

## Efficiency physical rehabilitation patients with chronic obstructive pulmonary disease with moderate severity

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### ABSTRACT

The aim - to examine the effectiveness of the impact of the proposed technology for physical rehabilitation of respiratory function in patients with chronic obstructive pulmonary disease of moderate severity. The study involved 162 patients. Analysing the average values of respiratory function of patients in both groups at baseline, it was determined that they are much lower than normal and did not differ among themselves, which indicates poor functional capacity of the lungs and bronchial patency. For each patient selected individual program of physical rehabilitation, taking into account the physical features of lung function parameters, specific physiological and psychopathological disorders. Patients of the main group before observed positive dynamics: reducing breathlessness, improved discharge sputum. The use of physical rehabilitation led to the extension of functionality of patients expressed increasing average values of indicators of lung function studied in the main group at the end of studies that demonstrate its effectiveness. **Keywords:** Patients; Chronic obstructive pulmonary disease; Physical rehabilitation; Respiratory function; Efficiency.

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## INTRODUCTION

In health, social and economic terms, chronic obstructive pulmonary disease (COPD) is a major cause of morbidity and mortality worldwide; People suffering from this disease for years and die prematurely from it or its complications. Worldwide there is rapid growth in the number of patients with COPD as a result of prolonged exposure to risk factors and an aging population. The proportion of COPD, as one of the leading causes of mortality is increasing. COPD suffer from 8 to 22% of adults aged 40 years and older (Grygus & Maystruk, 2013; Grygus, 2015; Jones, et al., 2014).

The disease has a huge economic impact, according to 2011 1/5 of the causes of disability takes COPD, the average retirement age with COPD in developed countries - 54 years (reduced to 11 years). In the US, COPD cost of approximately US \$ 50 billion, which included \$ 20 billion in indirect costs and 30 billion dollars in direct health care costs. It is expected that these costs will continue to increase with the progression of the disease. Costs increase with increasing severity of the disease and the majority of these costs lead to stay in the hospital, losses are US \$ 316,000 per person. COPD - a medical, social and economic damage to the entire global community, who may have more pronounced in Ukrainian reality (Guarascion, et al., 2013; Maio, et al., 2014; Maystruk & Grygus, 2015; Represas-Represas, et al., 2016).

In patients with COPD, there are significant changes in the emotional and mental health, there are depression, increased anxiety. In the early stages of these disorders associated with hypoxia. Patients become irritable, sometimes even aggressive. Against the progression of the pathological process occurring decreased performance and exercise tolerance, reduced social activity of patients with the emergence of a feeling of isolation from other people, which further increases the depression (Criner, 2015; Greening, 2014; Kon, 2014).

Even against the backdrop of adequate medical treatment in patients with COPD remain weakness, decreased performance and tolerance to physical stress, depression, and reduce total lean body mass, often there are violations on the part of the cardiovascular system. But in the first place always manifest breach of respiratory function (ERF). Despite the growing medical and rehabilitative possibilities of modern medicines and treatments, the problem of regenerative treatment of patients with COPD has not lost its relevance, because there is a need to find new methods to improve their performance through physical rehabilitation. Particular relevance wide implementation of physical rehabilitation in pulmonology practice defined modern concepts of extrapulmonary disorders that develop as a result of COPD [Ali, 2014; Vincent, 2017; Global Strategy for the Diagnosis, Management and Prevention of Chronic Obstructive Pulmonary Disease, GOLD Executive Summary, 2017).

### The aim of the study

Study the effectiveness of the proposed technology impact on the physical rehabilitation of respiratory function in patients with chronic obstructive pulmonary disease of moderate severity.

## METHODS

Research conducted at the branch pulmonary Rivne Regional Hospital. The accumulation of research results conducted as admission of patients to hospital treatment. Patients (COPD II Stage, moderate severity) were distributed by randomization to control (CG 2 - comprised of females (n = 40) and men (n = 44) sex) and basic (BG 2 - comprised of females (n = 38) and men (n = 40) sex) group. All patients were examined at the beginning and end of the study, were under medical supervision. Stage COPD and pulmonary disease

degree was determined according to clinical changes in the patient functional status and data spirometric study (ERF). Evaluation of physical capabilities of each patient was performed using conventional tests with load (treadmill test, 6-minute walk, etc.). Patients in the control group were treated according to protocol and rehabilitation for the conventional method, and patients of the group - according to protocol treatment and rehabilitation of the proposed technology.

## RESULTS

Research ERF in patients with COPD is optional and allows to objectify the degree of airflow obstruction, reversibility and its variability, and the effectiveness of treatment and physical rehabilitation carried out (Borges, 2014; Deepak, 2014; Global Strategy for the Diagnosis, Management and Prevention of Chronic Obstructive Pulmonary Disease, GOLD Executive Summary, 2017; Kim, 2016).

Analysing the average values of ERF COPD patients in both groups at baseline, we see that they are lower than normal and did not significantly differ, indicating that poor functional capacity of the lungs and bronchial patency. The observed indicates poor functional health status of patients and requires appropriate treatment and early rehabilitation.

Methodology Physical Rehabilitation included the use of the optimal level of early rehabilitation facilities under the terms of the proposed regime, depending on general condition of the patient. The main purpose of the application of physical rehabilitation was to reduce the intensity of dyspnea, number and duration of hospitalizations; improving exercise tolerance, improve ERF improving quality of life (Borghi-Silva, 2015; Rodriguez, 2016).

The technology of physical rehabilitation of patients with COPD included several stages: assessment of the patient; Learning patient; measures for correction of body weight; physical drilling program; psychological support. For each patient with COPD selected individual program of physical rehabilitation, taking into account the physical capacity, performance ERF, functional status, it started early.

While studying proper breathing patients pay attention to that to exhale they had relaxed, without any tension. Sigh at compressed lips is a proven method of assisted ventilation, which leads to increased intra-bronchial pressure and in turn increases intrapleural pressure and keeps Airways fault for a longer time. Control of breathing trained in different positions, so that patients learned ability to keep proper breathing in any lesson average intensity. Another way to improve ventilation was to help the patient in learning optimal breathing even while breathlessness. To achieve insensitivity to breathlessness, using exercises performed by the patient to achieve a level of discomfort, followed by suspension of the exercise and control of the patient's breathing, with a gradual increase of patient in a state of discomfort. To some extent this is also achieved by increasing the tolerance of the patient to increased daily physical activity. If you experience shortness of breath, stop classes, restoring breathing, and continued training, using a slow and deep breathing through clenched lips. The patient explained that you need to be patient and gradually achieve smooth and quiet breathing further increase physical activity. With the increasing strength and muscle endurance Peripheral patients better tolerated exercise, which allowed to increase the intensity sessions, focusing on the level of dyspnea, which the patient can control. To improve the general condition of the day added physiotherapy, therapeutic dosed walking, bicycle.

The effectiveness of treatment and physical rehabilitation determined by a number of parameters, the most important of which were fluctuations in forced expiratory volume in the first second (FEV1), changes in lung

vital capacity (VC), which is traditionally considered the best indicators for assessing the degree of airway obstruction. To determine the reversibility of airflow obstruction (RAO) for bronchial reactivity indices bronchodilatation test conducted  $\beta$ 2-agonists short-term action. Research ERF is the most informative indicator for assessing the severity of airway obstruction, severity and progression of COPD, the effectiveness of treatment and physical rehabilitation.

Results of physical rehabilitation on a background of conventional treatment in all patients we examined the dynamics that made it possible to objectively determine the efficacy of traditional and proposed rehabilitation measures. As a result of the comparative analysis of survey data 162 patients (COPD II Stage, moderate severity) of the control (CG 2 - comprised of females (n = 40) and men (n = 44) sex) and basic (BG 2 - consisted of females (n = 38) and men (n = 40) sex) groups were identified following. Patients BG 2 previously observed positive dynamics: reducing breathlessness, improved discharge of phlegm, wheezing disappeared in the lungs, improved sleep and health.

It is particularly important to be considered that the disease they become controlled, as evidenced by statistically significant increase in the average compared with ERF (Fig. 1-6, where the horizontal scale marked with numbers of patients, and the vertical - the figures in% of ERF appropriate values).

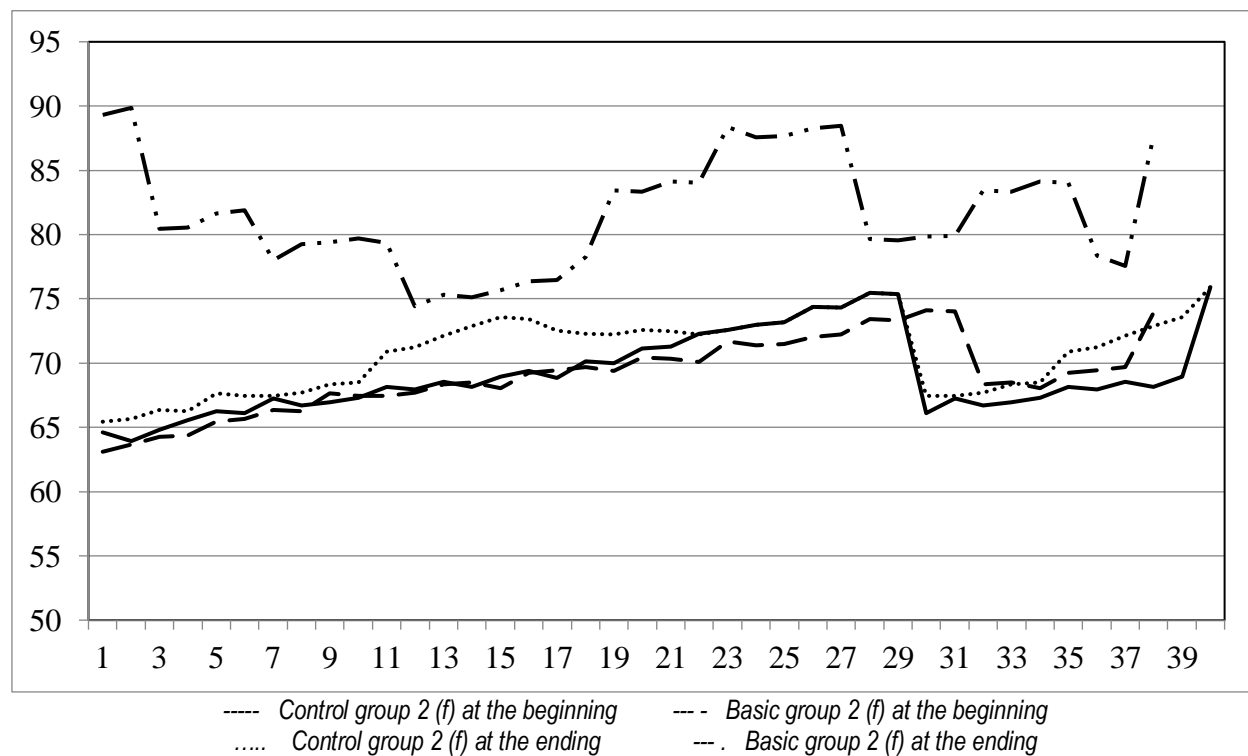


Figure 1. Performance FEV1 in patients with COPD female at the beginning and end of the study.

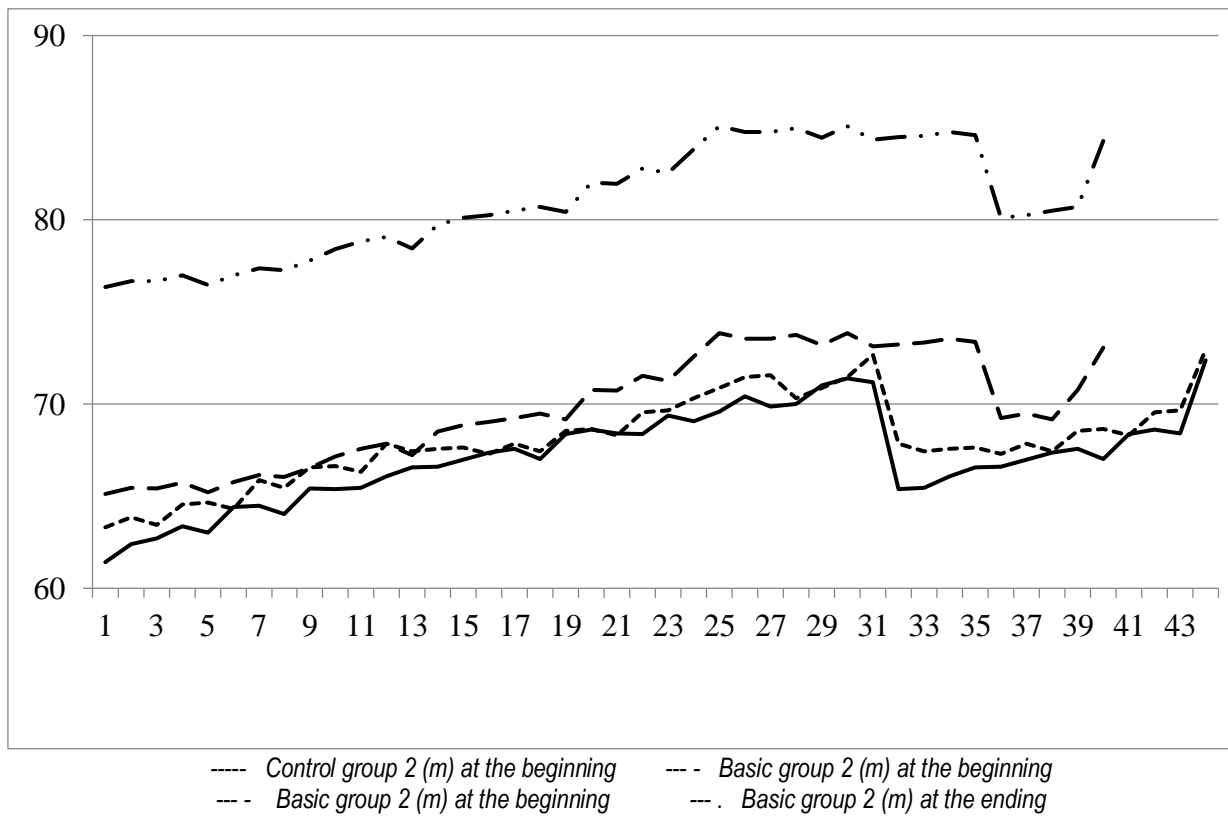


Figure 2. Indicators FEV1 in patients with COPD male at the beginning and end of the study.

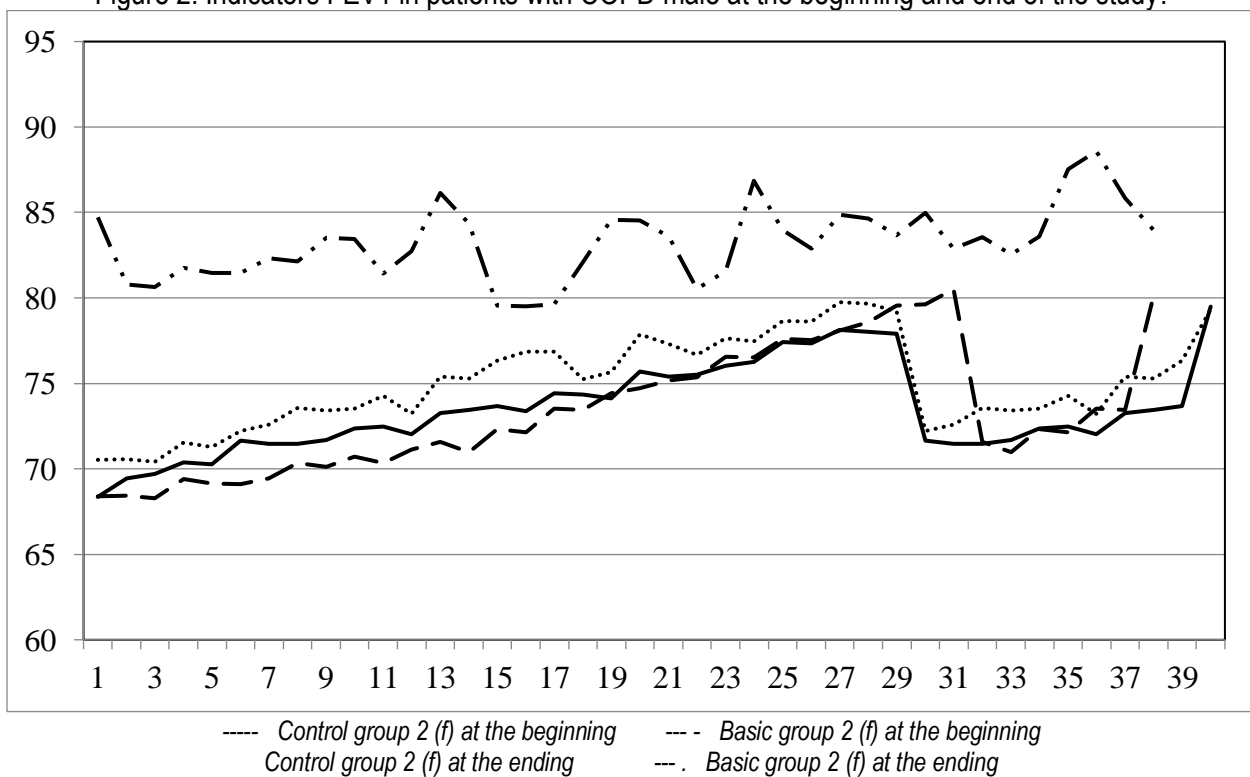


Figure 3. Indicators VC female patients with COPD at the start and end of the study.

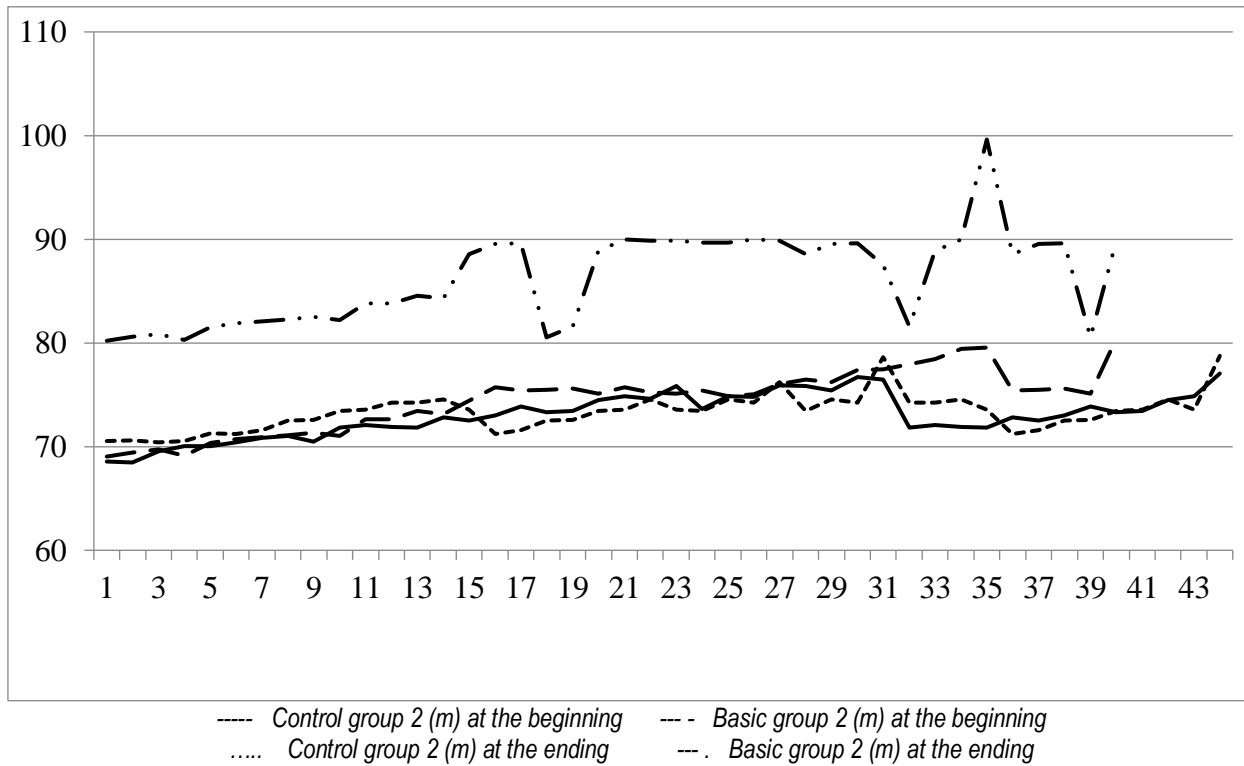


Figure 4. Indicators VC male patients with COPD at the start and end of the study.

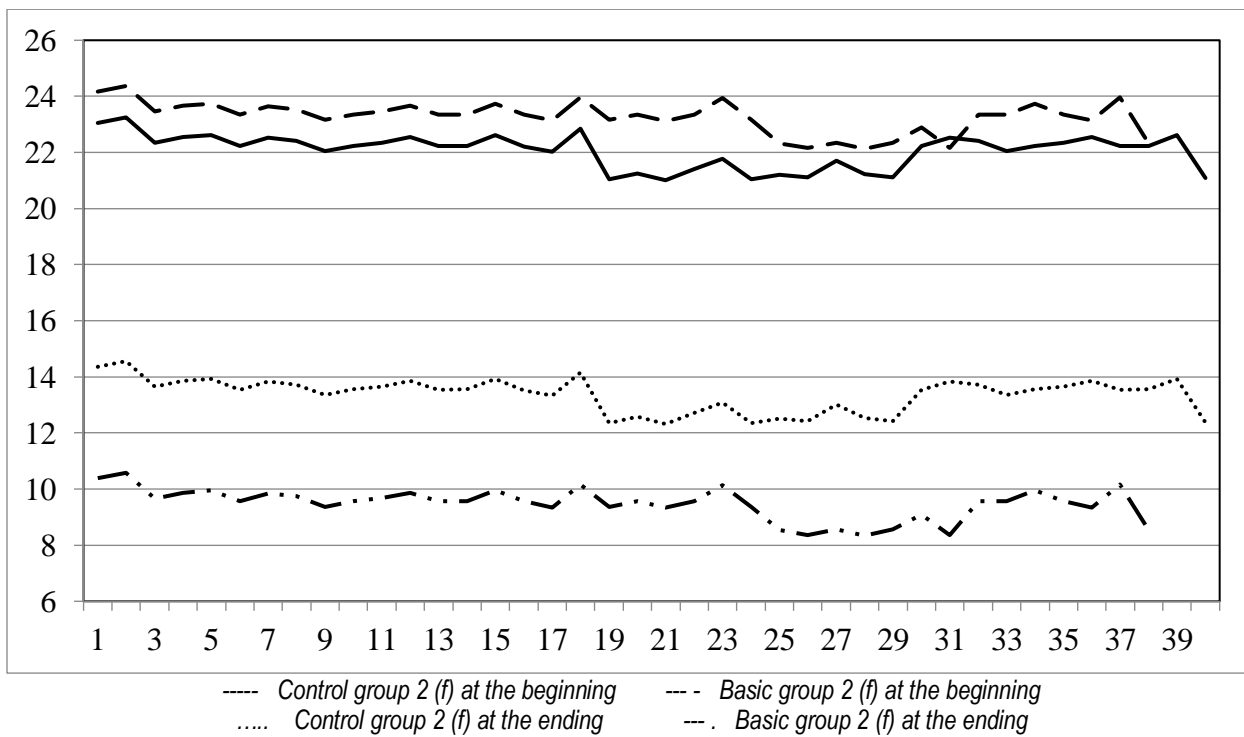


Figure 5. Performance RAO female patients with COPD at the start and end of the study.

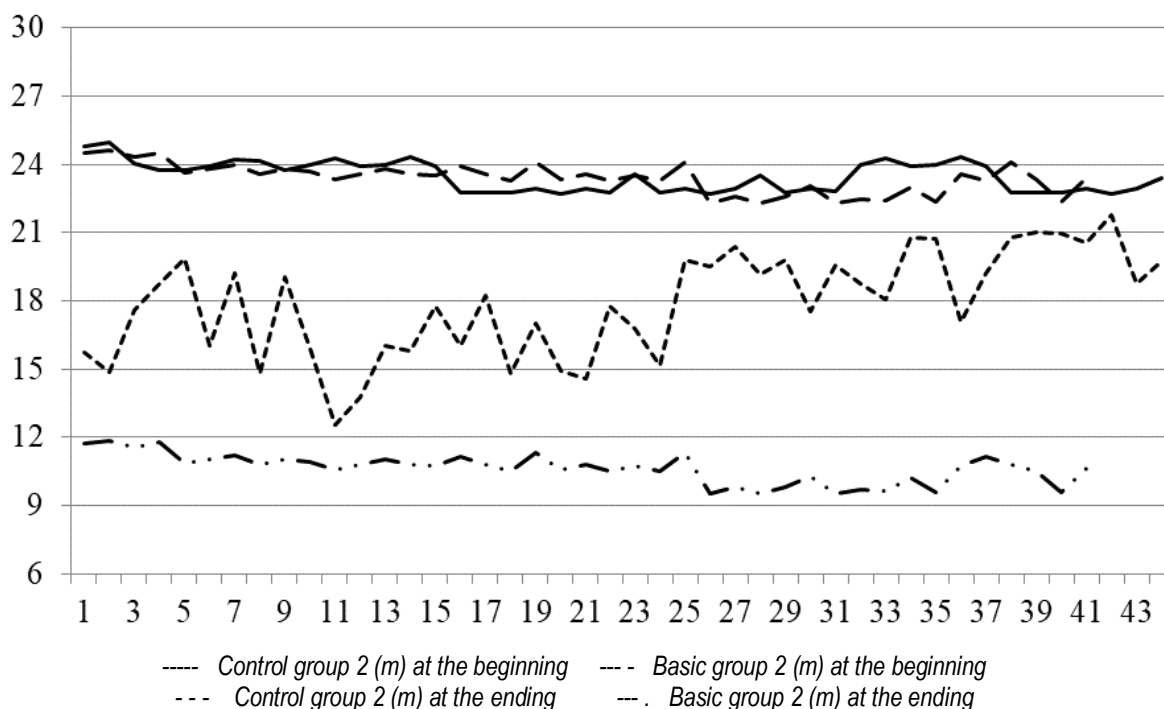


Figure 6. Indicators RAO male patients with COPD at the start and end of the study.

Overall dynamics of ERF patients in both groups in the study is presented in Table 1 and Table 2.

Table 1. Overall dynamics of ERF (% Of appropriate values) in patients with COPD females in both groups at the beginning and end of the study

Groups of patients	Stages of research	FEV1%	VC%	RAO%
CG 2 (w. n = 40)	early	69.11 ± 0.50	73.47 ± 0.42	22.07 ± 0.10
	<b>in the end</b>	<b>70.84 ± 0.47</b>	<b>75.02 ± 0.43</b>	<b>13.38 ± 0.10 *</b>
BG 2 (g. n = 38)	early	69.04 ± 0.23	73.34 ± 0.35	23.27 ± 0.01
	<b>in the end</b>	<b>81.68 ± 0.51 *. **</b>	<b>83.23 ± 0.12 *. **</b>	<b>9.48 ± 0.01 *. **</b>

Remarks: \* - the difference between the indexes statistically significant within group (p<0.05). \*\* - difference between the indexes statistically significant between the groups (p<0.05)

Table 2. Overall dynamics of ERF (% Of appropriate values) in patients with COPD males in both groups at the beginning and end of the study

Groups of patients	Stages of research	FEV1%	VC%	RAO%
CG 2 (h. n = 44)	early	67.11 ± 0.38	73.05 ± 0.32	23.47 ± 0.10
	<b>in the end</b>	<b>68.03 ± 0.36</b>	<b>73.31 ± 0.27</b>	<b>10.91 ± 0.06 *</b>
BG 2 (h. n = 40)	early	69.81 ± 0.48	74.47 ± 0.47	23.40 ± 0.10
	<b>in the end</b>	<b>81.00 ± 0.48 *. **</b>	<b>86.30 ± 0.70 *. **</b>	<b>10.64 ± 0.10 *. **</b>

Remarks: \* - the difference between the indexes statistically significant within group (p<0.05). \*\* - difference between the indexes statistically significant between the groups (p<0.05)

## DISCUSSION

If the average baseline FEV1 in patients KG 2 women with COPD were  $69,11 \pm 0,50\%$  Of BG 2  $-69,04 \pm 0,23\%$ ; at the end of the study, respectively  $-70,84 \pm 0,47\%$  and  $81,68 \pm 0,51\%$  ( $P < 0.05$ ). Averages FEV1 at the end of the study in female patients with COPD BG 2 that engaged the developed concept of physical rehabilitation, patients are higher than 2 KG.

Mean values of FEV1 at baseline in patients KG 2 males with COPD were  $67,11 \pm 0,38\%$  Of BG 2  $-69,81 \pm 0,48\%$ ; and the end of the study, respectively  $-68,03 \pm 0,36\%$  and  $81,00 \pm 0,48\%$  ( $P < 0.05$ ). The use of physical rehabilitation led to the extension of functionality of patients expressed with increasing average indicators FEV1 in patients with BG 2 males with COPD in excess of such patients KG 2.

When analysing the performance VC observed that at the beginning of the study were female patients KG 2  $-73,47 \pm 0,42\%$  In BG 2  $-73,34 \pm 0,35\%$ ; The study  $-75,02 \pm 0,43\%$  and  $83,23 \pm 0,12\%$  ( $P < 0.05$ ), respectively.

Mean values of VC at the beginning of the study were male patients with COPD kg 2  $-73,05 \pm 0,32\%$  In BG 2  $-74,47 \pm 0,47\%$ ; The study  $-73,31 \pm 0,27\%$  and  $86,30 \pm 0,70\%$  ( $P < 0.05$ ), respectively. We see a significant increase in VC parameters in patients with male and female of BG 2 at the end of the study.

At baseline the average RAO female patients with COPD KG 2 were  $22,07 \pm 0,10\%$  Of BG 2  $-23,27 \pm 0,01\%$ ; end of the study, respectively  $-13,38 \pm 0,10\%$  ( $P < 0.05$ ) and  $9,48 \pm 0,01\%$  ( $P < 0.05$ ). Averages RAO in patients with COPD BGs involved in the developed concept of physical rehabilitation, patients are higher than 2 KG.

If the baseline average RAO male patients with COPD KG 2 were  $23,47 \pm 0,10\%$  Of BG 2  $-23,40 \pm 0,10\%$ ; at the end of the study, respectively  $-10,91 \pm 0,06\%$  ( $P < 0.05$ ) and  $10,64 \pm 0,10\%$  ( $P < 0.05$ ). Averages RAO in patients with COPD BG 2 that engaged the developed concept of physical rehabilitation, patients are higher than 2 KG.

That is, we can say that significant changes have occurred with indicators of bronchial reactivity in patients with male and female COPD BG 2 which statistically significantly decreased after the implementation of programs of physical rehabilitation ( $p < 0.05$ ), which did not happen in the control group.

Analysing the average values of ERF COPD patients in both groups, we see that at the beginning of the study, these figures were lower than normal, significantly differed among themselves, and end of the study in patients BG 2 they were higher (approached to appropriate), indicating an improvement patency of small bronchi, which is especially important for patients. Intuitively, we see a slight increase in average values of FEV1 (by 1.73%), VC (by 1.55%) and sufficient RAO (to 8.69%) in female patients KG 2 and male patients KG 2: slight increase in FEV1 (by 0.92%), VC (0.26%) and sufficient RAO (at 12.56%) at the end of the study. Instead of BG 2 in patients traced a steady positive trend: significant ( $p < 0.05$ ) a significant increase in average values of FEV1 (to 12.64%), VC (by 9.89%), RAO (to 13.79%) in female patients and FEV1 (to 11.19%), VC (at 11.83%) and RAO (to 12.76%) in patients with male end of the study. The use of physical rehabilitation led to the extension of functionality of patients expressed increasing medium values of ERF studied in the BG 2 at the end of the study. Improving the functional state of the respiratory system studied in the BG 2 demonstrates the positive effect of physical rehabilitation developed technique on motor capabilities of



patients with COPD. In general it can be noted that all patients BG 2 treatment and physical rehabilitation led to normalization of the ERF.

Introduced in the daily treatment of COPD early physical rehabilitation can reduce symptoms of the disease, optimize functional status of the patient and reduce the cost of treatment by stabilization or reduction of systemic manifestations of the disease.

Use in patients with COPD physical rehabilitation can achieve those positive changes that cannot be achieved only through drug therapy. Through its application cannot control the symptoms, improved functional status of patients, increased exercise tolerance, increased daily physical activity decreases the frequency and severity of dyspnea, improves quality of life, which is expressed primarily in reducing anxiety and depression associated with COPD.

## **CONCLUSIONS**

Today COPD is one of the most common forms of disease, which leads to high morbidity and mortality rates of patients. Physical rehabilitation has an important place in the treatment of patients with COPD. The use of physical rehabilitation in patients with COPD has led to increasing functional capacity of patients expressed increasing average values of indicators of lung function studied in the main group at the end of studies that demonstrate its effectiveness. Improving the functional state of the respiratory system in patients of the main group indicates the positive effect of physical rehabilitation developed technique on motor capabilities of patients with COPD. Physical rehabilitation should be recommended for patients with COPD to help control symptoms, improve quality of life and increase physical activity.

## **ETHICS APPROVAL AND CONSENT TO PARTICIPATE**

The research related to human use complied with all the relevant national regulations, institutional policies, and was in accordance with the tenets of the Helsinki Declaration. The study protocol was approved by the Ethical Committee of National University of Water and Environmental Engineering, Rivne, Ukraine.

During realization of tests, all participants provided informed consent and used all measures for maintaining anonymity of participants.

## **CONSENT TO PUBLISH**

Not applicable

## **COMPETING INTERESTS**

The authors declare that they have no competing interests.

## **FUNDING**

No funding

## AUTHORS' CONTRIBUTIONS

IG, MM participated in the design of this study. IG, MM performed the statistical analyses. IG, MM, WZ drafted the manuscript. IG, MM, WZ were involved in data collection and/or made important intellectual contributions to the interpretation of data and the writing of paper. All authors critically revised and approved the final version.

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