Kardiyovasküler Hemşirelik Dergisi

DOI: 10.5543/khd.2020.92905
Turk J Cardiovasc Nurs 2020;11(26):125–131

Original Article Klinik Çalışma

khd.tkd.org.tr

The Effect of Alternate Nostril Breathing Exercise on Regulation of Blood Pressure in Individuals with Hypertension

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Abstract

Objective: In this study as a simple randomization method was aim to evaluate the effect of alternate nostril breathing exercise on regulation of blood pressure in individuals with hypertension.

Methods: The study was conducted between October 2017 and March 2018 with patients (n=76) with essential hypertension who visited the internal medicine outpatient clinic of a training and research hospital. The patients (n=76) were divided into experimental and control groups according to the inclusion criteria. Patients in the experimental group (n=37) performed alternate nostril breathing exercise and those in the control group (n=39) sat silently for 15 min/day for a period of two weeks. The pre- and post-intervention blood pressure of patients in the two groups was measured in the clinic at the end of the first and second week; the pre- and post-intervention measurements of blood pressure were performed at home daily for two weeks.

Results: The study included 72.4% female patients and 27.6% male patients; the mean age of the patients was 52.4±6.9 years. The mean systolic blood pressure (SBP) of patients in the experimental group measured at the clinic in the second week was approximately 4 mmHg lower than that of the control group ($p<0.05$). In addition, the mean SBP of patients in the experimental group measured at home in the second week was approximately 3 mmHg lower than that of the control group ($p<0.05$).

Conclusion: Alternate nostril breathing exercises in addition to pharmacological treatment may regulate the blood pressure in patients with hypertension.

Keywords: Blood pressure; breathing exercises; hypertension; nursing; yoga.

Alternatif Burun Solunumu Egzersizinin Hipertansiyonu Olan Bireylerin Kan Basıncının Düzenlenmesinde Etkisi

Özet

Amaç: Bu çalışmada, hipertansiyon tanısı olan bireylerin kan basıncının düzenlenmesinde alternatif burun solunumu egzersizinin etkisi değerlendirildi.

Yöntemler: Deneysel tipte olan araştırma, Ekim 2017-Mart 2018 tarihleri arasında bir eğitim ve araştırma hastanesi dahiliye polikliniklerine başvuran esansiyel hipertansiyonu olan hastalar (n=76) ile yürütüldü. Hastalar dahil etme kriterlerine uygun

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Submitted Date (Başvuru Tarihi): 24.09.2020 **Accepted Date (Kabul Tarihi):** 14.12.2020

olarak deney ve kontrol grubuna ayrıldı. Deney grubundaki hastalardan (n=37) alternatif burun solunumu egzersizi, kontrol grubundaki (n=39) hastalardan sessiz oturma seansını iki hafta boyunca 15 dakika süreyle uygulamaları istendi. Her iki grubun klinik kan basıncı ölçümleri ilk ve ikinci hafta; evdeki ölçümleri ise iki hafta boyunca uygulama öncesi ve sonrası olacak şekilde planlandı ve uygulandı.

Bulgular: Araştırmada hastaların %72.4'ü kadın, %27.6'sı erkek, yaş ortalaması 52.4±6.9 bulundu. İlk ve ikinci haftanın sonunda yapılan klinik kan basıncı ölçüm sonuçlarına göre, ikinci hafta deney grubu ortalama SKB değeri kontrol grubuna göre yaklaşık 4 mmHg düşük bulundu ($p<0.05$). Deney grubunun evde ikinci hafta ortalama SKB değeri kontrol grubuna göre yaklaşık 3 mmHg daha düşük bulundu ($p<0.05$).

Sonuç: Bu çalışma sonucunda elde edilen bulgular ışığında alternatif burun solunumu egzersizinin farmakolojik tedaviye ek olarak uygulanmasının kan basıncını kontrol altına almaya yardımcı olacaktır.

Anahtar sözcükler: Alternatif burun solunumu; hemşirelik; hipertansiyon; kan basıncı; yoga.

Cite this article as: Uğur G, Uysal H. The Effect of Alternate Nostril Breathing Exercise on Regulation of Blood Pressure in Individuals with Hypertension. Turk J Cardiovasc Nurs 2020;11(26):125–131.

Hypertension, which is one of the causes of mortality and morbidity across the world and is a public health problem, can be controlled and prevented.[1] The incidence of hypertension is 25% among men and 20% among women, and it affects approximately 1.13 billion adults worldwide.[2] The Turkish Hypertension Prevalence Study reports that the prevalence of hypertension among the Turkish adult population aged over 18 is 30.3% with 32.3% in women and 28.4% in men.[3]

In addition to medical treatment, cognitive-behavioral approaches, which are considered complementary and alternative medicine (CAM) practices, are among the proposed lifestyle changes for treating hypertension.[4-6] The CAM practices mostly suggested for cardiovascular diseases are yoga, Tai Chi, Qigang, acupuncture, acupressure, chiropractic treatment, nutritional support, and respiratory therapy.[7,8]

Nadi Shodhan pranayama, which is one of the yoga-based breathing exercises, is known as alternate nostril breathing. This exercise allows for slow breathing in a controlled manner alternating between the left and right nostrils. Previous studies indicate that slow and rhythmic breathing reduces chemoreceptor responses, increases baroreceptor sensitivity, and suppresses activation of the sympathetic nervous system, thereby increasing the activity of the parasympathetic nervous system, which causes changes in the cardiovascular, respiratory, and autonomic parameters.[9-11]

This study evaluated the effects of alternate nostril breathing exercise (ANBE), which can be performed along with lifestyle changes, does not require any special equipment or environment, and can be performed daily without material costs, on regulating the blood pressure of patients with hypertension.

Method

In this study as a simple randomization method was aim to evaluate the effect of alternate nostril breathing exercise on regulation of blood pressure in patients with hypertension. The study was conducted between October 2017 and March 2018 with patients with essential hypertension who visited the internal medicine outpatient clinic of a training and research hospital. The patients were divided into experimental and control groups according to the inclusion criteria using a simple randomization method (1:1). Patients in the experimental group (n=37) performed alternate nostril breathing exercise and those in the control group (n=39) sat silently for 15 min/day for a period of two weeks (Fig. 1).

Data Collection

The research data were collected in three stages: preparation, pre-, and post-intervention.

Preparation Stage: The patients who visited the outpatient clinic and met the study inclusion criteria were informed about the study. Verbal and written consents were obtained from the patients who agreed to participate in the study; then, they were asked to fill in the data form. The patients were divided into the experimental (performed alternate nostril breathing exercises) and control (sat silently) groups using a simple randomization (1:1) method.

- Before the first clinical measurement of blood pressure, the patients in the experimental group were informed about the alternate nostril breathing exercise, and the patients in the control group were informed about sitting siltently. The first clinical measurements of blood pressure, heart rate, and level of oxygen saturation (SaO_2) were performed in the morning after the patients sat in the examination room for 5 min. Then, the patients performed the alternate nostril breathing exercise (ANBE) or silent sitting session (SSS) according to the guidelines described below;

Guidelines for performing the alternate nostril breathing exercise: (1) The patient was verbally asked whether he/she felt ready for the exercise. (2) The patient was placed in an appropriate position with the head, neck, and body

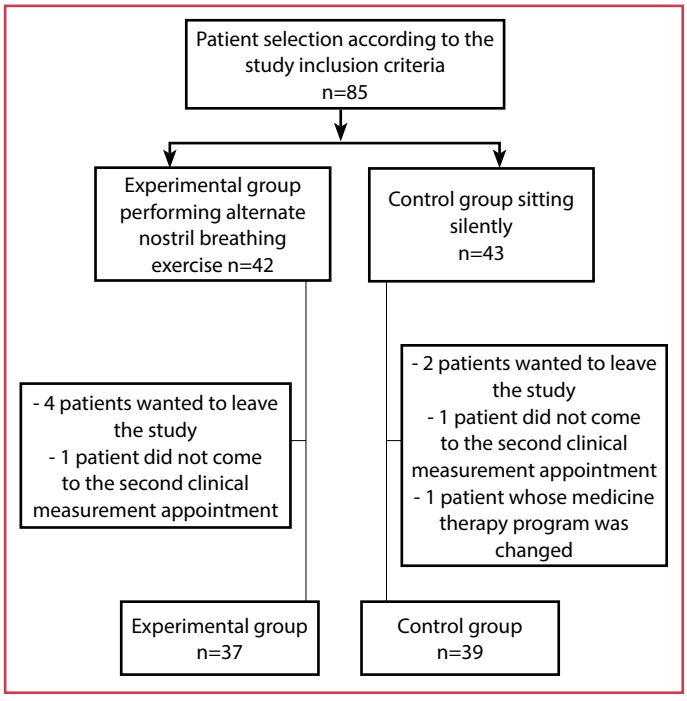

Figure 1. Randomization.

in an upright position. (3) The patient was asked to inhale through the nose and exhale through the mouth three times. (4) When breathing for the fourth time, the patient was asked to close the right nostril with his/her right thumb and to breathe gently through his/her open left nostril. (5) When his/her right nostril was closed, he/she was told to breathe through his/her left nostril. (6) While closing the left nostril with the ring finger of the right hand, the patient was asked to open his/her right nostril and breathe through his/her right nostril.[12-14]

Guidelines for silent sitting session:(1)The patient was verbally asked whether he/she felt ready for the session. (2) The patient was placed in an appropriate position with the head, neck, and the body in an upright position. (3) The patient was asked to sit down for 5 min. without talking. After 1 min of rest following the exercise, the clinical blood pressure, heart rate, and oxygen saturation levels were recorded again.

Intervention stage: The blood pressure of the patients was measured at home. The patients in the respective groups were instructed to perform the alternate nostril breathing exercise or the silent sitting session (SSS) for two weeks (Table 1), once a day, 2-3 h after breakfast every day. Automatic blood pressure devices, which belonged to the patients, were calibrated by the researcher, and the blood pressure at the upper arm was used for the home measurements of blood pressure.[4] The patients were asked to records the values measured at home on the record form prepared by the researchers.

To remain focused, the patients were asked to perform the intervention alone in a quiet room without television, radio, etc. To increase the motivation and compliance of the patients with the intervention, the patients were contacted by telephone on the second and tenth day of the intervention. In addition, the patients were informed that they could consult the researcher over the phone.

Post-intervention stage: The effect of alternate nostril breathing exercise on blood pressure was evaluated using the blood pressure values measured at home and in the clinic. The forms of follow-up blood pressure measurements were taken from the patients in the experimental and control groups who came to the clinic in the morning at the end of two weeks. After resting for 5 min, the researcher recorded the blood pressure, heart rate, and oxygen saturation levels of the patients. At the end of the intervention and after collecting all the relevant data, the patients were given a "Hypertension Information Brochure," which describes the importance of lifestyle changes for maintaining optimal blood pressure.[4,5]

Table 1. Steps of alternate nostril breathing exercise and silent sitting session

Before ANBE or SSS	ANBE and SSS Interventions					
	1. Intervention		2. Intervention		3. Intervention	
Rest, 5 min Then, measure and record the BP, heart rate, and SaO_2 levels	NBE or SSS intervention, 5 min	Break after ANBE or SSS intervention, 1 min Then, measure and record the BP, heart rate, and SaO_2 levels	ANBE or SSS application, 5 min	Rest after ANBE or SSS, 1 min Then, measure and record the BP, heart rate, and SaO_2 levels	ANBE or SSS intervention, 5 min	Rest after ANBE or SSS; 1 min Then, measure and record the BP, heart rate, and SaO_2 levels

ANBE: Alternate nostril breathing exercise; SSS: Silent sitting session; BP: Blood pressure; SaO_2: Oxygen saturation.

The data were collected using home blood pressure measurements in the follow-up form and information form. The information form consists of two parts; the first part includes questions about the sociodemographic characteristics of the patients, presence of additional disease, use of drugs, tobacco products, and alcohol, and a history of yoga or breathing exercises. The second part of the form includes a record of the blood pressure of the patients in the experimental and control groups measured in the clinic. In addition, the home blood pressure follow-up form was created to record the blood pressure of the patients in the experimental and control groups and was administered to the patients after the first clinical measurements. An aneroid sphygmomanometer and a pulse oximeter, which were calibrated by the researchers, were used for clinical measurements.

Data Evaluation

The qualitative and numerical variables were statistically evaluated using the mean, standard deviation, and median tests. The Wilcoxon test was used to compare two continuous variables that did not conform to normal distribution. The data were assessed using the MedCalc statistical software version 12.7.7. The level of statistical significance was accepted as $p<0.05$.

Ethical and Legal Considerations

The necessary approval for conducting the study (decision no. 2017-14-09 dated 23/10/2017) was obtained from the Clinical Research Ethics Committee at Istanbul, Turkey.

The patients included in the study were informed about the study purpose, data collection process and instruments, and research and application time through the "Informed Volunteer Consent Form" prepared by the researcher according to the Declaration of Helsinki. The patients were included in the study after obtaining written and verbal informed consents.

Results

The study included 76 patients; 55 (72.4%) were women, 21 (27.6%) were men, the mean age of the patients was 52.4±6.9 years, and the mean body mass index (BMI) was 27.6 (SD=3.4) (Table 2).

Compared to the mean values of the first measurement of clinical SBP and diastolic blood pressure (DBP), the mean values of the second measurement of clinical SBP and DBP showed a decrease of approximately 3 and 5 mmHg, respectively, in patients in the control group, and a decrease of 4 mmHg in both the SBP and DPB in patients in the experimental group. The patients in the experimental group showed a greater decrease in the mean values of the second clinical SBP than the patients in the control group

Table 2. Sociodemographic characteristics of patients in the control and experimental groups

Sociodemographic characteristics	Total n (%)	Experimental group n (%)	Control group n (%)	p
Gender				
Female	55 (72.4)	32 (86.5)	23 (59)	0.010**
Male	21 (27.6)	5 (13.5)	16 (41)	
Marital status				
Married		29 (78.4)	27 (69.2)	0.439**
Single		8 (21.6)	12 (30.8)	
Education level				
Illiterate		2 (5.4)	0	0.683**
Primary school		19 (51.4)	20 (51.3)	
Secondary school		8 (21.6)	10 (25.6)	
High school		6 (16.2)	5 (12.8)	
University		2 (5.4)	4 (10.3)	
Mean age (years)+	52.4±6.9	56±7.9	51.8±5.9	0.703*
Body mass index+	27.6±3.4	27.6±1.7	28.3±1.3	0.075*

*Mann-Whitney *U*; **Student *t*, Fisher's exact ($p<0.05$); +Mean±SD: Mean±standard deviation.

Table 3. The results of clinical measurements of blood pressure in the first and second week (n=76)

Clinical measurements	Experimental Group Mean (SD)	Control Group Mean (SD)	p*
First clinical SBP+	129 (13)	134 (13)	0.105
Second clinical SBP+	125 (10)	131 (12)	0.026
First clinical DBP+	79 (10)	82 (9)	0.172
Second clinical DBP++	75 (8)	77 (8)	0.152
First clinical oxygen saturation level (%)	98.08 (1.28)	98.28 (1.07)	0.470
Second clinical oxygen saturation levels (%)	98.46 (0.73)	98.18 (1.30)	0.696
First clinical heart rate (beats/min)	84.84 (10.45)	87.21 (8.67)	0.214
Second clinical heart rate (beats/min)	83.97 (9.04)	85.82 (7.57)	0.373

+SBP: Systolic blood pressure; ++DBP: Diastolic blood pressure; Mean±SD: Mean±standard deviation; *Mann-Whitney *U* Test; +mmHg.

Table 4. Results of the mean blood pressure before and after the intervention in both groups (n=76)

Blood Pressure Measurement (mmHg)	Intervention	Control Group¶ Mean (SD)	Experimental Group¶ Mean (SD)	p
First Week SBP+	Pre-intervention	133.8 (12.1)	130.7 (11.9)	0.257*
	Post-intervention	130.9 (10.7)	127.1 (10)	0.113*
Second Week SBP+	Pre-intervention	130.4 (10.2)	128.5 (11.3)	0.192**
	Post-intervention	130.2 (10.3)	125.4 (7.5)	0.019**
First Week DBP++	Pre-intervention	75.3 (6.3)	75.5(6.5)	0.849*
	Post-intervention	74 (6.6)	73.8 (6)	0.893*
Second Week DBP++	Pre-intervention	74.7 (6.2)	75.1 (5.3)	0.776*
	Post-intervention	73.9 (6)	73.8 (5.1)	0.996**

+SBP: systolic blood pressure; ++DBP: diastolic blood pressure; ¶Mean±SD: mean±standard deviation; *Independent sample t test **Mann Whitney U Test.

(p<0.05) (Table 3). However, no significant difference was observed between the first and second measurements of clinical DBP (p>0.05) in both groups.

For results of blood pressure measurement at home; At the end of the first week, the mean SBP after the breathing exercise and sitting session was approximately 3 mmHg lower than that before the respective intervention in both groups, and the mean DBP after the intervention was approximately 3 mmHg lower than that before the intervention in both groups. No statistically significant difference was observed between the mean SBP and DBP in the first week in both groups (p>0.05) (Table 4).

At the end of the second week, the mean SBP after the intervention was approximately 3 mmHg lower than that before the intervention in the experimental group (p<0.05). Moreover, no statistically significant difference was observed in the DBP at second week between both groups (p>0.05) (Table 4).

Discussion

The incidence of hypertension similar to that of other chronic diseases increases with age. The Turkish Hypertension Prevalence study (2012) reports that the prevalence of hypertension is 5% in the 18-29 age group and 67.9% in the 60-69 age group. Hypertension affects one out of three adults over 18 years and one out of two adults over 50 years.[15] The mean age of the patients in this study was 52.4 (SD=6.9) years (Table 2). Our results are consistent with those published previously.[16,17]

A 2 mmHg decrease in blood pressure causes a 7% decrease in deaths due to coronary artery disease and a 10% decrease in stroke-induced deaths.[18] Pranayama means the control of prana or breath, a concept in yoga, and is based on controlled, rhythmic, deep, and slow breathing. Previous studies indicate that pranayama decreases blood pressure by reducing the activity of the sympathetic nervous system. The decrease in the activity of the sympathetic nervous system activity increases the activity of the parasympathetic nervous system and decreases the levels of stress.[19,20] In addition, pranayama provides autonomic balance by decreasing the activity of the peripheral adrenergic system.[21-23]

A previous study showed that a performing pranayama for 5 min decreases the average SBP by 5 mmHg.[24] The results of another study showed that alternate nostril breathing exercise causes a significant decrease in the SBP but no decrease in the DBP in healthy individuals.[25]

A randomized controlled study showed that the average SBP and DBP decreased by approximately 10 mmHg at the end of a slow breathing exercise program conducted for 3 months.[16] A 12-week pranayama exercise program showed a significant improvement in the cardiovascular parameters (heart rate, respiratory rate, DBP, and SBP) of healthy individuals.[26] Another study of 60 healthy individuals showed that a 12-week alternate nostril breathing exercise program showed a significant decrease in the mean SBP of the participants.[27] The results of this study showed that the patients who participated in the silent sitting session showed a decrease of approximately 3 and 5 mmHg in the SBP and DBP, respectively, whereas the patients who performed the alternate nostril breathing exercise showed a decrease of about 4 mmHg in both SBP and DBP measured at the end of the second week (Table 3). Results of intergroup evaluation of the decrease in BP showed a significant decrease in the SBP of patients who performed the breathing exercises, which is consistent with the findings reported previous (p<0.05) (Table 3).

A previous study investigated the effect of gender on DBP, SBP, and heart rate in healthy adults who performed the alternate nostril breathing exercises for 12 weeks; the re-

sults of this study showed a significant improvement in the cardiac parameters of both female and male participants.[28] Pal et al.[29] conducted a study with 85 healthy young individuals; the participants performed the alternate nostril breathing exercises once a day for 6 weeks, and a significant difference was observed between the pre- and post-intervention heart rate, SBP, and DBP. The results of a randomized controlled study showed that patients who performed slow breathing exercise experienced an approximate 10 mmHg decrease in the SBP at the end of 3-month exercise program.[24] The results of this study showed no statistically significant difference between the mean BP measured at home in the first week in both groups ($p > .05$) (Table 4). However, a 5 mmHg decrease was observed in the mean SBP measured at home in the second week ($p<0.05$) (Table 4).

Limitations

Low number of samples due to limited working time and the limitation of clinical blood pressure measurement to a measurement of the patients is among the limitations of the study.

Conclusion

The results of this study showed that:

A statistically significant difference was observed between the clinical BP measured in the first and second week in both groups. A statistically significant decrease was observed in the clinical SBP of the patients with hypertension. The mean SBP and DBP measured in the first week at home of patients in the control group were statistically significantly lower after the silent sitting session than those before the session, whereas only the mean DBP measured in the second week was significantly different before and after the intervention. The mean SBP measured at the home of patients in the control group showed a significant decrease only in the first week, whereas the patients in the experimental group showed a significant decrease in the pre- and post-intervention mean SBP in the first and second weeks. The mean SBP of patients in the experimental group in the second week was significantly lower than that of the control group.

Thus, alternate nostril breathing exercises in addition to pharmacological treatment may decrease the dose of antihypertensive agents and regulate the blood pressure in patients with hypertension.

What's New and Important?

Alternate nostril breathing exercises in addition to pharmacological treatment may decrease the dose of antihypertensive agents and regulate the blood pressure in patients with hypertension. It can be applied as an important nursing intervention to help hypertension patients to control their blood pressure.

Acknowledgements: The authors would like to thank all the health professionals who supported in the clinic during the study and the patients who participated in the study.

Ethics Committee Approval: Approval was obtained from Bakirkoy Dr. Sadi Konuk Education and Research Hospital Clinical Research Ethics Committee in order to conduct the research (Date: 23 October 2017 and no: 2017-14-09).

Peer-review: Externally peer-reviewed.

Conflict of Interest: The authors declared that there are no potential conflict of interest with respect to the research, authorship, and/or publication of this article.

Funding: The authors reveived no financial support for the research, authorship, and/or publication of this article.

Authorship Contributions: Concept - G.U., H.U.; Design - G.U., H.U.; Materials - G.U., H.U.; Data collection or processing - G.U.; Analysis or interpretation - G.U., H.U.; Literature Search - G.U., H.U.; Written - G.U., H.U.

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