6.7		
2-chest expansion		Normal	21	70.0	3	10.0	*(0.000)#	
		Limited	9	30.0	27	90.0		
3-air hunger		No	24	80.0	12	40.0	10.000*	0.002
		Yes	6	20.0	18	60.0		
4-cough		No	4	13.3	0	0.0	4.683*	0.028
		Dry	5	16.7	6	20.0		
		Productive	21	70.0	24	80.0		
Sputum	Colour	White	28	93.3	20	66.7	7.814*	0.007
		Blood Stained	2	6.7	4	13.3		
		Yellow Green	0	0.0	6	20.0		
	Odder	No odder	29	96.7	23	76.7	*0.000#	
		Foul	1	3.3	7	23.3		
	Consistency	Thin	25	83.3	11	36.7	9.234*	0.001
		Thick and tenacious	5	16.7	19	63.3		
5-inter costal retraction		Yes	3	10.0	16	53.3	*(0.000) #	
		No	27	90.0	14	46.7		
6-Use accessory muscles		Yes	4	13.3	24	80.0	*(0.000) #	
		No	26	86.7	6	20.0		
7-cyanoisis		Absent	30	100.0	30	100.0	FEET	1.000
8-body temperature		Normal	29	96.7	22	73.3	7.381*	0.003
		hypothermia	1	3.3	5	16.7		
		hyperthermia	0	0.0	3	10.0		
9-breathing sound	On right side of the lung	Normal	24	80.0	18	60.0	5.013*	0.031
		Diminished	2	6.7	5	16.7		
		Wheezes	1	3.3	3	10.0		
		Crepitation	3	10.0	4	13.3		
	On left side of the lung	Normal	22	73.3	18	60.6	5.900*	0.038
		Diminished	2	6.7	5	16.6		
		Wheezes	1	3.3	2	6.2		
		Crepitation	5	16.7	5	16.6		

P value of fisher exact test P= 0.000 * Significant at 0.05 level of significance

Tables (10): Comparison between the degree of dyspnoea among the study and control group two - weeks post nutritional support implementation.

Groups	Levels of dyspnoea								X2	P-value
	No		Mild		Moderate		Sever			
	No	**%**	**No**	**%**	**No**	**%**	**No**	**%**		
Study group	13	43.3	17	56.7	-	-	-	-	24.87	0.000
Control group	5	16.6	5	16.6	19	63.4	1	3.4		

* Significant of 0.05 Level

Discussion

COPD is the fourth leading cause of death in the United State. Persons with COPD have an increased risk of mortality compared to those who do not, with consequent reduction in life expectancy **(Cancer Lung Association, 2010).**

General profile of the study group and their controls

The findings of the present study revealed that there were no statistical significant differences in the basic data between the study and control groups regarding to age, sex and education except in marital status. Also, it showed that the majority of the studied subjects of both groups were in the late adult period while the minority of the studied subjects of both groups was in middle adult age. These findings are congruent with the finding of the **European Respiratory Society (2009)** illustrated that the prevalence of COPD is higher among late adulthood patients.

Regarding to sex, slightly over half of each of both study and control groups were males. This finding is in the same line with **Kenneth, et al., (2019)** who reported that COPD is more prevalent in males than females. This could be attributed to the higher smoking rate among males than females. Meanwhile, this finding contradicts with **Jindal (2016**) who found that women are more susceptible to COPD due to indoor air pollution.

As for marital status, the findings showed that the majority of the patients in both groups were married. This finding is supported by the findings of **Barnes (2018)** who reported that the majority of his sample was married.

This finding contradicts with the finding of **Halbert, et al., (2013)** who examined the associations between marriage and COPD and illustrated that marriage significantly correlates with reduced risk of COPD, compared to their controls.

Regarding to level of education, the majority of patients of the study group of patients were illiterate compared to the control. While none of both groups had basic education, and this result was in line with **Cutler (2017)** who found that illiteracy represent high rate for hospital admission and is also supported by **Hughe (2019)**. This may be attributed to educated people are more likely to care for themselves and practice healthful life style as intake of healthy food, performed exercise, and respect follow up.

Concerning daily food intake of the study and control patients based on 24-hour dietary and caloric recall, the mean daily intake for both the study and control groups was less than the Dietary

Reference Intake (DRI) at the baseline assessment. This finding is congruent with the result of **Merce, et al., (2015)** who conducted a study to investigate the effects of oral nutritional on quality of life of patients with COPD at base line; they found that all patients needed oral nutritional supplements to achieve the required daily energy intake and the Required Daily Allowance (RDA).

After implementing of the nutritional support the results of this study revealed that the mean daily caloric intake for the study group was higher than that for the control group and this difference was statistically significant.

Concerning the total energy intake, post implementing the nutritional support, the findings revealed a statistically significant increase in the total consumption of protein, carbohydrate, fat, vitamins and minerals among the study group than that of the control group, and improved than the baseline assessment. This finding is congruent with the findings of **Furie and Kelly (2018), Rabadi, et al., (2018) and Strazzullo, et al., (2018).** These findings reflect the success of the implementing the nutritional support to provide the study group with the daily requirements of caloric and energy intake.

Anthropometric measurements

The result of this study revealed that the mean height at the base line assessment, for the study and control groups were similar with no statistical significant difference. However, the mean weight of the study group was slightly lower than that for the control group and this difference was not statistically significant. But post nutrition support implementation for two weeks the mean weight of the study group improved and became higher than that for the control group with statistically significant difference. This improvement could be related to the success of implementing the nutritional support.

Also, at the baseline assessment, the mean body mass index (BMI), mean mid arm muscle circumference (MAMC), and the mean triceps skin thickness (TST) were within the normal level for both groups with no statistical significant differences. However, post two weeks of implementing the nutritional support, the BMI, MAMC of the study group was significantly higher than that of the control group. This finding was supported by **Ugur & Tanseli (2017), Albin (2014)**. However, the TST of the study group was lower post implementing of the nutritional support than that of the control group. This finding means improvement because subcutaneous tissue is replaced by fat as store for energy.

Concerning clinical signs of malnutrition, the present study revealed that patients of both groups showed clinical signs of malnutrition related to hair, eye, lips, teeth and gums, skin and muscle weakness, with no statistical significant differences between the study and control groups at the baseline assessment. However, after two weeks of implementing the nutritional support, there was statistical significant improvement in all clinical signs of malnutrition. This finding was similar to the findings of **Dudek (2016), Gates and Fink (2016),** who emphasized the need for implementing a nutritional support to COPD patient undergoing mechanical ventilation to replace the loss and lack of adequate nutrients during the prolonged hospitalization.

Regarding Biochemical parameters, the findings revealed no statistical significant differences found between the study and control group at

the baseline assessment. However, post two weeks of implementation of the nutritional support, the serum haemoglobin and haematocrit level, serum blood urea, serum albumin level and creatinine level was statistically significantly improved. These findings were in the same line with the findings of **El- Sayed (2017), Ugur and Tanseli (2017), Smeltzer and Bare (2019) and Harita (2018)** who found statistical significant improvement in all biochemical parameters of the patient's post implementing the nutritional support. Theses improvement could be due to improvement in essential nutrients as iron, vitamin b12, and minerals and also to improvement in kidney function due to improved nutrition. Oxygenation of the studied groups was assessed through arterial blood gases, pulmonary function tests, respiratory assessment parameters and degree of dyspnoea.

Arterial blood gases

The mean PH level, PaO2, PaCo2, HCo3, SO2, was nearly equal in both study and control groups with no significant differences observed at the base line assessment. However, post two weeks of nutritional support, there was a statistical significant improvement in all parameters of arterial blood gases among the study group than the control group. This result was supported by **Selman, et al., (2016),** stated that the mean value of PaO2and Paco2, and SO2 turned to be within normal values in the second week compared to the baseline, which could be attributed to the success of the nutritional support in providing adequate control of arterial blood gases. Also, improvements in arterial blood gases for the study group attributed to good nutritional support which affect the weaning process and improve oxygenation.

Likewise, there was no statistical significant difference of the mean values of FVC, and FEV1 at the baseline assessment. Meanwhile, the mean values of FVC, and FEV1 became significantly higher among the study group than the control group. This finding is supported by study done by **Breslin & Volz (2017), and Pieter & Jan Willem (2019).** This finding means that the nutritional support improves the muscles of respiration and lung function for the study group.

Respiratory rate

The mean respiratory rate of the study group was nearly equal to their controls; they were almost equal in having shallow respiration, with no statistical significant difference. However, there was statistical significant improvement post two weeks of implementation of the nutrition support among the study group. Also, in the baseline assessment, the majority of patients in both groups had air hunger, cough, and inter costal retraction, use of accessory muscles, wheezes and cyanosis. These complaints were statistically improved among the study group post two weeks of implementation of the nutrition support than that in the control group. These findings were congruent with the findings of **Stephen, et al., (2018) and Mahler, et al., (2019)**, This improvement is due to improvement in respiration is due to improvement in nutritional status of the study group post two weeks of implementation of the nutrition support.

Regarding the Baseline degree of dyspnoea among the study and control patients according to Dyspnoea Analogue Scale Score, post two weeks of nutritional support implementation, none of the patients in the study had sever dyspnoea compared to about tenth of the control group. The differences observed as

regards the degree of dyspnoea between the two groups was statistically significant. These results were consistent with the result reported by **Klaus & Rabe (2016).**

Conclusions

Based on the findings of the current study, it can be concluded that nutritional support had been proven to be an important aspect of patient care and improve oxygenation as there were statistical significant improvement among patients in the study group than that for patients in the control group.

Recommendations

1. Nutritional screening, assessment and monitoring should be part of patient care plan.

2. The hospital menu must be adapted according to patient need to provide suitable caloric requirement.

Conflicts Of Interest Disclosure

The authors declare that there is no conflict of interest.

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