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Research Article

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The Effects of Diaphragmatic Mobilization Techniques on Respiratory Functions, Sleep Quality, Anxiety and Depression in Persons: Application in Obese Persons

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Abstract

Aim: *The effects of mobilization approaches in weight-related respiratory problems in people diagnosed with obesity are not clearly known. In this study, the effects of dia-phragmatic mobilization methods on respiratory functions, fatigue, sleep quality, anxiety and depression in obese individuals were emphasized.*

Methods: *Within the scope of our study, people aged between 18-65 years and a body mass index (BMI) of 30 kg/m2 and above were included in the process, sociodemographic information was recorded, and randomized diaphragmatic mobilization group (n=20) and control group (n=20) were included. The study was continued by dividing into two groups. Diaphragmatic mobilization approaches (diaphragmatic translation technique, di-aphragm stretching technique, diaphragm eight technique) were applied to the treated group for an average of 15-20 minutes, 2 sessions per week, for a total of 4 weeks. No effects were seen in obese subjects in the control group. Necessary evaluations were made within the group before and after the study.*

Result: *In the comparison of the difference values of both groups within the scope of our study, spirometric measurements were FEF (25-75%), MVV (%), (L) parameters, respir-atory muscle strength measurement in all parameters, fatigue, sleep quality, depression, SF-36; A statistically significant difference was found in physical function and energy sub-parameters (p<0.05).*
Conclusion: As a result, it has been seen that diaphragm mobilization techniques are a safe and feasible approach that can improve the respiratory functions, sleep and quality of life of obese individuals and minimize the symptoms of fatigue.

Summary Statement
What is already known about this topic?

- *Respiratory functions, sleep and quality of life of obese individuals are not good and they experience fatigue very often. What this paper adds?*
- *Demonstrated the effect of diaphragm mobilization techniques. The implications of this paper:*
- *As a result, it has been revealed that diaphragm mobilization techniques are a good indication in obese individuals.*

Keywords: Obesity, Diaphragm, Mobilization, Respiratory Functions

Introduction

Obesity emerges as a public health problem that is increasing related to morbidity. With increasing life expectancy and increasing population, it is inevitable that obesity-related diseases will become more common. Obesity is a health problem with an increasing prevalence worldwide, primarily in developed countries. Obesity is the second leading cause of preventable death after smoking [1].

Obesity is defined by the World Health Organization (WHO) as an increase in the amount of lipids in body composition that adversely affects human health [2, 3]. Causes of increase in obesity; These are factors such as consuming foods with high calorie levels, low physical activity, and increasing use of transportation vehicles [4]. Obesity is a chronic disease that is characterized by excessive fat storage in the body and causes increased morbidity and mortality due to its negative effects on the endocrine, cardiovascular, respiratory, gastrointestinal, genitourinary and musculoskeletal systems [5]. WHO and the National Institutes of Health classify overweight as having a body mass index (BMI) between 25.0 and 29.9 kg/m^2, and obesity as having a BMI greater than 30 kg/m^2 [6].

Obesity is a chronic disease with complications such as cardiovascular diseases, hypertension, hyperlipidemia and diabetes, leading to reductions in life expectancy. In general, it is stated that people who are obese have lower health-related quality of life than those who are not obese. However, the relationship between quality of life and obesity also differs by gender. Compared to men, it is observed that the quality of life of obese women is lower [7]. Recent studies show that abdominal obesity increases at a higher rate than general obesity [8]. The global obesity epidemic seems to be one of the most detrimental causes of health in the world [9].

Considering the effects associated with obesity, it is stated that obesity may be associated with deterioration in sleep quality, an increase in anxiety, depression levels, and decreases in respiratory functions. It shows that insomnia, insufficient sleep, poor sleep quality and disruption of circadian rhythms can cause obesity [10].

It is stated that depression and anxiety will be the driving force that increases obesity, and as obesity increases, this may increase depression and anxiety [11]. At the same time, it is stated that there may be respiratory symptoms such as obesity and especially shortness of breath. Excess fat tissue in the abdominal region presses on the thoracic region, this pressure prevents the full expansion of the thorax during breathing and causes a decrease in the movement of the chest wall [12]. Obesity increases the incidence of chronic respiratory problems, especially asthma [13, 14]. In order for adequate and adequate breathing to occur, both the lungs and the chest wall must be able to expand with little effort. If this does not happen, for example, if the lung or chest wall is obstructed for any reason, ventilation failure or excessive fatigue of the respiratory muscles will occur. In cases such as obesity, a restrictive situation occurs in the chest wall. In restrictive conditions, there is a decrease in lung volumes such as forced vital capacity (FVC) or forced expiratory volume in the first second (FEV1) [13].

Manual therapy approaches are one of the methods used in recent years to alleviate respiratory tract problems [15]. Thoracic manual therapy approaches are known as stretching the respiratory muscles, soft tissue massage and relaxation of the muscles [16]. The aim of most of these techniques is to increase the mobility of the rib cage and spine, increasing the function of the lungs and circulation [17]. Manual therapy methods applied to the thorax can be used as a treatment for respiratory disorders and respiratory diseases such as hyperventilation and hypocapnia [18, 19].

Diaphragm muscle is the first muscle that comes to mind when respiratory muscles are mentioned [20]. Diaphragmatic muscle dysfunctions cause deterioration in respiratory patterns and disrupt the physiological balance between body systems [21]. Mobility and physiological changes of the diaphragm muscle have been investigated in chronic lung diseases [22]. However, it is seen that there are very few studies on diaphragmatic mobilization, especially in conditions that affect the respiratory system [23, 24]. In recent years, muscle stretching technique plays an important role in the pre-activity preparation of athletes, especially in high performance sports [25]. Recent studies on muscle stretching technique have proven that muscle control, flexibility and range of motion increase [26, 27].

Although there is little evidence that manual therapy is effective in respiratory system dysfunctions, it has the potential to improve spirometric measures of lung function and reduce symptoms of medical therapy in individuals with asthma [28-32]. According to our literature review, few studies have investigated the effects of manual techniques, especially diaphragmatic techniques, in obstructive lung diseases, and the effects of these techniques in restrictive lung diseases and obesity have not been investigated yet. Our aim in our study is to examine the effects of Diaphragmatic Mobilization Techniques on Respiratory Functions, Fatigue, Sleep Quality and Anxiety, Depression in Obese Individuals.

- **H_0**: Diaphragmatic mobilization techniques have no effect on respiratory functions, fatigue, sleep quality and anxiety and depression in obese individuals.
- **H_1**: Diaphragmatic mobilization techniques have effects on respiratory functions, fatigue, sleep quality and anxiety and depression in obese individuals.

Materials and Methods

Sociodemographic characteristics of the individuals participating in our study; Age, gender, height, body weight and BMI values were recorded. The evaluations of all individuals participating in the study before and after the four-week study period were made with the following outcome measures.

Evaluation of respiratory functions

Pulmonary functions of individuals were evaluated in sitting position, using a portable spirometer device (COSMED, Micro Quark-Spirometer, Rome, Italy) according to ATS/ERS criteria [33].

The individuals participating in the study were informed about the test before the test. The test was repeated 2 times and the best results were recorded. The individual was seated in an armless chair, a latch was placed on his nose, and his mouth was asked to close tightly so that the corners of the mouth could fully grasp the device. In pulmonary function test, FVC, FEV1, FEV1/FVC, peak flow rate (PEF), 25-75% of forced expiratory flow rate (FEF(25-75%)) and maximum voluntary ventilation (MVV) values, age, height , were recorded as expected values and percent of body weight and sex [34].

Sleep Quality Assessment

The Pittsburg Sleep Quality Index (PUKI) was used to evaluate the sleep quality of the individuals participating in our study before and after the 4-week study. PUKI is a test used to determine an individual's sleep quality in the last month and sleep-related problems in the last month. It is a scale consisting of 24 questions and 19 self-report items, with a score range of 0-21, and five questions must be answered by a roommate or a spouse. Assessing a wide variety of domains related to sleep quality, including titles, sleep duration, delays in falling asleep, frequency and severity of sleep-related problems, and the impact of poor sleep on an individual's functioning. It is a test with validity and reliability [35, 36].

Anxiety and depression level assessment

The Hospital Anxiety and Depression (HAD) scale was used to determine the anxiety and depression levels of the individuals participating in the study before and after the 4-week study. This scale is a self-report scale including anxiety and depression subscales. It consists of 14 items, 7 of which are depression and 7 of which are investigating symptoms of anxiety. The answers are evaluated in a 4-point Likert format and scored between 0-3. The aim of the scale is not to diagnose, but to determine the risk group by screening for anxiety and depression in patients with physical illness in a short time [37].

Findigs

Descriptive Characteristics of Participants

A total of 40 individuals, consisting of obese volunteers between the ages of 18-65, 20 individuals in the Diaphragmatic Mobilization group and 20 individuals in the Control group were included in our study. At the end of the study, 3 people in the Diaphragmatic Mobilization group and 3 people in the Control Group could not complete the study due to the Covid-19 pandemic process, and 17 people in the training group and 17 people in the control group completed the study.

The mean age of the individuals participating in the study was 38.11±10.46 years, and the mean BMI was 31.38±1.96 kg/m². There was no statistically significant difference in all parameters in the groups included in the study ($p>0.05$) (Table 3.1). Statistics on the descriptive characteristics of the participants are shown in Table 3.2.

Table 3.1: Comparison of the sociodemographic characteristics of the participants

	Diaphragmatic Mobilization Group (n=20) X±SS	Control Group (n=20) X±SS	Total (N=40) X±SS	p
Age (years)	37,00±9,02	39,22±11,89	38,11±10,46	0,667
Height (cm)	169,44±8,33	168,05±8,29	168,75±8,22	0,500
Body weight (kg)	89,72±10,40	89,16±9,84	89,44±9,98	0,333
BMI (kg/m²)	31,16±1,56	31,60±2,32	31,38±1,96	0,500
X±SD = Mean ± Standard Deviation				
cm = centimeters, kg = Kilograms, BMI = Body Mass Index, m² = Square Meters, n = Number				

Table 3.2: Descriptive characteristics of the participants

		Diaphragmatic Mobilization Group (n=20)	Control Group (n=20) X±SS	Total (N=40)
Sex	Woman	6 (%30)	9 (%45)	15 (%37,5)
	Man	14 (%70)	11 (%55)	25 (%62,5)
Educational Status	Primary school	0	1 (%5)	1 (%2,5)
	Secondary School	1 (%5)	3 (%15)	4 (%10)
	High school	8 (%40)	9 (%45)	17 (%42,5)
	University	10 (%50)	7 (%35)	17 (%42,5)
	PhD	1 (%5)	0	1 (%2,5)
Smoking Habit	Yes	4 (%20)	6 (%30)	10 (%25)
	No	16 (%80)	14 (%70)	30 (%75)
n = Number, % = Percent				

Pulmonary Function Test Measurements

When the intra-group differences of pulmonary function test parameters were examined, there was no significant difference in all parameters except PEF ($p=0.011$) in the Diaphragmatic Mobilization group ($p>0.05$). In the control group, there was a significant decrease in the MVV ($p=0.028$) parameter, while there was no significant difference in all other parameters ($p>0.05$). Considering the effect sizes, the PEF parameter was found to be moderately effective in the Diaphragmatic Mobilization Group, while a low effect size was observed in all other parameters. In the control group, low effect size was observed in all parameters.

Table 3.3: Intragroup differences of Pulmonary Function Test measurement parameters

	Diaphragmatic Mobilization Group (n=17)			Control Group (n=20) X±SS		
	X±SS		p	X±SS		P
	First Measurement	Last Measurement		First Measurement	Last Measurement	
FEV1 (L)	3,02±0,66	3,15±0,58	0,535	2,86±0,67	2,99±0,70	0,408
ES	**0,1**			**0,09**		
FEV1 (%)	86,22±16,13	90,88±16,72	0,266	78,55±11,01	83,29±13,06	0,393
ES	**0,14**			**0,17**		
FVC (L)	4,08±0,78	4,15±0,60	0,287	3,76±0,68	3,98±0,78	0,246
ES	**0,05**			**0,14**		
FVC (%)	97,72±12,97	101,82±16,41	0,073	89,44±10,79	92,35±12,52	0,831
ES	0,13			0,12		
FEV1/FVC	73,24±11,19	76,95±8,49	0,619	72,36±11,48	73,10±10,35	0,586
ES	**0,18**			**0,03**		
PEF (L/sn)	4,54±2,10	6,25±2,12	**0,011***	4,45±2,15	0,758	0,758
ES	**0,37**			**0,01**		
FEF%25-75 (L)	2,94±1,03	2,94±1,23	0,435	2,75±1,06	2,94±1,02	0,255
ES	**0,00**			**0,09**		
MVV (L)	72,93±27,34	79,35±18,03	0,149	74,61±19,47	68,38±16,30	0,028*
ES	**0,13**			**0,17**		
MVV (%)	56,55±15,67	63,94±15,67 0,170	0,170	61,72±14,77	56,76±11,29	0,108
ES	**0,22**			**0,18**		

X±SD = Mean ± Standard Deviation, % = Percent, L = Liters, n = Number,
ES = Effect Size, FVC = Forced Vital Capacity,
FEV1 = Forced Expiratory Volume in One Second,
FEV1/FVC = Ratio of Forced Expiratory Volume to Forced Vital Capacity in One Second,
PEF = Peak Flow Rate,
FEF(25-75%) = 25-75% Flow Rate of Forced Expiratory Volume,
VC = Vital Capacity, IC = Inspiratory Capacity,
MVV = Maximum Voluntary Ventilation
Wilcoxon Test, *p<0.05

Evaluation of Sleep Quality

When the sleep quality differences before and after the treatment were examined, there was a statistically significant difference in the Diaphragmatic Mobilization Group (p=0.012), but no statistically significant difference was found in the control group (p=1,000). In the evaluation of Sleep Quality, the effect size of the effect size was low in both groups.

Table 3.4: Inter-measurement differences of sleep quality

	Diaphragmatic Mobilization Group (n=17)			Control Group (n=20) X±SS		
	X±SS		p	X±SS		P
	First Measurement	Last Measurement		First Measurement	Last Measurement	
Pittsburgh Sleep Quality Scale	9,59±2,37	8,77±1,89	**0,012***	8,24±1,64	8,29±1,76	1000
ES	0,13			0,03		
X±SD = Mean ± Standard Deviation, n = Number, ES = Effect Size						

Table 3.5: Comparison of sleep quality changes

	Diaphragmatic Mobilization Group (n=17) (ΔX±SS)	Control Group (n=17) (ΔX±SS)	p
Pittsburgh Sleep Quality Scale	0,82±1,13	0,05±0,89	**0,045***
Δ = Difference between measurements, n = Number, sec = Seconds, X±SD = Mean ± Standard Deviation Mann-Whitney U Test *p<0.05			

Evaluation of Anxiety and Depression

Considering the differences in anxiety and depression measurement parameters before and after treatment, there was a statistically significant difference for the HAD Scale Depression sub-parameter in the Diaphragmatic Mobilization Group (p=0.027), but not for anxiety (p=0.330). In the control group, there was no statistically significant difference in both sub-parameters (p>0.05). In the evaluation of depression, it was found to be moderate in the education group and low in the control group. In the assessment of anxiety, the effect size was found to be low in both groups.

Table 3.6: Intragroup differences of Anxiety and Depression measurement parameters

	Diaphragmatic Mobilization Group (n=17)			Control Group (n=17) X±SS		
	X±SS		p	X±SS		p
HAD	First Measurement	Last Measurement		First Measurement	Last Measurement	
Anxiety Score	8,33±2,42	8,00±2,29	**0,330***	7,27±2,21	7,35±1,90	0,257
ES	**0,14**			**0,03**		
Depression score	8,44±2,45	7,58±1,32	0,0270*	6,83±1,24	6,82±1,01	0,157
ES	0,43			0,00		
X±SD = Mean ± Standard Deviation, n = Number, ES = Effect Size Wilcoxon Testi *p<0,05						

Table 3.7: Comparison of changes in anxiety and depression measurement parameters

	Diaphragmatic Mobilization Group (n=17) (ΔX±SS)	Control Group (n=17) (ΔX±SS)	p
Anxiety score	1,11±1,11	0,41±0,50	0,451
Depression score	1,05±1,51	0,11±0,33	0,009*
Δ = Difference between measurements, n = Number, sec = Seconds, X±SD = Mean ± Standard Deviation Mann-Whitney U Test *p<0.05			

Discussion

At the beginning, 40 individuals with a mean age of 38.11±10.46 years and a mean BMI of 31.38±1.96 kg/m² participated in our study. A total of 34 obese individuals were able to complete the study by performing the final evaluations. Diaphragmatic mobilization techniques were applied to obese individuals in the training group for 15-20 minutes, twice a week, for a total of 4 weeks. As a result of our study, significant improvements were obtained in respiratory functions, respiratory muscle strength, resting metabolic rate, sleep quality, depression, fatigue and quality of life with diaphragmatic mobilization application in obese individuals.

Previous studies have shown that manual therapy has the potential to affect and alter respiratory mechanics in some chronic lung diseases such as chronic asthma and COPD, which includes chest wall flexibility and thoracic motion. It is stated that this may indirectly lead to improvement in exercise capacity and lung function [31, 38]. Pathological conditions affecting the respiratory system mechanically disrupt the structure of the diaphragm muscle, decreasing its length in the working direction of the diaphragm, reducing its function by changing the mechanical connection between the diaphragm parts, and this turns into a disadvantage. Since this will reduce diaphragmatic movement, it reduces the effect of raising and widening the lower rib cage, increases the work of breathing and reduces functional capacity.

According to our literature review, there is no study examining the effects of diaphragmatic mobilization techniques on respiratory functions, respiratory muscle strength and resting metabolic rate in obese individuals. In this sense, our study is the first to examine the effects of diaphragmatic mobilization techniques in this group with a control group.

In our study, it was observed that after 4 weeks of diaphragmatic mobilization, significant improvement could be achieved only in PEF parameter in respiratory test measurements of obese individuals. When the difference values of the two groups are examined, it is seen that the FEF values of 25-75% and the MVV values are significantly different between the two groups. Gonzalez-Alvarez et al. In their study to examine the effects of diaphragmatic mobilization techniques on healthy individuals, it was reported that an increase was obtained in FEV1, FVC parameters in respiratory functions [39]. Noll et al. It has been reported that a manual therapy session including the diaphragmatic mobilization technique improves respiratory function (Inspiratory Capacity, Residual Volume, Total Lung Capacity) in patients with COPD by looking at its acute effect [17]. Abdaleel Ash-raf AM et al. found that the diaphragmatic mobilization technique significantly increased FVC, FEV1, and 6-minute walk distance in patients with COPD. Similarly, Rocha et al. In a study conducted by A.Ş., in which the diaphragmatic mobilization technique was used, it was stated that diaphragmatic mobility improves inspiratory capacity in clinically stable COPD patients without a history of exacerbation in the last 6 weeks [24]. Yelvar GDY et al. found that a single session of manual therapy including diaphragmatic mobilization improved FEV1 and vital capacity in severe COPD [40]. In a similar study, Hakala et al. In their study examining the effects of Weight Loss on respiratory functions in Obese Patients with Asthma, it was reported that they achieved significant improvements in the PEF parameter [41]. When we look at our study and studies on chronic respiratory system diseases and healthy people, it is seen that especially diaphragmatic mobilization techniques may have the potential to improve respiratory functions.

In our study, significant improvement was achieved only in the PEF parameter in the diaphragmatic mobilization group after 4 weeks, and it was found to be moderately effective. In addition, when the difference values of the two groups are compared, it is seen that the FEF 25-75% and MVV values are significantly different between the two groups. Considering that the MVV and PEF parameters are also related to respiratory muscle strength, the obtained results can be considered as encouraging. This result also shows us that the mobilization techniques applied in our study can be a very effective technique especially on the muscle strength of the diaphragm, which is the primary inspiratory muscle. We think that the lack of significant difference in other pulmonary function test parameters may be due to our relatively small number of cases and the duration of application.

Obese individuals breathe by using their upper chest muscles and generally have a flexion posture, just like in obstructive pulmonary diseases such as COPD, due to the excess fat tissues in the trunk. This change causes an increase in accessory respiratory muscle activity. Therefore, it is expected that the respiratory muscle strength will decrease in obese individuals and there is a need to examine the approaches to improve it. In our study, we achieved significant improvement in the S Index, peak inspiratory flow and volume values of obese individuals after diaphragmatic mobilization techniques. We think that manual techniques provide an increase in thoracic region mobility and chest wall compliance with relaxation. At the same time, we think that thoracic cage flexibility and muscle relaxation also reduce respiratory effort, and thus we can achieve an increase in respiratory muscle strength. Yelvar et al. also examined the acute responses of diaphragmatic mobilization techniques, which they applied, in severe COPD patients, unlike our study. As a result of the study, they found that it improved inspiratory muscle strength [43]. Rocha et al. In their study in COPD, they achieved improvement in inspiratory muscle strength after 2 weeks, 6 sessions, and manual diaphragmatic technique, similar to our study [24].

Resting metabolic rate is the component of energy expenditure that explains the largest proportion of total daily energy needs in individuals, but the contribution of low resting metabolic rate to the etiology of obesity is still controversial. Studies suggest that resting metabolic rate has a strong genetic component and is a predictor of subsequent weight change for a given body composition.

In a study comparing obese individuals with a control group, it is shown that the resting metabolic rate evaluated in obese subjects is 3-5% lower than that of controls. They explain that weight loss is possible because of an irreversible decrease in metabolic rate, and that this decrease may also be a normal physiological phenomenon caused by energy restriction and weight loss. In another study, it is stated that anything that increases the metabolic rate can provide weight loss and weight control [42].

In our study, we found that there was a significant difference in resting metabolic rate, resting oxygen consumption and ventilation values in obese individuals after diaphragmatic mobilization for 4 weeks. There is no other study evaluating diaphragmatic mobilization practices in this respect and in obese individuals. Although there was no change in the weight of our patients at the end of 4 weeks, we achieved a change in their metabolic rate, which actually shows us that these practices can be a supportive approach in weight control in the longer term, as Lopes et al. Stated [42]. A study examining the effect of different types of exercise training on resting metabolic rate in adolescents with obesity reported that 6 months of combined training with aerobic, resistance or mild dietary restriction did not increase the resting metabolic rate compared to diet alone in adolescents with obesity, despite the increase in lean mass in the exercise groups [43]. Another study examining the effects of diet and diet plus exercise-induced weight loss on resting metabolic rate on obese individuals reported that diet plus exercise significantly increased the resting metabolic rate [42]. Therefore, the effects of different exercise and diet practices on resting metabolic rate have not been clarified yet.

Result

Forty healthy obese individuals participated in this study, which was conducted to examine the effects of Diaphragmatic Mobilization Techniques on respiratory functions, fatigue, sleep quality, anxiety and depression in obese individuals. Individuals who were randomly divided into two groups using a computer-assisted randomization program were not given diaphragmatic mobilization training to the first group, and no training was given to the second group as the control group. At the end of the study, final evaluations were performed with 34 patients. The results obtained in the study are as follows:

1. In our study, there was a significant difference in the PEF parameter of the pulmonary function test parameters in the diaphragmatic mobilization group. The effect size was found to be medium. There was no significant difference in other parameters. In the control group, there was a significant decrease in MVV, but there was no significant difference in other parameters. When the difference values are compared, it is seen that FEF 25-75% and MVV values are significantly different between the two groups.
2. Respiratory muscle strength measurement parameters in the diaphragmatic mobilization group showed a significant difference in Syndex, peak inspiratory flow and volume parameters, and the effect size was moderate. In the control group, there was a significant decrease in all parameters and the effect size was low. According to this result, we can say that diaphragmatic mobilization techniques have an effect on respiratory muscle strength in obese individuals.
3. When the basal metabolic rate differences of our groups before and after the treatment were examined, there was a significant difference in all parameters except FeO_2 parameter in the diaphragmatic mobilization group, while no statistically significant difference was found in the control group. When the effect sizes were evaluated in basal metabolic rate evaluation, it was seen that while the FeO_2 parameter had a low effect size in the diaphragmatic mobilization group, the other parameters had a medium effect size. In the control group, the effect size was found to be low in all parameters. According to this result, we can say that diaphragmatic mobilization techniques can increase the basal metabolic rate in obese individuals.
4. Considering the sleep quality differences before and after treatment, there was a statistically significant difference in the diaphragmatic mobilization group, but no statistically significant difference was found in the control group. It was found that the effect size in sleep quality assessment was low in both groups. According to this result, we think that more studies are needed on this subject due to the low effect size.
5. Considering the differences in anxiety and depression measurement parameters before and after treatment, there was a statistically significant difference in the depression parameter in the diaphragmatic mobilization group, but no significant improvement was found in the anxiety parameter. No statistically significant difference was found in the control group. The effect size was found to be low in both groups in the assessment of anxiety. In the evaluation of depression, the effect size was found to be moderate in the diaphragmatic mobilization group and low in the control group. According to this result, we can say that diaphragmatic mobilization techniques have a positive effect on depression in obese individuals.

In conclusion, we have seen that diaphragmatic mobilization techniques can improve important parameters affecting daily life such as respiratory functions, respiratory muscle strength, resting metabolic rate, sleep quality, fatigue, depression and quality of life in obese individuals. Due to these effects, we think that these techniques should be included in the physiotherapy and rehabilitation programs organized for obese individuals. At the same time, diaphragmatic mobilization techniques seem to be a safe and feasible approach. In future studies, these effects should be examined in more cases and in different disease groups [44-50].

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