



Impacts of intermittent aerobic exercise on depressive disorder and respiratory functions in patients with chronic obstructive pulmonary disease: 10-week prospective clinical study

Walid Kamal Abdelbasset^{1,2✉}, Saud F. Alsubaie¹, Eman Yassen²

¹Department of Physical Therapy and Health Rehabilitation, College of Applied Medical Sciences, Prince Sattam bin Abdulaziz University, Alkharj, Saudi Arabia.

²Department of Physical Therapy, Kasr Al-Aini Hospital, Cairo University, Giza, Egypt

✉ Corresponding author

Department of Physical Therapy and Health Rehabilitation,
College of Applied Medical Sciences,
Prince Sattam bin Abdulaziz University, Alkharj, Saudi Arabia;
Email: walidkamal.wr@gmail.com

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General Note

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ABSTRACT

Depression is a common community-health problem among patients with chronic obstructive pulmonary disease (COPD). Rare studies have evaluated the effects of intermittent aerobic exercise on depression status in patients with COPD. Therefore, this study aims to identify the short-term effects of intermittent aerobic exercise on depression status and respiratory functions in patients with COPD. Forty-two patients with moderate COPD ($50\% \leq FEV1 < 80\%$ predicted) were included in this prospective experimental study. The mean of their age was 48.4 ± 7.5 years. All patients were complaining of mild and moderate depression. Randomly, the patients were assigned into two groups, 21 in each group. The first group was recruited to intermittent aerobic exercise, 40 min/session, 4 sessions per week for 10 weeks (intermittent group). The second group did not receive an exercise program during the study period (conventional group). Depression status and spirometry assessments were performed. After the intervention the depression status and respiratory functions were significantly improved in the intermittent group ($p < 0.05$) while the conventional group showed non-significant changes in any parameters of the outcome measures ($p > 0.05$). Changes in the intermittent group were significantly different from the conventional group ($p < 0.05$). 10-week intermittent aerobic exercise reduces depression status and improves respiratory functions in patients with moderate COPD. Intermittent aerobic exercise should be recommended in the rehabilitation program of COPD, especially depressed patients.

Keywords: Chronic obstructive pulmonary disease, intermittent aerobic exercise, depression status, Spirometry test.

1. INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a progressive obstruction of the airways that affects respiratory system (Kim et al., 2015). COPD is commonly combined with several impairments of the human body systems involving cardiovascular and musculoskeletal systems which result in disturbances of psychological state and quality of life (Abdelbasset et al., 2016). Exercise training and chest physical therapy improve dyspnea and quality of life (Abdelbasset et al., 2018; Abdelbasset et al., 2016; Abdelbasset et al., 2015). COPD is usually associated with lowering in aerobic capacity and which leads to frailty of respiratory muscles and increase of mortality rate which consequently disturbs respiratory functions (Donaire-Gonzalez et al., 2015). In the past thirty years, the rate of COPD was augmented and became one of the common causes of death (Lopez and Murray, 1998).

Many previous studies approved that patients with COPD suffer from impairment of their psychological status, particularly depression which affects stable and unstable COPD and leads to disturbed functional performance and high rate of disability and mortality (Galić et al., 2019; Marsh and Guck, 2016; Yohannes and Alexopoulos, 2014).

Aerobic exercise is a one of the safe and therapeutic modality which has beneficial influences in COPD while rare documents have designed to identify the influence of intermittent aerobic exercise on depression state and respiratory functions in COPD patients. Accordingly, our study has assessed the short-term impacts of intermittent aerobic exercise on depression state and respiratory functions in COPD hypothesizing that this type of exercise could reduce depression and improves respiratory function in those patients.

2. MATERIALS AND METHODS

Participants

Between January and June 2019, forty-two stable patients with moderate COPD ($50\% \leq FEV1 < 80\%$ predicted) were included in this prospective experimental study at the outpatient physical therapy clinic of the university hospital. The mean of their age was 48.4 ± 7.5 years. All patients were complaining from mild to moderate depression depending on the patient health questionnaire 9 (PHQ9). Severe depressed patients, unstable COPD, and musculoskeletal limits which affect exercise intervention have been excluded from the study. Before starting the study, each participant has signed an informed consent. Ethical clearance was obtained from the physiotherapy ethical committee at Cairo university hospitals (PT-019-011).

Sample size and randomization

Depending on available volunteers rather than sample size estimation, fifty-one patients have been assessed for eligibility to participate in the study. Forty-two patients have participated and nine subjects have not participated (four have not met the study criteria and five have refused to participate). Randomly, the forty-two participants were allocated to two groups before intervention, 21 in each group. First group has been recruited to intermittent aerobic exercise, 40 min/session, 4 sessions per week for 10 weeks

(intermittent group). The second group has not received exercise program during the study period (conventional group). Allocation has been carried out before intervention by a blind physiotherapist. Figure 1 shows the flowchart of the study.

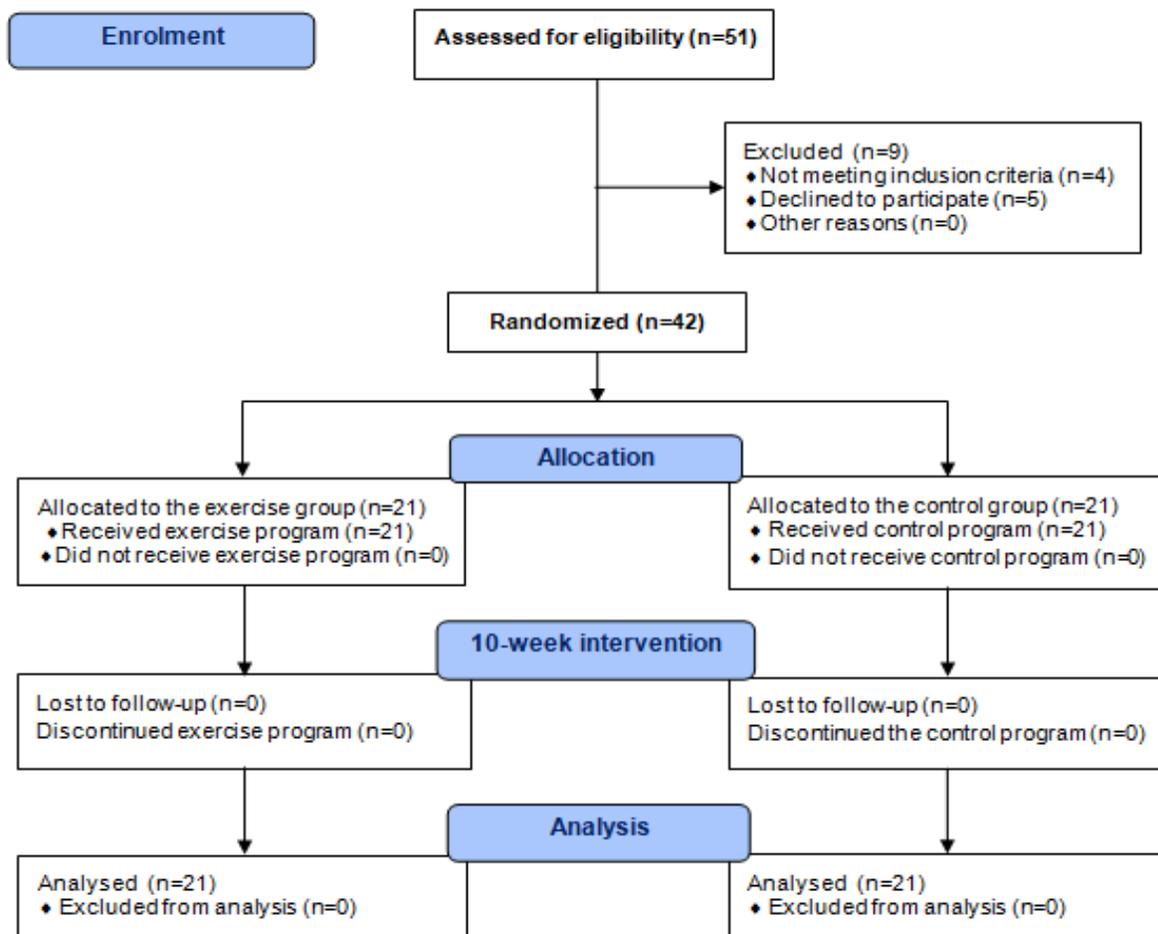


Figure 1 The flowchart of the study

Procedures

Assessment

Demographics and baseline data were obtained from hospital medical files and self-report form. A valid patient health questionnaire 9 (PHQ9) was used to appraise the depressive symptoms in COPD patients (Kroenke et al., 2001). The total scoring of the nine items of the PHQ9 is ranged from (0 to 27), 0 indicates no depression and 27 indicates severe depression. Spirometry test has been performed to assess the respiratory functions, particularly forced vital capacity (FVC) and forced expiratory volume in one second (FEV1). All the outcome measures have been assessed by the same blind examiner pre- and post-treatment.

Treatment

The patients of the intermittent group have been recruited to 40-min intermittent aerobic exercise, 4 sessions per week for 10 weeks. Each exercise session has been initiated with warming-up for 5 minutes on bicycle ergometer and finished with same period of cooling down under supervision of experienced therapist. The exercise session has been consisted of four alternating sets of 5-7.5 minutes of moderate-intensity with maximum workload of 40-50% and high-intensity with maximum workload of 70-80% (Gibala and McGee, 2008). The watt max test was used to calculate the maximum workload before starting the exercise session (Figure 2). The patients of the conventional group have not received exercise program while they have been encouraged to keep on active lifestyle.



Figure 2 Intermittent aerobic exercises

Statistical analysis

For analyzing data, the IBM SPSS statistics for windows version 25 (IBM Corp., Armonk, NY, USA) has been utilized. Descriptive statistics (mean±SD) have been performed on the PHQ9, FVC, and FEV1. For assessing the differences of the normal distributed data between the intermittent and conventional groups, the students' t-test has been used while the Mann-Whitney U test has been used to assess the changes of non-normally distributed data. The significance level has been set at $p < 0.05$.

3. RESULTS

At baseline assessment, there were no significant differences between the intermittent and conventional groups in demographics and outcome measures (age, genders, body mass index (BMI), PHQ9, FVC, and FEV1) with $p > 0.05$ as described in Table 1 and Figure 3.

Table 1 Demographics and clinical features

	Intermittent group (n=21)	Conventional group (n=21)	<i>p-value</i>
Age (years)	49.2±7.6	47.6±7.4	0.493
Gender (males)	14(62%)	12(57%)	0.753
BMI (kg/m ²)	28.24±3.2	29.15±3.5	0.384
PHQ9	17.6±4.4	16.4±4.7	0.398
FVC (% pred.)	77.3±5.1	76.7±4.8	0.696
FEV1 (% pred.)	66.1±3.8	65.6±3.6	0.664

BMI: body mass index; PHQ9: Patient health questionnaire9; FVC: Forced vital capacity; FEV1: Forced expiratory volume in one second.

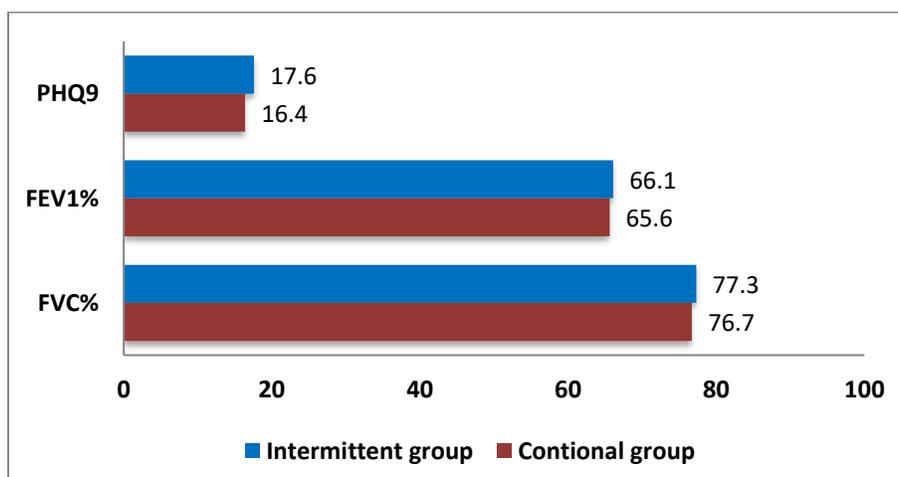


Figure 3 Baseline clinical data

After intervention, PHQ9 and respiratory functions have been significantly improved ($p < 0.05$) in the intermittent group while no significant changes has been observed in the conventional group ($p > 0.05$). Statistically, there were greater improvements of the PHQ9, FVC, and FEV1 in the intermittent group more than conventional group at the end of the 10-week intervention as described in Table 2 and Figure 4.

Table 2 Differences within and between intermittent and conventional groups post-intervention

Variables		Intermittent group (n=21)	Conventional group (n=21)	<i>p</i> -value
PHQ9	Pre-	17.6±4.4	16.4±4.7	0.398
	Post-	6.7±2.3	14.8±4.5	<0.001
	P-value	<0.001	0.266	
FVC%	Pre-	77.3±5.1	76.7±4.8	0.696
	Post-	89.5±7.2	77.8±4.6	<0.001
	P-value	<0.001	0.452	
FEV1%	Pre-	66.1±3.8	65.6±3.6	0.664
	Post-	79.4±4.6	67.5±4.1	<0.001
	P-value	<0.001	0.118	

PHQ9: Patient health questionnaire9; FVC: Forced vital capacity; FEV1: Forced expiratory volume in the one second.

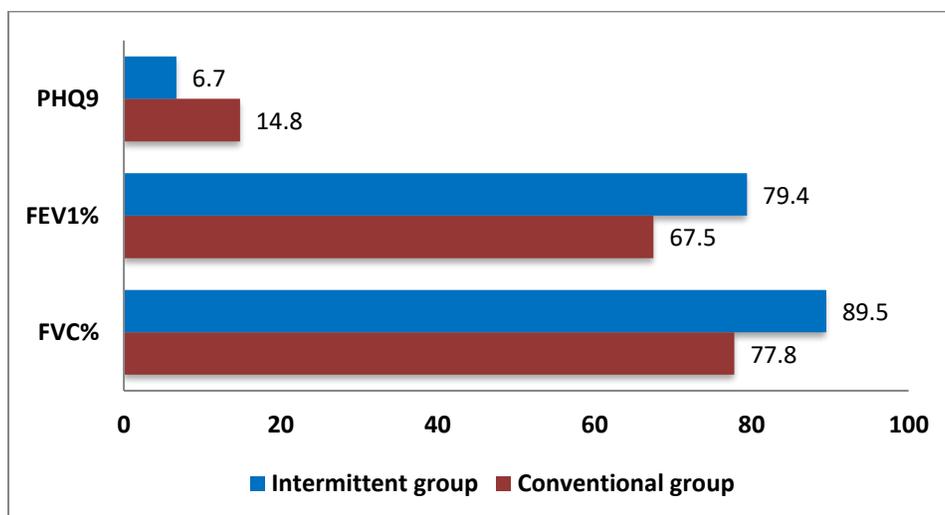


Figure 4 Post-intervention differences between the two groups

4. DISCUSSION

Our current study aims to identify the short-term effects of intermittent aerobic exercise on depression status and respiratory functions patients with COPD. The findings show that adhering to intermittent aerobic exercise for 10-week intervention result in sustained improvements of depression scores and respiratory functions in adult patients with COPD. Several prior studies approved that physical exercises have a critical role for maintaining health conditions and improve psychosocial status in cardiac patients (Abdelbasset et al., 2019; Abdelbasset et al., 2017). Also, in earlier study, we demonstrated that moderate and low-moderate aerobic exercises reduce depressive illness in patients with heart failure in the short term (Abdelbasset et al., 2019).

Regarding depression illness, a review of literature provided that regular physical exercise enhances the secretion of the biological proteins which consequently reduces depression illness and improves mentality condition (Abdelbasset et al., 2019; Rustad et al., 2013). In agreement with our findings, Dunn et al. concluded that 30-minute walking daily for ten days resulted in a decrease major depressive disorder (Dunn et al., 2005). Moreover, Knubben et al. explained that depressive symptoms are reduced following aerobic exercise in cardiac patients (Knubben et al., 2007). Overall, this prospective study has appraised the psychological condition and respiratory functions that are significant measures for COPD patients. The main symptom of the COPD is a reduced

respiratory function (Velloso et al., 2006). The study findings explained the significant effects of intermittent aerobics on FVC and FEV1.

Similar to the current study findings, prior documents approved that adherence to physical exercise improves psychological condition and respiratory functions in COPD patients (Abdelbasset et al., 2018; Manger and Motta, 2005). These findings are resulted from the improving of muscle strength of the respiratory muscles which consequently improves exercise tolerance and arterial blood gases (Güell et al., 2000). Furthermore, improving muscle strength after a program of exercise training increases respiratory functions and exercise capacity and reduces the mortality and morbidity rates among COPD patients (Donaire-Gonzalez et al., 2015).

The primary limitation of the study is the small sample size which affects the accuracy and generalizability of the study findings. Lack of intermediate (5 weeks) assessment is also considered as one of the study limitations. Moreover, the study lacked medical intervention for depression disorder. To address these limits, future studies should include a larger sample size and assessment of the combination of medical treatment and exercise rehabilitation with intermediate and long-term analysis of the study measures. Also, future studies should assess different pulmonary rehabilitation programs with different durations on psychological disorders and respiratory functions in COPD patients.

5. CONCLUSIONS

10-week intermittent aerobic exercise reduces depression status and improves respiratory functions in patients with moderate COPD. Intermittent aerobic exercise should be recommended in the rehabilitation program of COPD, especially depressed patients.

What is known about this topic?

Respiratory functions are reduced in COPD patients.
COPD is associated with impairment of the psychological conditions.
Aerobic exercise improves the strength of skeletal muscles.

What this study adds

Intermittent aerobic exercise is easy and safe intervention in COPD.
Intermittent aerobic exercise improves depression in COPD patients.
Intermittent aerobic exercise improves respiratory functions and psychological conditions in short-term (10-week intervention).

Authors' Contributions

All authors conceptualized, designed, and carried out the study, collected and analyzed data. All authors read and agreed the final manuscript.

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Conflicts of Interest: The authors declare no conflict of interest.

REFERENCE

1. Abdelbasset WK, Alqahtani BA, Alrawaili SA, Ahmed AS, Elnegamy TE, Ibrahim AA, Soliman GS. Similar effects of low to moderate-intensity exercise program vs moderate-intensity continuous exercise program on depressive disorder in heart failure patients: A 12-week randomized controlled trial. *Medicine (Baltimore)* 2019;98(32):e16820.
2. Abdelbasset WK, Alqahtani BA, Elshehawy AA, Tantawy SA, Elnegamy TE, Kamel DM. Examining the impacts of 12 weeks of low to moderate-intensity aerobic exercise on depression status in patients with systolic congestive heart failure - a randomized controlled study. *Clinics (Sao Paulo)* 2019;74:e1017.
3. Abdelbasset WK, Alqahtani BA. A randomized controlled trial on the impact of moderate-intensity continuous aerobic exercise on the depression status of middle-aged patients with congestive heart failure. *Medicine (Baltimore)* 2019;98(17):e15344.
4. Abdelbasset WK, Alsubaie SF, Tantawy SA, Abo Elyazed TI, Kamel DM. Evaluating pulmonary function, aerobic capacity, and pediatric quality of life following a 10-week aerobic

- exercise training program in school-aged asthmatics: a randomized controlled trial. *Patient Prefer Adherence* 2018;12:1015-1023.
5. Abdelbasset WK, Elnegamy TE. Effect of chest physical therapy on pediatrics hospitalized with pneumonia. *Int J Health Rehabil Sci* 2015;4(4):219-226.
 6. Abdelbasset WK, Elsayed SH, Abo Elyazid TI. Comparison of high intensity interval to moderate intensity continuous aerobic exercise on ventilatory markers in coronary heart disease patients: a randomized controlled study. *Int J Physiother Res* 2017;5(3):2013-18.
 7. Abdelbasset WK, Nambi G, Mahmoud MZ. Impact of Resisted Exercise on Chronic Obstructive Pulmonary Disease (COPD) in Elderly Patients in Al-Kharj, Saudi Arabia. *Int J Med Res Health Sci* 2016;5(5):187-195.
 8. Donaire-Gonzalez D, Gimeno-Santos E, Balcells E, de Batlle J, Ramon MA, Rodriguez E, Farrero E, Benet M, Guerra S, Sauleda J, Ferrer A, Ferrer J, Barberà JA, Rodriguez-Roisin R, Gea J, Agustí A, Antó JM, Garcia-Aymerich J. Benefits of physical activity on COPD hospitalisation depend on intensity. *Eur Respir J* 2015;46(5):1281-9.
 9. Dunn AL, Trivedi MH, Kampert JB, Clark CG, Chambliss HO. Exercise treatment for depression: efficacy and dose response. *Am J Prev Med* 2005;28(1):1-8.
 10. Galić K, Dodaj A, Čorluka-Čerkez V, Lasic V, Pejić R, Šimić J, Vukojević M. Study of depression and anxiety in patients with asthma and chronic obstructive pulmonary disease. *Psychiatr Danub* 2019;31(Suppl 1):112-117.
 11. Gibala MJ, McGee SL. Metabolic adaptations to short-term high-intensity interval training: a little pain for a lot of gain? *Exerc Sport Sci Rev* 2008;36(2):58-63.
 12. Güell R, Casan P, Belda J, Sangenis M, Morante F, Guyatt GH, Sanchis J. Long-term effects of outpatient rehabilitation of COPD: A randomized trial. *Chest* 2000;117(4):976-83.
 13. Kim V, Crapo J, Zhao H, Jones PW, Silverman EK, Comellas A, Make BJ, Criner GJ. Comparison between an alternative and the classic definition of chronic bronchitis in COPD. *Ann Am Thorac Soc* 2015;12(3):332-9.
 14. Knubben K, Reischies FM, Adli M, Schlattmann P, Bauer M, Dimeo F. A randomised, controlled study on the effects of a short-term endurance training programme in patients with major depression. *Br J Sports Med* 2007;41(1):29-33.
 15. Kroenke K, Spitzer RL, Williams JB. The PHQ-9: validity of a brief depression severity measure. *J Gen Intern Med* 2001;16(9):606-13.
 16. Lopez AD, Murray CC. The global burden of disease 1990-2020. *Nat Med* 1998;4(11):1241-3.
 17. Manger TA, Motta RW. The impact of an exercise program on posttraumatic stress disorder, anxiety, and depression. *Int J Emerg Ment Health* 2005;7(1):49-57.
 18. Marsh S, Guck TP. Anxiety and depression: Easing the burden in COPD patients. *J Fam Pract* 2016;65(4):246-56.
 19. Rustad JK, Stern TA, Hebert KA, Musselman DL. Diagnosis and treatment of depression in patients with congestive heart failure: a review of the literature. *Prim Care Companion CNS Disord* 2013;15(4). pii: PCC.13r01511.
 20. Velloso M, Jardim JR. Study of energy expenditure during the activities of daily living using and not using body position recommended by energy conservation techniques in COPD patients. *Chest* 2006;130(1):126-32.
 21. Yohannes AM, Alexopoulos GS. Depression and anxiety in patients with COPD. *Eur Respir Rev* 2014;23(133):345-9.