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Research Article / Araştırma Makalesi

Investigation of the effects of 8-week Nordic and traditional walking training on blood pressure in prehypertensive postmenopausal women

Prehipertansif postmenopozal kadınlarda 8 haftalık İskandinav yürüyüşü ve geleneksel yürüyüş antrenmanının kan basıncına etkisinin araştırılması

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ABSTRACT

Objective: This study aimed to investigate the effects of Nordic walking (NW) and traditional walking (TW) training on blood pressure and resting heart rate in prehypertensive postmenopausal women.

Materials and Methods: Twenty women aged 57.9 ± 7.2 years participated in the study. Participants were divided into two groups of 10: NW and TW. Exercises were performed three days a week for eight weeks and 50 min/day at 40-60% of the maximum heart rate. Body composition, blood pressure, and resting heart rate values of the participants were measured before and after the 8-week exercise program.

Results: Upon comparing the values before and after exercise; body weight, body mass index, hip circumference, systolic and diastolic pressure values decreased significantly ($p<0.05$), while there was no significant change in the resting heart rate ($p>0.05$) in the NW group. In the TW group; body weight, body mass index, waist circumference, hip circumference, systolic and diastolic pressure decreased significantly ($p<0.05$). No significant changes were found in other parameters ($p>0.05$). The effect size of NW training was found to be higher in body weight, BMI, and systolic and diastolic pressure values.

Conclusion: NW training is more effective than TW training in the regulation of blood pressure in prehypertensive postmenopausal women.

Keywords: *Exercise, nordic walking, prehypertensive, postmenopausa*

ÖZ

Amaç: Bu çalışmada, prehipertansif postmenopozal kadınlarda nordik yürüyüş (NW) ve geleneksel yürüyüşün (TW) kan basıncı ve istirahat kalp atım hızı üzerindeki etkilerini araştırmak amaçlandı.

Gereç ve Yöntem: Çalışmaya yaşları 57.9 ± 7.2 olan 20 kadın katıldı. Katılımcılar 10'ar kişilik iki gruba ayrıldı: NW ve TW. Egzersizler, sekiz hafta boyunca haftada üç gün, maksimum kalp hızının %40-60'ında günde 50 dk süreyle uygulandı. Katılımcıların vücut kompozisyonu, kan basıncı ve istirahat nabız değerleri 8 haftalık egzersiz programı öncesi ve sonrasında ölçüldü.

Bulgular: Egzersiz öncesi ve sonrası değerler karşılaştırıldığında; NW grubunda vücut ağırlığı, vücut kitle indeksi, kalça çevresi, sistolik ve diyastolik kan basıncı değerleri anlamlı olarak düşerken ($p<0.05$), dinlenik kalp hızında anlamlı bir değişiklik olmadı ($p>0.05$). TW grubunda; vücut ağırlığı, vücut kitle indeksi, bel çevresi, kalça çevresi, sistolik ve diyastolik kan basıncı değerleri anlamlı düzeyde azaldı ($p<0.05$). Diğer parametrelerde anlamlı değişiklik bulunmadı ($p>0,05$). NW antrenmanın etki büyüklüğü vücut ağırlığı, VKİ, sistolik ve diyastolik kan basıncı değerlerinde daha yüksek saptandı.

Sonuç: Prehipertansif postmenopozal kadınlarda kan basıncının düzenlenmesinde NW eğitimi TW eğitiminden daha etkili bulundu.

Anahtar Sözcükler: *Egzersiznordik yürüyüş, prehipertansif, postmenopozal*

INTRODUCTION

Prehypertensive individuals have a systolic pressure of 120-139 mmHg or a diastolic pressure of 80-89 mmHg, and are more likely to be diagnosed with hypertension in the future. The purpose of the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure for defining prehypertension is to increase awareness of at-risk individuals, to delay or prevent a diagnosis of hypertension with early adoption of healthy lifestyle interventions in order to lower blood pressure levels and reduce the risk of cardiovascular disease (1).Lifestyle changes, such as adopting non-pharmacological diet and exercise habits, have been recommended for the prevention and treatment of prehypertension (1,2).

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Menopause is associated with an age-related increase in arterial damage and a decrease in muscle strength, which generally leads to an increased risk of cardiovascular disease (3). Brachial-ankle pulse wave velocity, which is an index of systemic arterial stiffness, high blood pressure, and sarcopenia, age-related loss of muscle strength and mass are observed in post-menopausal women. Recent studies have demonstrated that increased isometric and dynamic muscle strength may have a protective effect against arterial stiffness, hypertension, and cardiovascular diseases. It has been shown that exercise training is an effective way to improve the elevated blood pressure and arterial stiffness associated with sedentary aging. Exercise is known to protect against age-related increased risk factors for cardiovascular disease (4).

It is known that aerobic exercise programs improve physical fitness, and have positive metabolic and cardiovascular effects (5). Traditional walking (TW) training, the most popular aerobic exercise, is frequently prescribed to patients as a cheap, safe and motivating form of exercise (6). A new form of aerobic exercise called 'Nordic walking' (NW) has also recently gained popularity. NW is a type of aerobic exercise in which specially designed sticks called 'walking poles' are used. In NW training, the chest, shoulder and abdominal muscles, in addition to lower limb and trunk muscles, are actively involved in walking (7,8). According to the literature, the proper use of sticks leads to increased oxygen uptake (VO_2max), heart rate and blood lactate concentration during walking by activating the upper limb to push the body forward during walking in comparison with TW training (9).

Furthermore, it has been reported that NW improves cardiovascular conditions more effectively than TW (5). Due to these advantages, the effect of NW training in different disease groups has recently become a focus of research (5,10,11). There is no study in the literature examining the effect of NW training in prehypertensive individuals, and there are few studies conducted on hypertensive patients (12,13). This study aimed to investigate the effects of NW and TW training on blood pressure in prehypertensive postmenopausal women.

MATERIAL and METHODS

Ethical approval for the study was obtained from the Non-Interventional Clinical Research Ethics Committee of Pamukkale University at the board meeting no. 06.08.2019/14 (Protocol No: 60116787-020/54329). Detailed written and verbal information was provided to all participants, and then written informed consent was received from each of them.

Participants

Twenty sedentary postmenopausal women aged 40-65 years who presented to the Cardiology Outpatient Clinic of Pamukkale University, who were diagnosed with prehypertension (systolic blood pressure ≥140 mmHg and diastolic blood pressure ≥90 mmHg) by a specialist physician were enrolled in the research. Exclusion criteria of the study were having coronary artery disease, diabetes, renal failure, rheumatoid arthritis, lung disease, to have received chemotherapy within six months, or having had a myocardial infarction, and being involved in an exercise program in the past six months. Patients were selected by a cardiologist based on the exclusion criteria, and they were evaluated for fitness for exercise. During the study, the participants did not use any medication, except for insulin resistance (2x500 mg glyphor per day).

Study Design

The individuals enrolled in the study were randomly divided into two groups: NW (n=10) and TW (n=10), based on the order of admission. The risks of hypertension were explained to all participants by a cardiologist, and the 'Dietary Approaches to Stop Hypertension' (DASH) food diet was explained and recommended to be followed in addition to walks to delay or prevent the onset of medication use. Verbal statements regarding patients' compliance with nutritionalrecommendations were taken during the process. The NW and TW groups walked three days a week for eight weeks and 50 min/day. The training was carried out by forming groups of 3-4 people accompanied by a physiotherapist. Outdoor, park, and walking areas were preferred to apply the exercise program.

The walks were carried out with a Polar M200 model wrist-based heart rate tracking watch with GPS, which measures heart rate. The target heart rate was calculated by the percentage of maximum heart rate method (14). The range of 40-60% of the maximum heart rate was determined, and each participant was asked to walk briskly by keeping their heart rates within this range using a running watch with GPS (15). Walks were carried out as 5 min of warm-up, 50 min of walking, and 5 min of cooling down. The participants were evaluated before and after eight weeks of exercise at Pamukkale University School of Physical Therapy and Rehabilitation. Body mass and height were measured using a standard balance and a stadiometer accuracies of 0.1 kg and 0.5 cm, respectively. Waist and hip circumferences were measured with a tape measure while individuals were in the anatomical position. SBP and DBP at rest were recorded using an Omron HEM-907XL apparatus (Omron Healthcare, Inc., IL, USA) (12). The individuals were blinded to their test

results to avoid the expectation effect. Statistical analysis was conducted by an independent and blinded expert.

Statistical Analysis

In the power analysis carried out in accordance with the expectations, considering that the effect size of the difference between the two groups might be at a strong level (f=0.6), it was calculated that 80% power could be obtained at a confidence level of 95% when at least 20 individuals (at least 10 individuals for each group) were included in the study. Data were analyzed using the SPSS 24.0 package program. Values are given as arithmetic mean±standard deviation (AM±SD). The conformity of the data to normal distribution was examined by the Shapiro-Wilk test. The significance test of the difference between the two means was used to compare the independent group differences when parametric test assumptions were met, and the Mann-Whitney U test was used when parametric test assumptions were not met. In dependent group comparisons, the significance test of the difference between the two pairs was used when parametric test assumptions were met, and the Wilcoxon paired two-sample test was used when parametric test assumptions were not met. The level of significance was set at $p<0.05$. Cohen's effect size (d) was calculated to compare the two groups, and the effect size was interpreted as follows: 0.2 small, 0.5 medium, and 0.8 large (16).

RESULTS

Twenty women with a mean age of 57.9 ± 7.2 years participated in the study. Pre-exercise blood pressures and anthropometric characteristics of the groups in the study were compared, and no significant difference was revealed ($p>0.05$). Upon comparing the anthropometric characteristics before and after exercise in prehypertensive postmenopausal women, significant decreases were found in body weight, BMI, and hip circumference values in the NW and TW groups ($p<0.05$). Moreover, the effect size of NW training was found to be higher in the decrease in body weight and BMI. Upon comparing the waist circumference values before and after exercise, there was no significant change in the NW group ($p>0.05$), whereas a significant decrease was identified in the TW group ($p<0.05$) (Table 1).

Table 1. Comparison of anthropometric characteristics of the participants before and after exercise

Parameter	Before exercises	After exercises	p	d	z/t
Body weight(kg)					
NW	72.4±11.5	69.9±11.4	0.003*	1.089	z=2.936
TW	70.5±10.0	69.1±09.5	0.009*	1.056	t=3.342
BMI(kg/m²)					
NW	29.7±3.4	28.6±3.3	0.003*	1.032	z=-2.938
TW	28.5±4.0	27.9±3.6	0.011*	1.001	t=3.168
Waist circ.(cm)					
NW	102.2±12.0	101.2±11.8	0.331	0.342	z=-0.973
TW	100.9±12.4	99.9±11.9	0.046*	0.730	t=2.310
Hip circ.(cm)					
NW	110.8±8.1	109.0±7.9	0.018*	0.918	t=2.903
TW	111.5±5.8	109.6±5.2	0.003*	1.294	t=4.092

NW: nordic walking (n=10), TW: traditional walking (n=10), BMI: body mass index; d: Cohen's effect size, z: Wilcoxon paired-sample test, t: significance test of difference between two pairs, *: p<0.05.

When systolic and diastolic pressure levels were compared before and after exercise in prehypertensive postmenopausal women, a significant decrease was found in both groups ($p<0.05$). Furthermore, the effect size of NW training was higher in the decrease in blood pressure. Upon comparing resting heart rate values before and after exercise in prehypertensive postmenopausal women, no significant change was found in both groups (Table 2).

Table 2. Comparison of blood pressure and heart rate of the participants before & after exercise

Parameter	Before exercises	After exercises	p	d	t/z
Systolic pr.(mmHg)					
NW	126.0±11.7	113.0±6.8	0.002*	1.370	t=4.333
TW	128.0±10.3	119.0±5.7	0.029*	0.817	t=2.586
Diastolic pr.(mmHg)					
NW	90.0±6.7	77.0±8.2	0.006*	1.926	z=-2.739
TW	92.0±7.9	83.0±6.8	0.007*	1.585	z=-2.714
Resting HR (bpm)					
NW	76.0±7.4	77.4±7.5	0.372	0.281	t=-0.934
TW	80.1±7.1	78.1±5.7	0.396	0.298	t=0.897

NW: nordic walking (n=10), TW: traditional walking (n=10), HR: heart rate, d: Cohen's effect size, z: Wilcoxon paired-sample test, t: significance test of difference between two pairs *: p<0.05.

DISCUSSION

As a result of the 8-week NW and TW training in prehypertensive postmenopausal women, a significant decrease was revealed in systolic and diastolic pressure in both exercise groups, while no significant change was found in resting heart rate. Moreover, there was a significant decrease in body weight, BMI, and hip circumference values in the NW group, whereas no significant change was detected in waist circumference and waist/hip ratio. In the TW group, there was a significant decrease in body weight, BMI, waist circumference, and hip circumference, while the waist/hip ratio increased significantly. As an important result of our study, NW training was revealed to be more effective in regulating blood pressure.

In a similar study examining the physiological effect of NW training, Latosik et al. found a statistically significant decrease in dysfunctional systolic blood pressure following eight weeks of NW training in systolic-hypertensive postmenopausal women (systolic pressure ≥140 mmHg and diastolic pressure <90 mmHg), but no significant change was revealed in diastolic pressure and resting heart rate (12). In our study, a significant decrease was found in both systolic and diastolic pressure. The reason for this difference may be that Latosik et al. included only systolic-hypertensive individuals in their study. Kucio et al. did not find a significant change in blood pressure after four weeks of NW training in overweight or obese patients with hypertension (13). The difference between the results can be explained by the fact that they provided a shorter duration of exercise training compared to other studies.

In evamining the effect of TW training on blood pressure, He et al. evaluated the effect of 12-week brisk walking training (60-min brisk walking, 3/wk for a total of 12 wk) according to exercise intensity in patients with essential hypertension. Brisk walking reduced blood pressure in patients with essential hypertension during exercise with different intensities (17). In their study examining the effectiveness of walking and its duration on hypertension, Hayashi et al. reported that walking to work prevented hypertension and reduced the risk of developing hypertension with an increase in walking time (18). In his study examining exercise and blood pressure, Cox highlighted that exercise, especially TW, regulated blood pressure (19). In line with these studies, a significant decrease in blood pressure was found with TW training applied for eight weeks. Hornbuckle et al. investigated the effects of 12-week TW training on cardiovascular disease risk factors in middle-aged sedentary healthy women. They did not find a significant change in blood pressure with TW training (20). Unlike this study, the fact that other studies in the literature, along with our study, provide brisk walking training with heart rate tracking instead of daily step count, may have caused them to be more effective in reducing cardiovascular risks.

Figard-Fabre et al. have recently compared NW and TW that they maintained three days a week for 12 weeks in obese and middle-aged women. The researchers reported that a significant decrease in only diastolic pressure in both exercise groups might be due to the fact that obesity is generally associated with the development of diastolic dysfunction, not systolic dysfunction (21). Our study revealed a significant decrease in both systolic and diastolic pressures in both study groups. Moreover, as an important result of our study, the effect size of the NW group on blood pressure was higher. The reason for this result may be that although there was no difference in perceived effort between NW and TW, NW required a higher cardiorespiratory workload due to the large muscle mass it contained, which had a greater effect on the cardiovascular system (15).

In postmenopausal women, hypertension is usually associated with cardiovascular risk factors such as visceral obesity, dyslipidemia, chronic low-grade inflammation, oxidative stress, endothelial dysfunction, and cardiac remodeling. Therefore, there is a widespread need for the treatment and prevention of cardiovascular risks in this high-risk population (22). Numerous studies have demonstrated the beneficial roles of exercise training in the cardiovascular system (23,24). It is also known that traditional walking

training has positive effects on blood pressure in hypertensive individuals (25). Our study is the first one to investigate the effect of NW training on blood pressure in prehypertensive postmenopausal individuals.

As can be seen, there are limited studies in the literature on patients diagnosed with hypertension (12,13). The reason for this has been shown to be that NW training is carried out in the open air, and therefore patients cannot be followed up continuously (ECG, blood pressure, heart activity), unlike in training performed under fixed conditions (13). Thus, there is no study examining the effect of NW training in prehypertensive individuals. Considering this situation in our study, before starting the training, cardiac examinations of the patients were performed by a cardiologist, and individuals without any obstacle to exercise were included in the study. Heart rate was followed by running watches with GPS that measure heart rate during the training, and regular monitoring of blood pressure was requested by a cardiologist.

In our study, the fact that we organized a walking program in small groups, provided a socializing environment for both exercise groups and increased the motivation to participate in exercises. In NW training, the fact that sticks can be adjusted according to the height of individuals and facilitate walking by supporting individuals on a rough terrain, and the presence of additional apparatus for walking on soil increase applicability. The ease of application of NW training and the pleasure of doing a different exercise increase the motivation to participate in exercise. Furthermore, the coordinated work of both the lower and upper limbs in NW training may also improve the coordination of individuals. On the other hand, high cost of poles, and the fact that pain may be indicated in some upper limb muscle groups in the first weeks due to the involvement of different muscles in walking appear as disadvantages. Moreover, long-term follow-up of patients regarding the transition to hypertensive medication use was not performed. In future studies, NW training, which we think may be a protective exercise approach in prehypertensive individuals, can be followed up for six months to a year.

CONCLUSION

NW was found to be more effective than TW in regulating blood pressure, and reducing body weight and BMI in prehypertensive postmenopausal women. Therefore, NW training can be considered an alternative and motivating exercise approach for individuals who are recommended life modification.

Ethics Committee Approval / Etik Komite Onayı

The study was approved by the Ethics Committee of Pamukkale University (Date: 06.08.2019, Decision no: 14). The study was conducted in accordance with the international declaration guidelines, etc.

Conflict of Interest / Çıkar Çatışması

The authors declared no conflicts of interest with respect to authorship and/or publication of the article.

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Author Contributions / Yazar Katkıları

Concept: FU; Design: ET, FU; Supervision: FU; Materials: ET; Data Collection and/or Processing: YTY, ET; Analysis and Interpretation: ET; Literature Review: FU, YTY; Writing Manuscript: ET, FU, YTY; Critical Reviews: YTY, FU, ET.

Other Information / Diğer Bilgiler

This study was derived from one of the authors', Ebru Tekin's Master's thesis titled "Comparison of the Effects of 8-Week Nordic Walking Training and Traditional Walking Training on Physiological and Functional Parameters in Prehypertensive Postmenopausal Women."

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