Original Article

Effects of Inspiratory Muscle Training and Deep Breathing Training in Chronic Renal Failure Patients: A Comparison Randomized Control Trial

Yuenyongchaiwat K, PhD[1], Saengkrut P, BSc[1], Vasinsarunkul P, BSc[1], Phongsukree P, BSc[1], Chaturattanachaiyaporn K, BSc[1], Charususin N, PhD[1], Pairojkittrakul S, MSc[2]

[1] Physiotherapy Department, Faculty of Allied Health Sciences, Thammasat University, Pathumthani, Thailand
[2] Nephrology clinic, Thammasat University Hospital, Pathumthani, Thailand

Background: To compare the effects of inspiratory muscle training (IMT) and deep breathing training (DBT) in patients with chronic renal failure.

Materials and Methods: Seventy-five participants were recruited from outpatient's hemodialysis units. Individuals were divided into three groups; IMT, DBT and sham training (ST). The IMT group was requested to perform the Threshold Loader load of 40% of the maximal inspiratory pressure (MIP) in a set of 15 times for three sets, at 60 seconds intervals. In addition, the DBT group performed three sets of 15 inspirations with the of rate inspiration: expiration ratio (1: 1.5) and interval 60 seconds. Besides, the ST group was required to use the Threshold Loader load of 0% of the MIP 15 times for three sets, interval 60 seconds. These interventions were created for three days a week for eight weeks of the training program. The respiratory muscle strength and six-minute walk test (6MWT) were examined before and after intervention program.

Results: After intervention program, the inspiratory muscle strength was statistically significant differences between groups of IMT and ST (Δ24.10$\pm$8.13 cmH_2O). Further, increased MIP values were observed between before and after intervention in both IMT and DBT groups (Δ12.44$\pm$3.55 cmH_2O and Δ12.22$\pm$3.33 cmH_2O, respectively). In addition, six-minute walk distance (6MWD) was a difference between before and after training in IMT group (Δ24.78$\pm$8.89 meters).

Conclusion: Improved inspiratory muscle was reported in both IMT and DBT groups. A significant improvement in 6MWD was observed in only IMT group.

Keywords: Chronic renal failure, Hemodialysis, Inspiratory muscle strength, Functional capacity, Inspiratory muscle training, Deep breathing training

J Med Assoc Thai 2020;103(Suppl.3): 37-42
Website: http://www.jmatonline.com

Globally, chronic renal failure (CRF) is a major problem disease and related to high economics of burden of CRF in Thailand. In addition, the higher incidence rate of CRF is associated with age(1). It has been known that decreased muscle strength has been observed in CRF patients compare to healthy people, in particular respiration muscles(2). A reduction in size of type I and type II fibers, impairment in oxygen consumption and transportation and decreased protein synthesis caused by uremic syndrome which is related to fluid, electrolyte imbalance, and metabolic abnormalities(3). Therefore, physical performance, functional exercise capacity, muscle strength and muscle endurance are decreased in patients with CRF(4).

Breathing exercise is one of the basic physical therapy treatment to improve pulmonary ventilation. Deep breathing exercise, a conservative physical therapy treatment, is a breathing technique aiming to reduce dead space ventilation and renews air throughout the lungs(5). Deep breathing exercise induces parasympathetic tone, reduces sympathetic system thereby increases cardiorespiratory functions and functional exercise capacity(6,7). Another technique to increase cardiorespiratory function and functional capacity is inspiratory muscle training which increased respiratory muscle strength by using loading technique. It has been reported that respiratory muscle training in CRF patients could increases respiratory muscle strength and thereby increase functional exercise capacity. However, little is known the effect of different breathing training (i.e., inspiratory muscle training and deep breathing training) in Thai patients with CRF. Therefore, the study aimed to determine the effect of inspiratory muscle training and deep breathing training on respiratory muscle strength and

Correspondence to:
Yuenyongchaiwat K.
Physiotherapy Department, Faculty of Allied Health Sciences, Thammasat University, 99 Moo 18, Khlong Nueng, Khlong Luang, Pathumthani 12120, Thailand.
Phone: +66-2-9869213 ext. 7237
E-mail: ykornano@tu.ac.th; kornanong.y@allied.tu.ac.th

How to cite this article: Yuenyongchaiwat K, Saengkrut P, Vasinsarunkul P, Phongsukree P, Chaturattanachaiyaporn K, Charususin N, Pairojkittrakul S. Effects of Inspiratory Muscle Training and Deep Breathing Training in Chronic Renal Failure Patients: A Comparison Randomized Control Trial. J Med Assoc Thai 2020;103(Suppl.3): 37-42.

functional exercise capacity in CRF patients who are receiving hemodialysis.

Materials and Methods

According to the study of Figueiredo et al[4], the effect size was set 0.4, and the statistical power was 0.8. Therefore, 66 participants were recruited into three groups (i.e., inspiratory muscle training, deep breathing training and sham training). However, to account for dropout, totally 75 participants were recruited in the study. 46 male and 29 female participants with an average 50.85±12.00 years (range 30 to 75 years old) were enrolled in the study. They had been diagnosed end stage renal disease at stage 5 and receiving hemodialysis more than three months, undergoing hemodialysis three times a week. Participants who had resting systolic blood pressure greater than 200 mmHg and/or diastolic blood pressure greater than 120 mmHg, neurological problems (e.g., stroke, head injury), musculoskeletal problems, uncontrolled pulmonary disease, psychiatry problems and cognitive disorders were excluded in the study. Individual who had been unable to follow the instruction more than three times of the training program or decided to stop the program were terminated from the study. The protocol was approved from the Ethic committee of Thammasat University and Thammasat University Hospital. The participant information sheets and consent form were given to all participants.

Prior to the intervention program, maximal inspiratory pressure (MIP) and maximal expiratory pressure (MEP) were measured by a mouth pressure meter (Micromedical generation, Carefusion company, United Kingdom). According to the American Thoracic Society protocol, participants were asked to exhale completely to residual volume and take a deep breath in fast and forceful and hold on 1.5 seconds; this could be defined as MIP. For the MEP, participants take a deep breath to total lung capacity and exhale fast and forceful and then hold on 1.5 seconds[8]. Participants were requested to repeat these tests three to five times and choose maximal value of three times difference less than 10 cmH_2O. In addition, all participants were asked to perform 6-minute walk test, which represents to functional exercise capacity. This test was performed according to the American Thoracic Society (2002). Blood pressure, heart rate, oxygen saturation and rating perceived exertion (RPE) were reported before and after testing.

A simple randomization was used to divide the participants into three groups (i.e., inspiratory muscle training, deep breathing training or sham training). Regarding the inspiratory muscle training program, it has been found that several studies commonly asked the participants underwent the inspiratory muscle training program with an established load of 40% of the MIP[4,13]. Therefore, the present study requested the participants to perform by using the POWER breath K5 (England) at loading of 40% of the MIP in a set of 15 times for three sets, at 60 seconds intervals. Deep breathing training group was performed three sets of 15 inspirations and interval resting between each breath 60 seconds. The sham training group was asked to perform breathing normally with the POWER breath K5 (England) at loading of 0% of the MIP, 15 times/sets, for three sets and interval for 60 seconds. These participants were requested to perform the intervention program for three days per week. After four weeks, MIP was reevaluated for load adjustment (Figure 1).

Kolmogorov-Smirnov (Goodness of fit) test was used for test of distribution data. Two-way mixed ANOVA

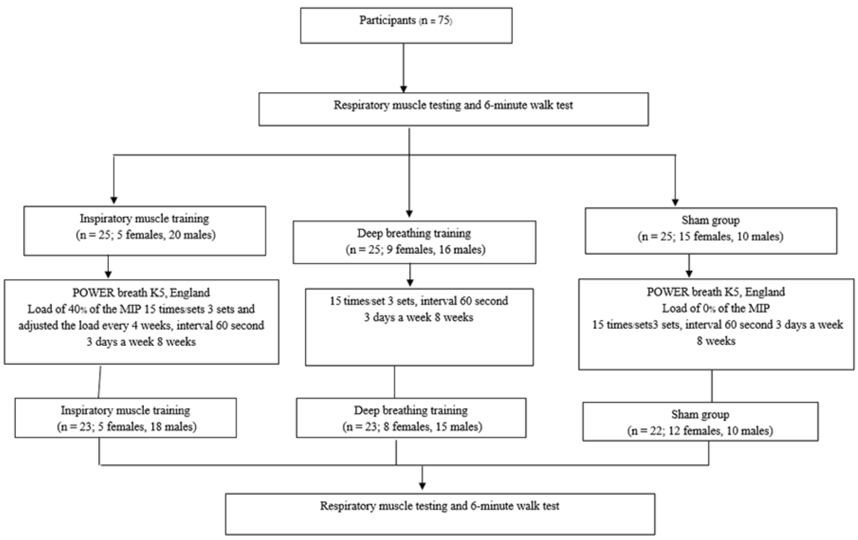

Figure 1. The flow chart enrolls the participants in the present study.

(time [2] X type [3]) was performed to evaluate the effect of respiratory muscle strength and functional exercise capacity in differences of breathing training, pre and post training within group with a confidence interval (CI) of 95%. The data analysis was calculated with SPSS program version 20. The statistically significance is set *p*-value less than 0.05.

Results

Seventy-five participants in this study were divided into three groups. Two participants in the inspiratory muscle training group were unable to complete the program because of their sickness. Two volunteers in the deep breathing training group refused to participant because of busy and three others were preparing for kidney transplant in the sham group. Thus, 68 participants (82.67%) in this study were reported with an average age of 50.79±14.95 years, 42 (61.76%) participants were male and 26 (38.24%) individuals were female. An average body mass index was 24.13±4.11 kg/m^2 with the duration of hemodialysis was 5.76±5.01 years. There were no significant differences among three groups in all variables prior to the intervention program (Table 1).

Respiratory muscle strength and functional capacity before and after intervention program

After training program, there were significant differences between groups of inspiratory muscle training and sham training (Δ24.10±8.13 cmH_2O, 95% CI = 7.855 to 40.339, p = 0.005, ηp^2 = 0.120). However, the MIP values were no significant differences between deep breathing training and the sham training (Δ13.92±8.13 cmH_2O, 95% CI -2.319 to 30.165, p = 0.092). In addition, the MIP values increased in inspiratory muscle training group and deep breathing group (Δ12.44±3.55 cmH_2O, 95% CI = 5.350 to 19.519, $p<0.001$, ηp^2 = 0.159 and Δ12.22±3.33 cmH_2O, 95% CI = 5.558 to 18.576, p = 0.001, ηp^2 = 0.171 respectively). According to the MEP, neither inspiratory muscle training nor deep breathing training were significant improved MEP ($p>0.05$).

Regarding the functional capacity, significance differences were not observed in three groups after intervention program ($p>0.05$). The 6-minute distance increased in only the inspiratory muscle training (Δ24.78±8.89, 95% CI = 7.035 to 42.530, p = 0.007, ηp^2 = 0.107) after an eight week intervention program, but not in the deep breathing training (Table 2).

Discussion

The study aimed to explore the effect of inspiratory muscle training, deep breathing training on respiratory muscle strength and functional exercise capacity (i.e., 6-minute walk test) among CRF patients. It was found that compare to the sham group, increased MIP values were noted in only inspiratory muscle training, but not in the deep breathing training. In addition, after an eight-week intervention program, MIP values and 6-minute walk distance increased in inspiratory muscle training. Furthermore, improved MIP values were observed in deep breathing training group.

Increased MIP values in inspiratory muscle training after intervention program was found in the present study, which is consistent with other studies[4,9]. It has been known that loss of muscle mass in CRF patients is the main problem that affects quality of life and activity of daily life[10,11]. The reduction of systemic protein and skeletal muscle mass leads to loss of muscle mass. In addition, Kosmadakis et al[12] assumed that inspiratory muscle training could increase Type I and type II muscle fibers in cross-sectional areas. Further, it has been also shown that inspiratory muscle training could increases in the proportion of show fibers and also in the size of the fast fibers[13]. It was also reported that exercise training results in transformation of fibers from fast fibers to slow fibers also opposite transformation[13]. Therefore, inspiratory muscle training could be reduced muscle atrophy and improved muscle strength.

However, only one study reported that inspiratory muscle training was not significant increased after eight weeks[14]. It might be due to insufficient intensity of training program; they increased duration time but not increasing load training whereas the other programs increased the intensity of inspiratory muscle training e.g., increasing from threshold at 40% to 50% of MIP. Therefore, the protocol of

Table 1. Characteristics data among three groups (n = 68)

	Inspiratory muscle training (n = 23)	Deep breathing training (n = 23)	Sham training (n = 22)	*p*-value
Gender (M/F)	18/5	15/8	10/12	
Age (years)	54.87±12.27	48.89±11.99	48.55±10.94	0.132
BMI (kg/m2)	25.51±4.26	23.24±3.48	23.63±4.34	0.135
Duration of HD (years)	6.93±5.67	4.26±4.98	6.09±4.03	0.183
MIP (cmH_2O)	67.43±32.91	57.04±25.27	54.45±24.38	0.258
MEP (cmH_2O)	67.26±25.83	66.70±33.11	68.50±29.44	0.978
6-MWD (meter)	359.30±79.35	404.43±88.99	376.05±138.89	0.344

M = Male, F = Female, BMI = Body mass index, HD = Hemodialysis, MIP = Maximal inspiratory pressure, MEP = Maximal expiratory pressure, 6-MWD = 6-minute walk distance inspiratory muscle training could affect the inspiratory muscle strength.

According to the deep breathing training, several studies revealed that the relationships between deep breathing training and the MIP values; those reports the deep breathing training could be an increase inspiratory muscle strength[15-17]. Rachatakarn et al[17] studied the effect of slow and deep breathing on respiratory muscle strength in healthy participants. They found that in the experimental group (i.e., deep breathing) had a higher MIP values compared with control group. They claimed that it might be the effect of an increase in diaphragm contraction and increase in lung inflation. Similarly, Jaju et al[15] examined the effect of pranayama breathing (i.e., deep breathing exercise) between patients with chronic obstructive pulmonary disease (COPD) and healthy group. These individuals were requested to perform inhale slowly for 6 seconds and also exhale slowly for 6 seconds. After 12 weeks deep breathing training program, MIP values significantly increased (Δ21.2 cmH_2O) in only the healthy group but not in the COPD group. Iranzo et al[16] examined the effect of inspiratory muscle training and yoga breathing (deep breathing was performed by slow and deep breathing) in older people with five days per week for nine weeks. The result found that increased inspiratory muscle strength was shown in both inspiratory muscle training and yoga training (Δ8 cmH_2O, and Δ17.1 cmH_2O, respectively). They suggested that decreases in respiratory muscle strength in older adults is due to the reduction of costovertebral joint mobility and the degradation of muscle fiber. Therefore, yoga breathing (i.e., deep breathing) could improve expansion of chest wall and increase in muscle length-tension resulting in an increased inspiratory muscle strength in elderly people. Santaella et al[18] examined the effect of yoga training (i.e, deep breathing) in elderly people for four months. Again, MIP values improved after training program (Δ14 cmH_2O). Deep breathing training is taking deep inspiration and slow exhalation resulting to decreasing respiration rate and that might have engaged in slow fibers[13]. However, the reason underlying the indirect improvement in MIP values caused by deep breathing is unclear, a possible reason is that, at least in part, due to a long inspiration and expiration that contribute to increased muscle length-tension and increased lung expansion resulting to inspiratory muscle strengthening. In addition, it should be noted that those studies reported in only healthy participants (including older people). Here, this is a first study that focused on the effect of deep breathing training in CRF patients; therefore, future studies need evidence to support the relationships between deep breathing training and cardio-respiration function in CRF.

Regarding to the functional capacity, 6-minute walk distance was increased in inspiratory muscle training group after eight weeks intervention program. The minimum clinically important difference (MCID) for 6-minute walk distance in the present study was 24.78 meters.

The other studies reported that MCID of 6-minute walk test in CRF patients that was changed in 65.5 meters after 10 weeks intervention program[19]. Likewise, Silva et al[14] found the 6-minute walk distance was increased estimated 102 meters after two months intervention. Here, the duration of study was only eight weeks which is shorter than previous studies[14,19]; therefore, this may reflect differences in the duration of intervention program and 6-minute walk distance. Further, a small change in the present study was observed in eight-week inspiratory muscle training program compared to other studies. This is might be a small changes in MIP values after training program (Δ12.44 cmH_2O) compared to Pellizzaro et al (Δ22.5 cmH_2O)[19] and de Silva et al (Δ50.1 cmH_2O)[14]. Therefore, it might be in part, explain small changes in 6-minute walk distance.

A systematic review with two studies (a total of 45 individuals compared between inspiratory muscle training

Table 2. Respiratory muscle strength and functional capacity values before and after training (n = 68)

	Inspiratory muscle training (n = 23)	Deep breathing training (n = 23)	Sham training (n = 22)
Baseline MIP (cmH_2O)	67.43±32.91***[a]	57.04±25.67**[c]	54.45±24.38
Post-intervention MIP (cmH_2O)	79.87±32.11***[a], *[b]	69.26±23.93**[c]	55.77±25.78*[b]
Δ MIP (cmH_2O)	12.44±3.55	12.22±3.33	1.32±3.63
Baseline MEP (cmH_2O)	67.26±25.83	66.70±33.11	68.50±29.44
Post-intervention MEP (cmH_2O)	71.39±27.06	72.74±24.25	66.32±25.18
Δ MEP (cmH_2O)	4.13±4.62	6.04±4.62	-2.18±4.72
Baseline 6-MWD (meter)	359.30±79.35*[a]	404.43±88.99	376.05±138.89
Post-intervention 6-MWD (meter)	380.09±85.69*[a]	410.48±82.94	374.09±126.98
Δ 6-MWD (meter)	24.78±8.89	6.04±8.89	-1.96±9.09

The data are expressed as mean ± SD

MIP = Maximal inspiratory pressure, MEP = Maximal expiratory pressure, 6-MWD = 6-minute walk distance

* $p<0.01$, ** $p\leq0.001$, *** $p<0.001$; [a, b, c] significant mean differences

and control group), the mean difference of 80 meters with 95% CI 41 to 119[20]. However, the present study reported the effect of inspiratory muscle training and deep breathing training on functional capacity, with sample size of 68 CRF patients. When compared to the breathing training (inspiratory muscle training or deep breathing training), walking distance did not significantly improvement in either inspiratory muscle training or deep breathing training group compared to the sham group. Therefore, a number of participants might be a consideration.

The present study found that neither inspiratory muscle training nor deep breathing training were a differences in sham group. It might be functional exercise capacity is influenced by the capacity of respiratory and cardiovascular systems to provide muscles with oxygen during exercise. Therefore, increases in respiratory muscle strength might not be able to increase functional exercise capacity. Further, several studies reported that lower limb strength (e.g., quadriceps muscle) is associated with the 6-minute walk distance[21-23]. As mention previously, patients with CRF have demonstrated uremic myopathy and affects cardio-respiratory function and musculoskeletal muscle function including peripheral muscle. Therefore, further studies need to examine the peripheral muscle strength.

The study has certain limitation that need to be taken into account. The study did not investigate performance of lower extremity muscle in particular quadriceps muscle that might associated with 6-minute walk distance. In addition, gender has been reported the association with respiratory muscle strength. Female gender in the sham group was higher compared to others groups (i.e., inspiratory muscle training and deep breathing training). Therefore, respiratory muscle strength in the sham group might be lower than other groups at baseline. Further, participants had a wide range of age (aged between 30 to 75 years). Thus, heterogeneity of age grouping and gender might be a confounding factor. Finally, the duration of intervention program should be a consideration which might effect on the cardiorespiratory function in CRF patients; difference in duration difference in the changes in cardiorespiratory function.

What is already known on this topic?

Decreased respiratory muscle strength has been observed in chronic renal failure patients compare to healthy people. Uremic syndrome leads to a reduction in size of type I and type II fibers, impairment in oxygen consumption and transportation and decreased protein synthesis. Inspiratory muscle training has evidenced to increase cardiorespiratory function and functional capacity in chronic renal failure patients who are receiving hemodialysis. However, deep breathing exercise has been also reported to improve respiratory performance and functional capacity in other conditions. Furthermore, these studies were examined in Western countries. However, little is known the effect of different breathing training (i.e., inspiratory muscle training and deep breathing training) in Thai patients with chronic renal failure.

What this study adds?

An increased in inspiratory muscle strength was noted in inspiratory muscle training among patients with chronic renal failure compared to sham group. In addition, improved inspiratory muscle strength could be found in both inspiratory muscle training and deep breathing training after 8-week intervention program. However, only inspiratory muscle training could improve functional capacity after training program but not in deep breathing training.

Potential conflicts of interest

The authors declare no conflicts of interest.

References

1. Ingsathit A, Thakkinstian A, Chaiprasert A, Sangthawan P, Gojaseni P, Kiattisunthorn K, et al. Prevalence and risk factors of chronic kidney disease in the Thai adult population: Thai SEEK study. Nephrol Dial Transplant 2010;25:1567-75.
2. Bohannon RW, Hull D, Palmeri D. Muscle strength impairments and gait performance deficits in kidney transplantation candidates. Am J Kidney Dis 1994;24: 480-5.
3. Tavana S, Hashemian SM, Jahromi FK. Effect of dialysis on maximum inspiratory and expiratory pressures in end stage renal disease patients. Tanaffos 2015;14: 128-33.
4. Figueiredo PH, Lima MM, Costa HS, Gomes RT, Neves CD, Oliveira ES, et al. The role of the inspiratory muscle weakness in functional capacity in hemodialysis patients. PLoS One 2017;12:e0173159.
5. Westerdahl E. Optimal technique for deep breathing exercises after cardiac surgery. Minerva Anestesiol 2015;81:678-83.
6. Kawecka-Jaszcz K, Bilo G, Drozdz T, Debicka-Dabrowska D, Kielbasa G, Malfatto G, et al. Effects of deviceguided slow breathing training on exercise capacity, cardiac function, and respiratory patterns during sleep in male and female patients with chronic heart failure. Pol Arch Intern Med 2017;127:8-15.
7. Turankar AV, Jain S, Patel SB, Sinha SR, Joshi AD, Vallish BN, et al. Effects of slow breathing exercise on cardiovascular functions, pulmonary functions & galvanic skin resistance in healthy human volunteers - a pilot study. Indian J Med Res 2013;137:916-21.
8. American Thoracic Society/European Respiratory Society. ATS/ERS Statement on respiratory muscle testing. Am J Respir Crit Care Med 2002;166:518-624.
9. El Deen HAB, Alanazi FS, Ahmed KT. Effects of inspiratory muscle training on pulmonary functions and muscle strength in sedentary hemodialysis patients. J Phys Ther Sci 2018;30:424-7.
10. van Loon IN, Bots ML, Boereboom FTJ, Grooteman MPC, Blankestijn PJ, van den Dorpel MA, et al. Quality of life as indicator of poor outcome in hemodialysis: relation with mortality in different age groups. BMC Nephrol 2017;18:217.

11. Pagels AA, Soderkvist BK, Medin C, Hylander B, Heiwe S. Health-related quality of life in different stages of chronic kidney disease and at initiation of dialysis treatment. Health Qual Life Outcomes 2012;10:71.
12. Kosmadakis GC, Bevington A, Smith AC, Clapp EL, Viana JL, Bishop NC, et al. Physical exercise in patients with severe kidney disease. Nephron Clin Pract 2010;115:c7-c16.
13. Polla B, D'Antona G, Bottinelli R, Reggiani C. Respiratory muscle fibres: specialisation and plasticity. Thorax 2004;59:808-17.
14. Silva VG, Amaral C, Monteiro MB, Nascimento DM, Boschetti JR. Effects of inspiratory muscle training in hemodialysis patients. J Bras Nefrol 2011;33:45-51.
15. Jaju DS, Dikshit MB, Balaji J, George J, Rizvi S, Al Rawas O. Effects of pranayam breathing on respiratory pressures and sympathovagal balance of patients with chronic airflow limitation and in control subjects. Sultan Qaboos Univ Med J 2011;11:221-9.
16. Iranzo MD, Arnall DA, Igual Camacho C, Tomas JM. Effects of inspiratory muscle training and yoga breathing exercises on respiratory muscle function in institutionalized frail older adults: a randomized controlled trial. J Geriatr Phys Ther 2014;37:65-75.
17. Rachatakarn R, Rittimanomai P, Itthithat P, Yuenyongchaiwat K. Preliminary outcome of the effect of slow and deep breathing exercise program on respiratory muscle strength in healthy participants aged 18-25: A randomized control trial. J Health Sci 2016;25:387-93. [in Thai]
18. Santaella DF, Devesa CR, Rojo MR, Amato MB, Drager LF, Casali KR, et al. Yoga respiratory training improves respiratory function and cardiac sympathovagal balance in elderly subjects: a randomised controlled trial. BMJ Open 2011;1:e000085.
19. Pellizzaro CO, Thome FS, Veronese FV. Effect of peripheral and respiratory muscle training on the functional capacity of hemodialysis patients. Ren Fail 2013;35:189-97.
20. de Medeiros AIC, Fuzari HKB, Rattesa C, Brandao DC, de Melo Marinho PE. Inspiratory muscle training improves respiratory muscle strength, functional capacity and quality of life in patients with chronic kidney disease: a systematic review. J Physiother 2017;63:76-83.
21. Pradon D, Roche N, Enette L, Zory R. Relationship between lower limb muscle strength and 6-minute walk test performance in stroke patients. J Rehabil Med 2013;45:105-8.
22. Rausch-Osthoff AK, Kohler M, Sievi NA, Clarenbach CF, van Gestel AJ. Association between peripheral muscle strength, exercise performance, and physical activity in daily life in patients with Chronic Obstructive Pulmonary Disease. Multidiscip Respir Med 2014;9:37.
23. Roxo RS, Xavier VB, Miorin LA, Magalhaes AO, Sens YA, Alves VL. Impact of neuromuscular electrical stimulation on functional capacity of patients with chronic kidney disease on hemodialysis. J Bras Nefrol 2016;38:344-50.

ผลของการฝึกกล้ามเนื้อหายใจเข้าและการหายใจแบบลึกในกลุ่มผู้ป่วยโรคไตวายเรื้อรัง: การเปรียบเทียบเชิงสุ่ม

กรอนงค์ ยืนยงชัยวัฒน์, พัชรินทร์ แสงครุฑ, ภัสสรา วศินศรัณย์กุล, ภูมิพัฒน์ พงษ์สุกรี, กชพรรณ จตุรัตนชัยพร, นพวรรณ จารุสุสินธ์, ศศิพิมพ์ ไพโรจน์กิตระกูล

วัตถุประสงค์: เพื่อเปรียบเทียบผลของการฝึกกล้ามเนื้อหายใจเข้าและการฝึกหายใจแบบลึกในกลุ่มผู้ป่วยโรคไตวายเรื้อรัง

วัสดุและวิธีการ: อาสาสมัครจำนวน 75 คน จากคลินิกผู้ป่วยนอกของฟอกไตเทียม อาสาสมัครถูกแบ่งออกเป็น 3 กลุ่ม; กลุ่มที่ได้รับการฝึกกล้ามเนื้อหายใจเข้า กลุ่มที่ได้รับการฝึกหายใจแบบลึก และกลุ่มควบคุม กลุ่มที่ได้รับการฝึกกล้ามเนื้อหายใจเข้าจะได้รับการฝึกใช้เครื่องฝึกกล้ามเนื้อหายใจด้วยระดับความหนักที่ 40% ของความแข็งแรงของกล้ามเนื้อหายใจเข้าโดยทำการฝึก 15 ครั้งต่อเซ็ต เป็นจำนวนทั้งสิ้น 3 เซต และมีช่วงพัก 60 วินาทีสำหรับกลุ่มที่ได้รับการฝึกหายใจแบบลึกจะได้รับการฝึกหายใจเข้าเป็นจำนวน 3 เซ็ตๆ ละ 15 ครั้ง โดยกำหนดอัตราหายใจเข้าต่อหายใจออกอยู่ที่ 1: 1.5 และมีช่วงพักเป็นเวลา 60 วินาที นอกจากนี้กลุ่มควบคุมจะได้รับการใช้เครื่องฝึกหายใจด้วยระดับความหนักที่ 0% ของความแข็งแรงของกล้ามเนื้อหายใจเข้า โดยทำการฝึก 15 ครั้งต่อเซ็ต เป็นจำนวนทั้งสิ้น 3 เซ็ต และมีช่วงพัก 60 วินาที โดยโปรแกรมดังกล่าวจะทำการฝึก 3 วันต่อสัปดาห์ เป็นเวลา 8 สัปดาห์ ทำการทดสอบความแข็งแรงของกล้ามเนื้อหายใจเข้าและการทดสอบระยะทางการเดิน 6 นาทีทั้งก่อนและหลังการให้โปรแกรม

ผลการศึกษา: หลังการให้โปรแกรมการฝึกพบว่ากล้ามเนื้อหายใจเข้ามีความแตกต่างอย่างมีนัยสำคัญทางสถิติระหว่างกลุ่มที่ได้รับการฝึกกล้ามเนื้อหายใจเข้ากับกลุ่มควบคุม (Δ24.10+8.13 เซนติเมตรน้ำ) นอกจากนี้ความแข็งแรงของกล้ามเนื้อหายใจก็พบว่ามีค่าเพิ่มขึ้นเมื่อเปรียบเทียบระหว่างก่อน-หลังการฝึก ทั้งในกลุ่มที่ได้รับการฝึกกล้ามเนื้อหายใจเข้าและกลุ่มที่ได้รับการฝึกหายใจแบบลึก (Δ12.44+3.55 เซนติเมตรน้ำ และ Δ12.22+3.33 เซนติเมตรน้ำ, ตามลำดับ) นอกจากนี้พบความแตกต่างของระยะทาง การเดินใน 6 นาทีก่อน-หลังการฝึกในกลุ่มที่ได้รับการฝึกกล้ามเนื้อหายใจเข้า (Δ24.78+8.89 เมตร)

สรุป: ความแข็งแรงของกล้ามเนื้อหายใจเข้ามีค่าเพิ่มขึ้น เมื่อเปรียบเทียบระหว่างก่อน-หลังการฝึกในกลุ่มที่ได้รับการฝึกกล้ามเนื้อหายใจเข้าและกลุ่มที่ได้รับการฝึกหายใจแบบลึก สำหรับระยะทางการเดินใน 6 นาทีพบว่ามีค่าเพิ่มขึ้นหลังการฝึกเฉพาะในกลุ่มที่ได้รับการฝึกกล้ามเนื้อหายใจเข้าเท่านั้น