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ORIGINAL ARTICLE

Diyafragmatik solunum egzersizlerinin fetal sağlık kaygısı ve prenatal stres ile baş etmeye etkisi

Effect of diaphragmatic breathing exercises on fetal health anxiety and coping with prenatal stress

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Öz

Amaç: Bu çalışma, gebelikte diyafragmatik solunum egzersizlerinin fetal sağlık kaygısı ve prenatal stres ile baş etme üzerine etkisini belirlemek amacıyla yapılmıştır.

Yöntem: Bu randomize kontrollü çalışma, Türkiye'nin doğusundaki bir aile sağlığı merkezinde yürütülmüştür. Araştırmanın örneklemini 108 gebe (deney grubu, 54; kontrol grubu, 54) oluşturmuştur. Deney grubuna bir defa yüz yüze ve devamındaki iki hafta süresince haftada 2 gün görüntülü telefon görüşmesi ile toplamda 5 defa diyafragmatik solunum egzersizleri uygulandı. Kontrol grubuna herhangi bir müdahale uygulanmadı. Verilerin toplanmasında Revize Prenatal Stresle Başa Çıkma Ölçeği, Fetal Sağlık Kaygı Envanteri kullanıldı.

Bulgular: Deney grubunda Revize Prenatal Stresle Başa Çıkma Ölçeği alt boyutlarından Planlama- Hazırlık (2,16 vs 2,17; p<,05) ve Manevi-Olumlu Başa Çıkma (2,55 vs 2,59; p<,05) alt boyut ortalama puanları kontrol grubuna göre anlamlı derecede yükselirken, kaçınma alt boyutu (2,61 vs 2,68; p<,05) ortalama puanları anlamlı derecede azaldı. Benzer şekilde deney grubu fetal sağlık anksiyetesi ortalama puanları kontrol grubuna göre önemli ölçüde azaldı (10,35 vs 13,57; p<,05).

Sonuç: Diyafragmatik solunum egzersizinin, gebelerin stresle etkin bir şekilde başa çıkmayı geliştirmede etkili olduğu ve gebelerin fetal sağlık kaygısını azalttığı belirlendi. Sağlık profesyonelleri, gebelerin fetal sağlık kaygılarını azaltmak ve işlevsel başa çıkma tarzlarını kullanabilmelerini desteklemek için diyafragmatik solunum egzersizini kullanabilirler.

Anahtar kelimeler: Gebelik, Solunum egzersizi, Fetal sağlık kaygısı, Stres, Başa çıkma, Ebelik bakımı.

Abstract

***Purpose**: This study was conducted to determine the effect of diaphragmatic breathing exercises on coping with fetal health anxiety and prenatal stress during pregnancy.*

***Methods:** This randomized controlled study was carried out at a family health center in eastern Turkey. The study sample consisted of 108 pregnant women (experimental group, 54; control group, 54). Diaphragmatic breathing exercises were applied to the experimental group, once face to face and 5 times in total, via video phone call 2 days a week for the following two weeks. Those in the control group received no intervention. Data were collected using the Revised-Prenatal Coping Inventory (NuPCI) and the Fetal Health Anxiety Inventory (FHAI).*

***Results:** The mean scores on planning-preparation (2.16 vs 2.17; p<.05) and spiritual-positive (2.55 vs 2.59; p<.05) subscales of NuPCI significantly increased and the mean score of avoidance (2.61 vs 2.68; p<.05) significantly decreased in the experimental group compared to the control group. Similarly, the mean scores of fetal health anxiety significantly decreased in the experimental group compared to the control group (10.35 vs 13.57; p<.05).*

***Conclusion:** Diaphragmatic breathing exercises were found to be effective in improving effective coping styles for stress and reducing fetal health anxiety during pregnancy. Health professionals can use diaphragmatic breathing exercise to reduce pregnant women's fetal health anxiety and support pregnant women in their functional coping styles.*

***Keywords:** Pregnancy, Breathing exercises, Fetal anxiety, Stress, Coping, Midwifery care.*

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INTRODUCTION

Pregnancy is a natural event that many women look forward to have with happiness and excitement, but it can be challenging for some women. In addition to physiological and psychological changes occurring during pregnancy, the readiness for a new life, changes in body image perception, fear of becoming a parent, uncertainties about childbirth, fears about the baby's development and survival can cause stress in pregnant women.[1] Moreover, stressors during pregnancy such as economic problems, epidemics, and natural disasters can contribute to anxiety about both maternal and fetal health and cause significant stress.[2-5] Stress is commonly observed during pregnancy and ranks high among stressful life events.[6-9]

The negative effects of stress on human health are well-known. Both maternal and fetal health and their immune responses are sensitive to stress during pregnancy. High cortisol levels can lead to changes in their immune responses, suppressing the immune system and causing complications such as premature birth.[10,11] Stress during pregnancy has been associated with negative pregnancy outcomes such as spontaneous abortion, pregnancy-induced hypertension, placental abnormalities, difficult labor, operative deliveries, low APGAR score, low birth weight, fetal death, postpartum depression, and long-term health problems such as cerebral palsy, neurodevelopmental delay, vision and hearing problems.[12-15]

Although many pregnant women are exposed to stress, not all women who experience stress have negative pregnancy outcomes. The positive or negative experiences of pregnant women during pregnancy, their styles of coping with these experiences and stress, and the stressors they are exposed to affect whether the stress will disrupt their body balance and cause negative outcomes such as illness.[16-18] The style of coping with stress is determinant in adapting to stressful events. Functional styles of coping with stress can reduce negative effects of stress, while ineffective coping styles can increase health risks.[19] Coping styles of pregnant women with stress may vary, including functional coping styles such as having self-confidence, seeking social support, planning, and spiritual readiness and ineffective coping styles such as helplessness and avoidance.[20,21] Considering the importance of coping with stress, understanding how pregnant women cope with stress and intervening to develop their styles of coping with stress may be useful in reducing stress during pregnancy. Various non-pharmacological methods such as relaxation exercises, yoga, biofeedback, massage therapy, acupuncture, and music therapy may be useful in reducing stress during pregnancy.[17,22] However, there is no study about the effect of non-pharmacological methods in pregnancy on coping styles with stress. Some studies have reported that diaphragmatic breathing exercises increase quality of life and oxygenation and have a positive effect on anxiety.[23,] Therefore, both physical and psychological effects of diaphragmatic breathing exercises in pregnant women may positively affect their styles of coping with stress and reduce fetal health anxiety. For this reason, this study aimed to determine the effect of diaphragmatic breathing exercises, on coping with fetal health anxiety and prenatal stress.

METHODS

Design

This randomized controlled study was conducted with pregnant women who were randomly assigned to experimental and control groups, and those who were assigned to the experimental group received diaphragmatic breathing exercises.

For conducting the study, an ethical approval was obtained from the Inonu University Health Sciences Non-Invasive Clinical Research and Publication Ethics Committee (Decision No: 2022/3797). Additionally, a Clinical Trials number was received from ClinicalTrials.gov (NCT05954754).

Participants

The sample for the study consisted of pregnant women who referred to a family health center (FHC) in the center of a city in eastern Turkey. Healthy pregnant women were monitored by midwives and family physicians at the FHC, while high-risk pregnancies were referred to hospitals.

The inclusion criteria for this study were as follows: (1) being pregnant women in their second and third trimesters (between 14-36 weeks);[24,25] (2) being ≥18 years old; (3) having no medical pregnancy complications; (4) having no diagnosed mental illness; (5) having no fetal anomaly diagnosis; (6) using a smartphone. The exclusion criteria from the study are as follows: (1) receiving a diagnosis of any chronic disease during the research process and starting medication for the chronic disease; (2) detection of a fetal risk during the research process.

A web-based software program was used to calculate the sample size for the study, considering the mean coping with stress during pregnancy score, which was the primary dependent variable. The coping with stress during pregnancy score reported by Faramarzi et al. was used as a reference (mean=2.28, standard deviation=0.54). The sample size was calculated to be 54 for each group (54 for the experimental group, 54 for the control group), assuming a 1-point increase in the mean coping with stress during pregnancy score after the intervention, with a two-sided significance level of 5%, 95% confidence interval, and 80% power. Randomization was used to assign pregnant women to either the intervention or control group. The Numbers section of the random.org website was used for randomization, and pregnant women who applied to the FHC were assigned to groups based on their order of arrival to the FHC, with the first and second women assigned to the experiment and control groups, respectively. The groups were allocated by a draw, where the number 1 was assigned to the experiment group and the number 2 was assigned to the control group. The same method was used to assign pregnant women to the experimental or control group until the desired sample size was reached. Figure 1 shows the sample selection process, which was conducted according to the CONSORT criteria.

Measures

The data were collected by the researchers after routine check-ups of pregnant women between November 2022 and June 2023. After pregnant women were informed about the study, the researchers asked questions to those who agreed to participate in the study, and their answers were marked on the data collection forms. The primary outcome of the study, coping with stress during pregnancy, was evaluated using the Revised-Prenatal Coping Inventory (NuPCI). The secondary outcome, fetal health anxiety, was measured using the Fetal Health Anxiety Inventory (FHAI).

A personal information form was created by the researchers in line with the literature to determine pregnant women's sociodemographic (age, education level, employment status, and income level) and pregnancy characteristics (trimester, gravida, and planned pregnancy).

The NuPCI was developed by[26] and its Turkish validity and reliability study was conducted by Bal et al. The scale measures pregnant women's coping styles and perceptions of stress. It consists of 30 items and three subscales: Planning-preparation, Avoidance, and Spiritual-positive. This is a 5-point Likert-type scale, scoring from 0 (never) to 4 (very often). Higher planning-preparation and spiritual-positive subscale scores and lower avoidance subscale scores indicates higher coping with stress. Bal et al. reported the Cronbach's alpha reliability coefficient for the planning-preparation, avoidance, and spiritual-positive subscales as 0.83, 0.57, and 0.69, respectively.[27] In this study, the Cronbach's alpha reliability coefficient for the planning-preparation, avoidance, and spiritual-positive subscales were found to be 0.81, 0.66, and 0.72, respectively.

The FHAI was developed by Reiser and Wright and its Turkish validity and reliability study was conducted by Gökbulut et al.[5] The scale measures pregnant women's anxiety related to the fetus' health. It consists of 14 items, and each item consists of four statements that best capture the women's experiences in the previous weeks. This is 4-point Likert-type scale, scoring from 0 (no symptoms) to 3 (severe symptoms). The sum of item scores gives the total fetal health anxiety score, and as the total score increases, the level of fetal health anxiety also increases. The Cronbach's alpha reliability coefficient of the scale was 0.85.[5] In this study, the Cronbach's alpha reliability coefficient of the scale was found to be 0.89.

Intervention

In the present study, the baseline data were collected by the researchers through face-to-face interviews in the counseling room of the FHC. Two weeks later, the post-treatment data were obtained using the same method. After the baseline data were collected, diaphragmatic

breathing exercise training was given individually to each pregnant women in the experimental group by one of the trained researchers, named E.S.B. At the end of the training, the pregnant women performed the exercise individually under the supervision of the researcher. Data collection, training and application lasted around 40 minutes. After the first application, the researcher had the pregnant woman repeat the application via video call, 2 days a week for two weeks. The video calls were made on the day and time when pregnant women were suitable, and each application lasted around 10 minutes. Thus, a total of five diaphragmatic breathing exercises were applied to pregnant women in the experimental group during two weeks. Pregnant women continued to do breathing exercises on their own for a total of 20-30 minutes a day, as tolerated (about ten minutes each), every day for two weeks. Although the optimal application time of breathing exercises is not yet determined in the literature, 2-3 sessions a week are planned for outpatients, while 5 sessions a week can be planned for inpatients.[28] No intervention was applied to pregnant women in the control group by the researchers.

In order for pregnant women to apply the correct technique in diaphragmatic breathing exercises, they were asked to first rest for 1-2 minutes in a supine position with pillows under their heads and support from their knees on a flat surface. Their one hand was placed on the abdomen and the other on the upper part of the chest wall. While inhaling, their hand on the abdomen moved upwards, while the other hand remained as still as possible. While exhaling, their hand on the abdomen moved downwards, while the other hand remained as still as possible. They were asked to breathe slowly, deeply, and without causing fatigue. They were told to breathe through the nose and exhale through the mouth. To prevent the risk of hyperventilation, they were instructed to slowly exhale all the air using controlled expiration. After they performed diaphragmatic breathing exercises correctly, the exercises were repeated in a sitting position. In the two-week exercise program, the exercises were performed in a seated position.[28,29]

Statistical analysis

For the statistical analysis, the data were assessed using SPSS 25.0 for Windows software (SPSS, Chicago, IL, USA). Descriptive statistical values, numbers, percentages, means and standard deviations were used for the analysis. Comparisons of the categorical variables between groups were carried out using the chi-squared test. An independent-samples t-test was used to make comparisons between the experimental and control groups; a paired-samples t-test was used to make comparisons intra-groups. If the results of the t-tests were significant, effect sizes were computed using Cohen's d to identify significant differences. The statistical significance level was considered as $p<0.05$.

RESULTS

The study was conducted with a total of 108 pregnant women, including 54 in the experimental group and 54 in the control group (Figure 1). Their characteristics, including age, education level, employment status, income level, trimester, gravid, and planned pregnancy, were similar in both groups ($p>0.05$) (Table 1).

Table 2 shows the pre-test and post-treatment NuPCI subscales mean scores. The planning-preparation and spiritual-positive mean scores of pregnant women in the experimental group significantly increased after the intervention (Cohen's d=0.693, Cohen's d=1.109, respectively; $p<0.05$), while their avoidance mean score significantly decreased (Cohen's d=0.443; $p<0.05$). The difference between the groups' mean scores after the intervention was statistically significant in favor of those in the experimental group (Cohen's d=0.665, Cohen's d=0.812, Cohen's d=0.821, respectively; $p<0.05$) (Table 2).

Table 3 presents the pre-test and post-treatment FHAI total mean scores. The FHAI mean score of pregnant women in the experimental group significantly decreased after the intervention ($p<0.05$; Cohen's d=0.487), and the difference between the groups' mean scores was statistically significant in favor of those in the experimental group ($p<0.05$; Cohen's d=0.651) (Table 3).

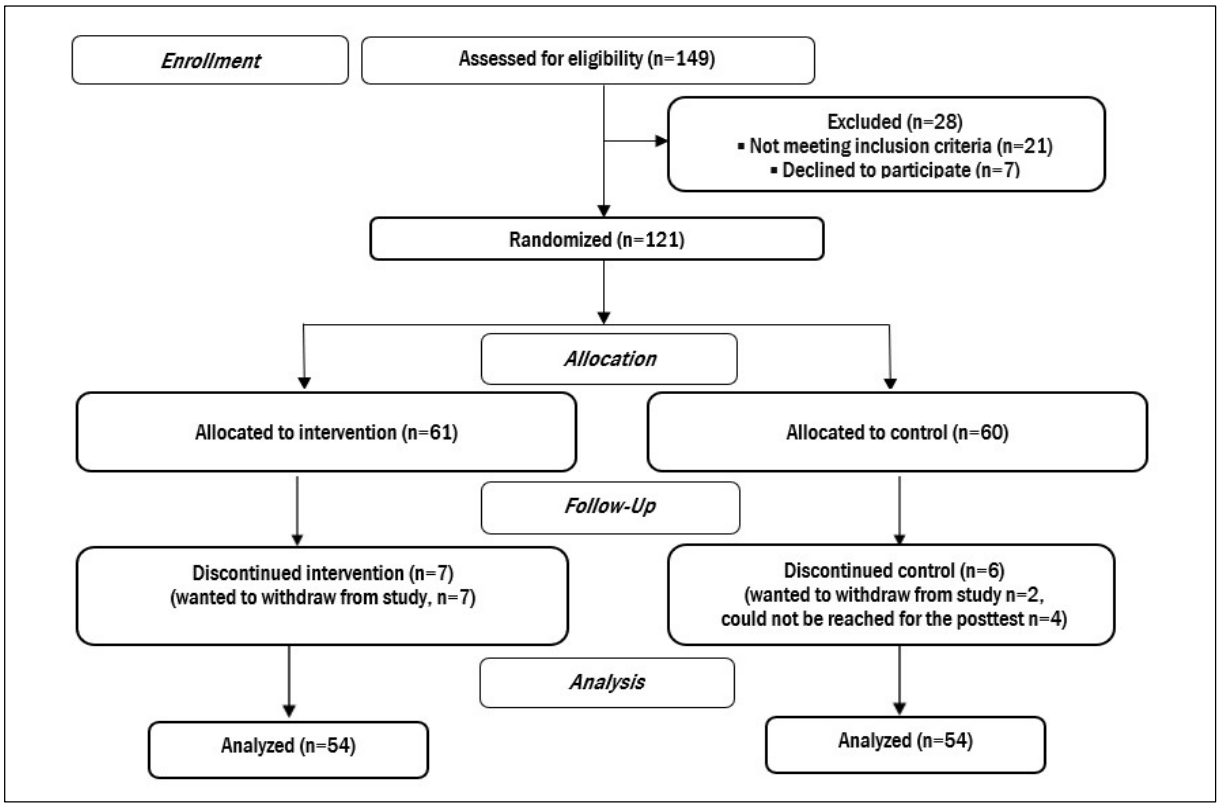

Figure 1. CONSORT diagram of the participants for each stage in the study.

Table 1. Characteristics of the participants.

	Experimental Group (N=54)	Control Group (N=54)	
	n (%)	n (%)	p
Age (years)			
≤ 25	18 (33)	15 (28)	0.531
≥26	36 (67)	39 (72)	
Education level			
High school and below	42 (78)	34 (63)	0.092
University or above	12 (22)	20 (37)	
Employment status			
Employed	18 (33)	12 (22)	0.197
Unemployed	36 (67)	42 (78)	
Income rate			
Low	8 (15)	13 (24)	0.224
Middle	46 (85)	41 (76)	
Trimester			
II.	13 (24)	18 (33)	0.288
III.	41 (76)	36 (67)	
Gravid			
Primigravid	22 (41)	19 (35)	0.552
Multigravid	32 (59)	35 (65)	
Planned pregnancy			
Yes	40 (74)	42 (78)	0.653
No	14 (26)	12 (22)	

Chi-square test.

Table 2. Comparison of the Pre- and Post-treatment Revised-Prenatal Coping Inventory (NuPCI) subscales mean scores of pregnant women in Experimental and Control groups.

	Pretest	Posttest		
	Mean±SD	Mean±SD	p (a)	Effect size (d)
Planning-preparation				
Experimental Group	1.97±0.64	2.39±0.57	0.001*	0.7
Control Group	2.16±0.73	2.12±0.67	0.497	
p (b)	0.164	0.027*		
Effect size (d)		0.665		
Avoidance				
Experimental Group	2.51±0.55	2.25±0.62	0.028*	0.4
Control Group	2.61±0.50	2.68±0.42	0.260	
p (b)	0.293	<0.001		
Effect size (d)		0.812		
Spiritual-positive				
Experimental Group	2.44±0.57	3.00±0.43	<0.001	1.1
Control Group	2.55±0.60	2.59±0.56	0.594	
p (b)	0.330	<0.001		
Effect size (d)		0.821		

* p<0.05. (a): Paired t Test. (b): Independent t Test. (d): Cohen d.

Table 3. Comparison of the Pre- and Post-treatment the Fetal Health Anxiety Inventory (FHAI) total mean scores of pregnant women in experimental and control groups.

	Pretest	Posttest		
	Mean±SD	Mean±SD	p (a)	Effect size (d)
Experimental Group	13.00±6.64	10.35±3.85	0.013*	0.4
Control Group	13.85±7.70	13.57±5.83	0.676	
p (b)	0.540	<0.001		
Effect size (d)		0.6		

* p<0.05. (a): Paired t test. (b): Independent t test. (d): Cohen d.

DISCUSSION

The results of this study indicate that diaphragmatic breathing exercises applied during pregnancy may be an effective approach to alleviate fetal health concerns and improve coping with stress.

Pregnant women in the experimental group were found to use functional coping strategies, such as planning and positive emotional coping strategies, more frequently, and to utilize non-functional coping strategies, such as avoiding maladaptive coping behaviors, less frequently after the intervention. There was a significant difference between the experimental and control groups in terms of using functional and non-functional coping strategies. The positive changes in the pregnant women's coping styles suggest that diaphragmatic breathing exercises may be an effective method for coping with stress during pregnancy. In the literature, there is no study about the effect of diaphragmatic breathing exercises on coping styles in pregnant women, but studies on the effect of interventions on stress are more common. A study applied breathing exercises to pregnant women and reported that breathing exercises were effective

in reducing stress in pregnant women.[30] Another study applied breathing exercises to pregnant women during the latent phase of labor, and reported that breathing exercises were an effective method for reducing anxiety during labor.[31] Another study of women with gestational diabetes reported that breathing exercises reduced depression and stress.[32] Studies have shown that breathing exercises are an appropriate method for reducing stress, and support our study results. Breathing exercises regulate oxygen exchange, metabolic rate, lower blood pressure, and help improve cognitive functions such as problem solving in pregnant women.[33] In another study, it was reported that breathing exercises and muscle relaxation exercises increased the sense of control and reduced stress in pregnant women.[34] Therefore, diaphragmatic breathing exercises applied to pregnant women in the experimental group in our study allowed them to develop appropriate coping strategies by improving their cognitive functions and increasing the sense of control.

In the present study, fetal health anxiety decreased significantly in the experimental group compared to the control group. Pregnant women experience anxiety for various reasons during pregnancy, including concerns about fetal health and life.[35] Breathing exercise is a form of relaxation technique, and its positive effect on anxiety is well known.[36] Diaphragmatic breathing exercises may alleviate fetal health concerns through this effect. A study applied breathing exercises to pregnant women for childbirth and reported that breathing exercises reduced state anxiety in pregnant women.[30] Another study reported that relaxation exercises such as breathing exercises reduce the rate of hospital admission and have a positive effect on the emotional state of the mother.[37] Pregnant women's ability to maintain their pregnancy healthy, cope with pregnancy-related problems, and their coping mechanisms are closely related to each other.[15] Decreased fetal health anxiety in our study may be because pregnant women in the experimental group acquired positive coping skills after the intervention, which allowed them to improve their ability to cope with their existing anxieties during pregnancy by developing their problem-solving skills.[38] These findings showed that diaphragmatic breathing exercise helps pregnant women cope with anxiety and reduces their concerns about fetal health. Accordingly, the available evidence suggests that diaphragmatic breathing exercise can be used among non-medical methods to alleviate fetal health anxiety in pregnant women.

Limitations

This study has some limitations. Firstly, since the study was conducted with pregnant women who applied to an FHC, its results cannot be generalized to the entire population. Secondly, another limitation is that they could not be followed up from the first trimester of pregnancy. Thirdly, coping styles were evaluated using a scale with only three sub-dimensions, which may have created limitations in evaluating coping styles. However, the use of a scale specific to pregnant women and its correlation with scales used for coping with stress in the general population may have provided advantages in evaluating coping styles of pregnant women. Despite all limitations, this study will guide future studies in demonstrating the effectiveness of diaphragmatic breathing exercises in coping with stress and alleviating fetal health anxiety during pregnancy.

Conclusion

This study suggests that diaphragmatic breathing exercises applied during pregnancy contribute to pregnant women's adoption of functional coping styles with stress and reduce fetal health anxiety. In this regard, the use of breathing exercises, a non-pharmacological method, can be recommended for pregnant women to cope effectively with stress and adopt functional coping styles.

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