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Effect of diaphragmatic anterior expansion training versus diaphragmatic breathing exercises on ventilatory function on postmenopausal kyphotic women

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***Abstract*---**Purpose: This study was conducted to determine the difference between the effect of anterior diaphragmatic training and diaphragmatic breathing on ventilatory function in post-menopausal kyphotic women. Subjects: Sixty women complaining from post-menopausal kyphosis participated in this study. They were selected randomly from Tanta University Hospital in Tanta. Their ages were ranged from 50 to 60 years old. Their body mass index was ranged from 25-30 kg/m2. Their degree of kyphosis was moderate degree of kyphosis according to block method. They did not receive any medical treatment during the research period. Women with mild and severe degree of kyphosis according to block method, cardiovascular conditions (Those with a known history of uncontrolled hypertension, ischemic attacks, stroke and congestive heart failure), severe pulmonary disease (Restrictive lung disease or obstructive lung disease) and musculoskeletal disorders (Severe osteoporosis or severe osteoarthritis) were excluded from the study. Design: Design of the study was randomized controlled study (Pre and post experimental study). They were divided into two equal groups (A&B). Group A consisted of thirty postmenopausal kyphotic women and treated by

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diaphragmatic breathing exercises, 3 times per week for 16 weeks. Group B consisted thirty postmenopausal kyphotic women and treated by anterior expansion breathing, 3 times per week for 16 weeks. Assessment: BMI was assessed by using standard weight and height scale. Kyphotic degree was assessed by using block method. Ventilatory functions was assessed by spirometer and 6-minute walk test for all women in both groups A & B. Results: There was significant increase in FVC, FEV1, FEV1/ FVC, FEF, MVV and 6-minute walk test in both groups A&B post treatment ($p<0.001$). Before treatment, there was no significant difference between two groups A&B in FVC, FEV1, FEV1/ FVC, FEF and MVV. Post treatment, there was significant difference between two groups in FVC, FEV1, FEV1/ FVC, FEF and MVV (More increase in group B). In 6 minute walk test, there was no significant difference between the two groups A & B before and after treatment. Conclusion: Accordingly, it can be concluded that the performance of anterior diaphragmatic expansion is more effective in improvement of ventilatory function than diaphragmatic breathing exercise in post-menopausal kyphosis women.

***Keywords*---**diaphragmatic anterior expansion training, diaphragmatic breathing exercise, ventilatory function, post menopausal kyphosis.

Introduction

Pregnancy is a physiological phenomenon that imposes numerous Kyphosis is a normal curvature of the thoracic spine, marked by a small anterior concavity resulting from the shape of vertebral bodies and intervertebral discs. After the fourth decade of life, the kyphosis angle begins to worsen and increase above 40°, leading to an excessive kyphosis curvature, known as “age-related hyper kyphosis” [1]. Increased thoracic kyphosis creates a mechanical restriction that can limit vital capacity [2]. Oxygen expenditure during walking has been correlated with kyphosis [3].

Hyper kyphosis reduces the amount of space in the chest, mobility of the rib cage, and expansion of the lungs. Decline in pulmonary function may be greater in persons with more severe kyphosis; however, no prospective studies have assessed this association. We conducted a longitudinal study to quantify the impact of kyphosis severity on decline in pulmonary function over 50 years in women and men on various organs and body systems of elder women, including their respiratory system, which naturally affect the health [4,5]. Older adults, especially women with hyper kyphotic posture, tend to have impaired respiratory function that places them at greater risk of earlier mortality due to pulmonary disorders such as pneumonia and chronic obstructive pulmonary disease [6].

Additionally, there is growing evidence to suggest that women with hyper kyphosis experience higher incidence of functional disorders, poor health conditions and earlier mortality [7]. Thus, due to the complications that can arise in people with age-related hyper kyphosis, it is crucial to provide significant attention to this condition. Age-related hyper kyphosis is currently attributed to underlying osteoporosis and vertebral fractures. Older individuals may be at greater risk of developing hyper kyphosis due to age-related decrease in muscle mass [8]. muscle strength [9].

In normal breathing, inspiration refers to the entry of external air into the body as the diaphragm contracts and moves downwards, while expiration refers to the relaxation an upward movement of the contracted diaphragm. However, when forced expiration or coughing occurs, the anterior and lateral abdominal muscles contract, thereby generating pressure that strongly moves the diaphragm upward. Here pelvic floor muscles (PFM)contraction helps maintain the abdominal pressure. From this view point, the PFM and deep abdominal muscles are involved in breathing through their concerted contractions [10].

Diaphragmatic breathing is a good technique for respiration and relaxation of the lungs because it enables sufficient exchange of oxygen and carbon dioxide. It is reported to be effective in improvement of ventilation efficiency, dyspnea, and activity ability [11]. reduction of metabolic acidosis, alleviation of back pain [12]. spine correction [13]. Anterior diaphragmatic training breathing is advanced technique to facilitate better oxygenation to achieve diaphragmatic breathing with good rib, spine, and pelvis position in form of: crocodile breathing, 3-month position and Kettebel breathing [10].

Material and methods

Subjects

Sixty women complaining from post-menopausal kyphosis participated in this study. They were selected randomly from Tanta University Hospital in Tanta. Their ages were ranged from 50 to 60 years old. Their body mass index was ranged from 25-30 kg/m2. Their degree of kyphosis was moderate degree of kyphosis according to block method. They did not receive any medical treatment during the research period. Women with mild and severe degree of kyphosis according to block method, cardiovascular conditions (Those with a known history of uncontrolled hypertension, ischemic attacks, stroke and congestive heart failure), severe pulmonary disease (Restrictive lung disease or obstructive lung disease) and musculoskeletal disorders (Severe osteoporosis or severe osteoarthritis) were excluded from the study. They were divided into two equal groups (A&B). Group A consisted of thirty postmenopausal kyphotic women and treated by diaphragmatic breathing exercises, 3 times per week for 16 weeks. Group B consisted of thirty postmenopausal kyphotic women and treated by anterior expansion breathing, 3 times per week for 16 weeks. This study was performed under the acceptance of ethical committee NO:012/003734 Faculty of Physical Therapy, Cairo University.

Materials

1. Weight-height scale:

It was used to measure the body weight and height to calculate the BMI for both groups A and B before and after treatment.

2. Stop watch:
   It was used to calculate time during six-minute walk test for each woman in both groups (A& B) before and after treatment.
3. Spirometer:
   It was used for assessment of ventilatory function for each woman in both groups (A& B) before and after treatment.

Procedures

All women were given a full explanation of the protocol of the study and consent form was signed for each woman before participating in the study.

Evaluation procedures

A detailed medical history and physical examination were taken from each woman in both groups before starting the study.

1. BMI assessment:
   Weight and height were measured to detect the BMI according to the following equation: BMI= weight/height^2 (Kg/m^2), before and after treatment for both groups (A and B).
2. Kyphotic degree assessment (Block method):
   The block method assessed women's degree of kyphosis by using 1.7 cm-thick blocks placed under the woman's head while lying supine. Hyper kyphotic individuals, when lying supine, are unable to lie in a neutral position without hyperextension of the neck. Blocks are placed under the head until a neutral position is achieved, with a greater number of blocks being indicative of a greater severity of kyphosis It was performed for all women in both groups A & B before and after treatment [2].

Fig. (1): Assessment of kyphosis by block method

3. Ventilatory function assessment (By spirometer):
   Spirometry is a simple test used to help diagnose and monitor certain lung conditions by measuring how much air she can breathe out in one forced

breath. It's carried out using a device called a spirometer, which is a small machine attached by a cable to a mouthpiece [14].

It was measured for all women who participated in the study. The following parameters were measured & recorded by spirometer (for all women in both groups A & B before and after treatment):

a- Forced vital capacity (FVC):
Forced vital capacity (FVC) is the amount of air that can be forcibly exhaled from the lungs after taking the deepest breath possible, as measured by spirometry. FVC spirometry was performed as follows:
i. Woman seated in a chair and asked to breathe comfortably.
ii. A clip is placed over her nose.
iii. Woman given a tube to breathe into.
iv. Sealing her lips tightly over the tube, and asked to inhale as deeply as possible and exhale as forcefully as she can [14].

b- Forced expiratory volume in first second (FEV1):
Forced expiratory volume in one second (FEV1) is a measurement of ability to expel air from lungs. More specifically, and as its name suggests, it is the amount that is exhaled in the first second of purposefully trying to breathe out as much air as possible.

c- The FEV1/FVC ratio: Forced expiratory volume in first second per forced vital capacity (FEV1/ FVC):
The FEV1/FVC ratio is a calculated ratio to be used in the diagnosis of obstructive and restrictive lung disease. It represents the proportion of a person's vital capacity that they are able to expire in the first second of forced expiration (FEV1) to the full, forced vital capacity (FVC). The result of this ratio is expressed as FEV1%. [14].

d- Forced expiratory flow (FEF25-75).
Mean forced expiratory flow during the middle half of the FVC. Formerly called the maximal mid-expiratory flow (MMEF), expressed in liters/second (BTPS). The FEF25-m • must be measured with an accuracy of at least ± 5% of reading or ± 0.200 Lis, whichever is greater, over a range of up to 7 L/s. The FEF25-75% must be measured on a system that meets diagnostic FVC recommendations [14].

e- Maximum voluntary ventilation (MVV):
The maximal voluntary ventilation (MVV) is the largest amount of air that a person can inhale and then exhale during a 12- to 15-s interval with maximal voluntary effort [14]. This maneuver was used to provide information about the functioning of the inspiratory pump and chest wall and is used to evaluate maximum ventilatory capacity [15]. and respiratory muscle endurance.
MVV may be determined directly by pulmonary function data using the functions MVV= FEV1 ×35.

Fig. (2): Assessment of ventilatory function.

Sex minute walk test

The 6 Minute Walk Test is a sub-maximal exercise test used to assess aerobic capacity and endurance. The distance covered over a time of 6 minutes is used as the outcome by which to compare changes in performance capacity. The object of this test is to walk as far as possible for 6 minutes. Woman walk back and forth in this hallway. Six minutes is a long time to walk, she was exerted herself. She probably gets out of breath or become exhausted. She was permitted to slow down, to stop, and to rest as necessary. Also lean against the wall while resting, but resume walking as soon as she were able. Way without hesitation [16]. It was performed for all women in both groups A & B before and after treatment

Treatment procedures

Group A (Diaphragmatic breathing exercise)

Each woman in group (A) were asked to take a deep breath from her nose slowly and make her abdomen like a balloon and then, to count of four, then asked to expire the air from her mouth with a sigh. This procedure was repeated four times of deep breaths to a count of four and expired to a count of four. 1-2 sets of 8 to 10 reps 3times per week for 16 weeks.

Fig. (3): Deep breathing exercises.

Group B (Anterior diaphragmatic expansion)

Anterior diaphragmatic expansion in the form of:

Crocodile breathing exercise

The woman lied on her stomach with her forehead resting on her hands. Then she was asked to begin deep breathing. Feel where she "rising and falling “is located”. If it is the chest: she asked to draw her breath down into the low back. Take as long as she need (usually at least 8-10 good deep breaths but sometimes longer). When she begins to feel her lower back rising and falling, continue with...

If it is the low back: gently push out the sides of her waist with her inhalations and allow them to ease back in with the exhalations. She was known when she has succeeded when she feels a "ballooning in and out" of her whole lower trunk (think 360-degree expansion of her midsection). Take as long as she need for this, until she feels her pelvis begin to rise and fall, then...

If it is the pelvis: she 're most of the way there! Just focus now on her feet as she breathes. This encouraged even deeper breathing. Continue this for 5-10 more good, deep, full breaths.

It is common to feel very relaxed after coming out from doing this. Her blood is highly oxygenated, her spine is more mobile, and her core muscles are now likely to operate more efficiently. 1-2 sets of 8 to 10 reps’ Full inhalation and full exhalation. 30 to 60 second rest for 16 weeks were done (Figure 4).

Fig. (4): Crocodile breathing exercise

Anterior three-month position

To achieve diaphragmatic breathing with good rib, spine, and pelvis position. Woman laid supine with knees wide, feet up and together; can use a wall for assistance initially. Chin should be tucked, with her shoulders and ribs down. Maintaining the good rib position, asked her take a deep breath in through the nose and into the belly. Forcefully exhale the air through the mouth and force the ribs down. After a full exhale, pause for a second and then take another breath in. Make sure ribs stay down! No arching of her the back, but also do not over flatten the back her shoulders should not elevate during the inhale breath should be into the diaphragm. 1-2 sets of 8 to 10 reps' Full inhalation and full exhalation. 30 to 60 second rest for 16 weeks were done (Figure 5).

Fig. (5): Anterior three month position.

Anterior-kettlebell breathing

Crock lying position with the kettlebell rested at lower abdomen hand rested beside the body with extended elbow and the other hand support the kettlebell. She asked to take deep breathing from her nose the diaphragm will lowering down and the kettlebell will see to be raised 1-2 sets of 8 to 10 reps. Full inhalation and full exhalation 30 to 60 second rest for 16 weeks (Figure 6).

Fig. (6): Anterior-kettlebell breathing

Statistical analysis

Data analysis was conducted using SPSS software, version 25 (IBM Corp., Armonk., NY., USA). The Shapiro–Wilk test was used to determine whether the data were normally distributed (p>0.05). Continuous data were described as mean± standard deviation (SD). Baseline characteristics between the two groups were compared using the Independent Samples t-test. Paired t-test was conducted to examine the changes in variables before and after the intervention in each group; while an independent samples t-test was conducted to examine the differences between the two groups. P-values < 0.05 were considered statistically significant.

Results

General characteristics of the patients

There was no significant difference (p>0.05) in the mean value of age, weight and height between both groups A and B before treatment (Table 1). There were no statistically significant differences between the two groups regarding age, weight, height and BMI before treatment.

Table (1)
Physical characteristics of patients

Variables	Group (A)	Group (B)	t-test [a]	P-value [a]	Significance
Age (years)	55.37±3.13	55.27±3.37	0.119	0.906	NS
Weight (Kg)	81.55±7.59	80.50±9.93	0.460	0.647	NS
Height (cm)	161.93±6.11	164.17±5.95	-1.433	0.157	NS
BMI (kg/m^2)	31.16±2.54	29.91±2.55	1.913	0.061	NS

Data represented as mean ± standard deviation (SD). **t**: Student t-test. NS: Not significant. [a]: Independent Sample t-test. [*]: Statistically significant at P <0.05 according to Independent Sample t-test.

Ventilatory functions (FVC, FVE1, FVE1/FVC, FEF, MVV) and 6 MWD

There was significant increase in FVC, FEV1, FEV1/ FVC, FEF, MVV and 6minute walk test in both groups A&B post treatment (p<0.001). Before treatment, there was no significant difference between two groups A&B in FVC, FEV1, FEV1/ FVC, FEF and MVV. Post treatment, there was significant difference between two groups in FVC, FEV1, FEV1/ FVC, FEF and MVV (More increase in group B). In 6 minute walk test, there was no significant difference between the two groups A & B. (Table 2).

Table (2)
Comparison of FVC, FVE1, FVE1/FVC, FEF, MVV, and 6MWD between pre and post intervention in both groups

Dependent variable		Pre treatment	Post treatment	Mean difference	Percentage of change	P value
FVC (L)	Group A	2.56±0.17	2.73±0.13	0.17±0.09	6.64% ↑	<0.001*

	Group B	2.54±0.15	2.87±0.14	0.33±0.11	12.99% ↑	<0.001*
	P value	0.665	<0.001			
FVE1 (L)	Group A	2.11±0.29	2.48±0.19	0.37±0.18	17.54% ↑	<0.001*
	Group B	2.13±0.42	2.60±0.21	0.47±0.44	22.07% ↑	<0.001*
	P value	0.665	0.037			
FVE1/FVC (%)	Group A	81.58±4.95	84.19±4.03	2.61±1.58	3.20% ↑	<0.001*
	Group B	81.83±6.52	86.93±5.04	5.11±2.96	6.23% ↑	<0.001*
	P value	0.0665	0.023			
FEF (L/S)	Group A	5.71±0.91	6.06±0.98	0.35±0.28	6.13% ↑	<0.001*
	Group B	5.70±0.62	6.73±0.92	1.03±0.68	18.07% ↑	<0.001*
	P value	0.665	0.008			
MVV (L/Min)	Group A	73.85±3.44	86.80±5.96	12.95±6.06	17.54%↑	<0.001*
	Group B	74.55±5.30	91.00±4.31	16.45±5.83	22.07%↑	<0.001*
FVE1/FVC (%)	P value	0.665	0.003			
6MWD)	Group A	572.68±39.84	594.58±45.23	21.90±19.01	3.82% ↑	<0.001*
	Group B	571.07±35.73	604.77±53.01	33.70±22.59	5.90% ↑	<0.001*
	P value	0.665	0.364			

FVC: Forced vital capacity (L). FEV_1: Forced expiratory volume in first second (L). FEV_1/ FVC: Forced expiratory volume in first second per forced vital capacity (%). FEF: Forced expiratory flow (L/S). MVV: Maximum voluntary ventilation (L/Min). 6MWD: Six-Minute Walk Test (m). Data represented as mean ± standard deviation (SD).

Discussion

The prevalence of hyperkyphosis occurs in 20–40 % of older adults above 50 years old [17]. While thoracic kyphosis impacts both sexes, the condition increases at a higher rate in women, particularly during the menopause years when compared with men. Additionally, there is growing evidence to suggest that women with hyperkyphosis experience higher incidence of functional disorders, poor health conditions and earlier mortality [7]. Thus, due to the complications that can arise in people with age-related hyperkyphosis, it is crucial to provide significant attention to this condition. Age-related hyperkyphosis is currently attributed to underlying osteoporosis and vertebral fractures. Older individuals may be at greater risk of developing hyper kyphosis due to age-related decrease in muscle mass, muscle strength muscle quality, bone mineral density and increased fragility of connective tissue [18].

Furthermore, women develop hyperkyphosis earlier than men and have greater degree of kyphosis in general Women may be at higher risk of greater kyphosis due to more associated factors including poor posture, changes in connective tissue, ligament and muscle tone loss, poorer spinal extensor muscle quality and strength, lower bone mineral density and more vertebral fractures, a lower physical activity level and the weight of hanging breasts. Increased thoracic kyphosis creates a mechanical restriction that can limit vital capacity, Oxygen expenditure during walking has been correlated with kyphosis [3].

In pulmonary defect airflow resistance impairs respiratory mechanics that may compromise postural alignment. There is a lack of studies that have investigated compromised postures and their possible associations with pulmonary function. Postural alignment of the anterior tilt of the right and left pelvis and thoracic kyphosis is different when compared with women and healthy individuals. There is a relationship between pulmonary function and postural alignment in Kyphotic women patients [3].

Hyperkyphosis reduces the amount of space in the chest, mobility of the rib cage, and expansion of the lungs. Decline in pulmonary function may be greater in persons with more severe kyphosis; however, no prospective studies have assessed this association. We conducted a longitudinal study to quantify the impact of kyphosis severity on decline in pulmonary function over 50 years in women. [4]. This study was conducted to determine the difference between the effect of anterior diaphragmatic training and diaphragmatic breathing on ventilatory function in post-menopausal kyphotic women.

Sixty women complaining from post-menopausal kyphosis participated in this study. They were selected randomly from Tanta University Hospital in Tanta. Their ages were ranged from 50 to 60 years old. Their body mass index was ranged from 25-30 kg/m2. Their degree of kyphosis was moderate degree of kyphosis according block method. They were medically stable and consented to participate in the study. They did not receive any medical treatment during the research period.

They were divided into two equal groups (A&B). Group A consisted of thirty postmenopausal kyphotic women and treated by diaphragmatic breathing exercises, 3 times per week for 16 weeks. Group B consisted thirty postmenopausal kyphotic women and treated by anterior expansion breathing, 3 times per week for 16 weeks. BMI was assessed by using standard weight and height scale. Kyphotic degree was assessed by using block method. Ventilatory functions was assessed by spirometer and 6 minute walk test for all women in both groups A & B before and after treatment.

Results of this study found that; there were no statistically significant differences between the two groups regarding age, weight, height and BMI before treatment. There was significant increase in FVC, FEV1, FEV1/ FVC, FEF, MVV and 6 minute walk test in both groups A&B post treatment ($p<0.001$). Before treatment, there was no significant difference between two groups A&B in FVC, FEV1, FEV1/ FVC, FEF and MVV. Post treatment, there was significant difference between two groups in FVC, FEV1, FEV1/ FVC, FEF and MVV (More increase in group B). In 6 minute walk test, there was no significant difference between the two groups A & B.

Older adults, especially women with hyperkyphotic posture, tend to have impaired respiratory function that places them at greater chance of earlier mortality due to pulmonary disorders such as pneumonia and chronic obstructive pulmonary disease [1]. Anterior diaphragmatic training breathing is advanced technique to facilitate better oxygenation to achieve diaphragmatic breathing with good rib, spine, and pelvis position in form of Crocodile breathing, 3 Month position and Kettebel breathing [19].

Crocodile Breathing is a way of encouraging breathing by diaphragmatic activation rather than inhibition. When diaphragm to breathe as opposed to the more typical "shallow breathing" of the intercostal muscles, greater thoracic mobilization is established and enhanced core muscle activation is enabled [20]. The 3-month Breathing Position aligns the body properly for effective breathing, proper respiratory function that is vital in developing efficient core function and important in building block in any workout [21].

Kettlebell breathing exercise very effective in changes about patient's pain or dysfunction as true functional core stability is created when multi-task and breathe from diaphragm as using kettlebell over the lower abdomen during individual breath-holding as a strategy to gain strength, Breathing Pattern into the start of routine will help in relieve stress, boost energy, realign body and give a boost to breathing better [22]. Diaphragmatic breathing is a good technique for respiration and relaxation of the lungs because it enables sufficient exchange of oxygen and carbon dioxide. It is reported to be effective in improvement of ventilation efficiency, dyspnea, and activity ability Moen et al., [11] reduction of metabolic acidosis, alleviation of back pain, spine correction [12].

The results of this study agreed with that of Stephanie et al., [23] who reported that high-intensity IMT (inspiratory muscle training) results in increased contracted diaphragm thickness and increased lung volumes and exercise capacity in people who are healthy. Also, the results agreed with that of Cho et al., [20] who investigated the effects of the crocodile breathing exercise on the muscle activity of the erector spinae muscle in patients with back pain and limited mild respiratory function. He suggests that crocodile breathing is a good method for improving muscle activity in patients with back pain and improvement of ventilatory function.

Our results are also in agreement with that of Dong et al., [24] who found that IMT (inspiratory muscle training) is able to improve maximum inspiratory pressure and skill-related physical fitness in post-menopausal kyphotic women. The results of this study are supported with that of Kim et al., [25] who found that IMT (inspiratory muscle training) very effective in improvement of pulmonary function and gait ability in sub-acute stroke patient. Anterior diaphragmatic training breathing is advanced technique to facilitate better oxygenation to achieve diaphragmatic breathing with good rib, spine, and pelvis position in form of Crocodile breathing, 3 Month position and Kettebel breathing [19].

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individual breath-holding as a strategy to gain strength, Breathing Pattern into the start of routine will help in relieve stress, boost energy, realign body and give a boost to breathing better [25].

The results agreed with that of Weiner et al., [26] who stated that a respiratory exercise program increased muscle strength and was associated with a positive effect on patient health and quality of life. Therefore, a respiratory training program could be included in the therapeutic approach in older adults.Also, the results agreed with Gopala et al., [27] who found that greater improvement in pulmonary function and diaphragm excursion during comparison of diaphragmatic breathing exercise, volume and flow incentive spirometry, on diaphragm excursion and pulmonary function in patients undergoing laparoscopic surgery.

The results also agreed with that of Budiman et al., [28] who found that there was a reduction in the Mean±SD score of breathlessness from 3.42±0.53 to 1.64±0.13 after diaphragmatic breathing (P=0.001). There were improvements in the breathing frequency (Mean±SD: 11.8±4.9 vs 9.5±1.6), oxygen saturation (93.39±3.20 vs 95.47±4.21), and FEV1/FVC (0.5±0.12 vs 0.3±0.45) in the study subjects in patient with chronic obstructive pulmonary disease.

The results of this study also supported with that of Ryu [29] who found that pulmonary physical therapy is considered necessary to improve respiratory function and fatigue degradation of elderly in a facility. Our results are also supported with that of Mohamed et al., [30] who showed that the responses of ventilatory functions to breathing exercise versus breathing exercise with chest mobilizing exercise in elderly women. The results showed that the ventilatory functions reported statistically significant improvement at post-exercise within each group when compared with pre-exercise mean values.The results are also supported with that of Salameh [31] who found that diaphragmatic breathing exercise improve ventilatory function and dyspnea relief in elderly women with kyphosis.

Our results came insistence with that of Min-Sik et al., [32] who found that there was a significant difference in the functional vital capacity (FVC) and slow vital capacity (SVC) before and after all breathing exercises through assessment Effects of diaphragm breathing exercise and feedback breathing exercise on pulmonary function in healthy adults. Our results also came insistence with that of Gomieiro et al., [33] who studied the effect of diaphragmatic breathing exercise program that increased muscle strength and was associated with a positive effect on patient health and quality of life in older adults with asthma.

The results of this study disagreed with that of Gosselink [34] who found no change significantly during diaphragmatic breathing. Dyspnea sensation tended to increase during diaphragmatic breathing in patient with chronic pulmonary dysfunction. The results of this study also disagreed with that of Tucker and Jenkin, [35] who found that there is no evidence that breathing control (diaphragmatic breathing exercises) improves regional ventilation. Regarding to the comparison between anterior diaphragmatic breathing and diaphragmatic breathing; results agreed with that of Hodges et al., [36] who compare activation of diaphragm from different limb position, versus deep breathing exercise and found that activation of anterior diaphragm more effective than diaphragmatic breathing in improve lung capacity and pulmonary function.

Also, the results agreed with Luca et al., [37] who studied the effects of new modality (core stabilization exercises based on anterior diaphragmatic breathing) on pulmonary function, abdominal fitness, and movement efficiency, have a major effect than traditional breathing exercise. The results of this study disagreed with that of Arazi et al., [38] who studied the effect of a breathing exercise on respiratory function and 6-Minute walking distance in patients under hemodialysis. They concluded that no significant difference was found in 6MW distance between the groups at the 2-month posttest.

Conclusion

Accordingly, it can be concluded that the performance of anterior diaphragmatic expansion is more effective in improvement of ventilatory function than diaphragmatic breathing exercise in post-menopausal kyphosis women.

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