ISSN 2458-8865 E-ISSN 2459-1505
www.fppc.com.tr
Family Practice and Palliative Care
https://doi.org/10.22391/fppc.639672

Research Article

The effect of pedometer on blood pressure in patients with personalized physical activity counselling

Kişiselleştirilmiş fiziksel aktivite danışmanlığı verilen hastalarda pedometrenin kan basıncına etkisi

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ABSTRACT

Introduction: The modern, electronic and trending method of studying the effect of the use of a pedometer on physical activity and hence the effect of body fat rate is a research topic.
Methods: Participants were randomly assigned to control, walking (PAC) and pedometer (PAC-PED) groups, and personalized physical activity was prescribed. We wanted to note the practices we had on the PAC group for the exercises and follow the exercises on the PAC-PED group with the pedometer. The control group was not followed.
Results: 52 patients in the control group, patients in the PAC group and patients in the PAC-PED group were randomly assigned. The mean age of all participants was 51.2 ± 14.5, the proportion of women by sex was 82.1%, and that of men was 17.9%. The mean blood pressures in systolic and diastolic values of the participants was 118.4 ± 19.4 and 72.3 ± 13.7, respectively. mean IPAQ score was 900.6 ± 852.6. Participants were followed as mean of 2.1 ± 1.3 (0.65 – 6.33) months. There was no difference between the groups as previous and next blood pressure values. However, there was a significant difference between the PAC-PED group and the control group in terms of mean blood pressure differences.
Conclusion: There is no decrease in blood pressure in patients given individualized physical activity. However, the use of a pedometer instead of a follow-up card may have a positive effect on blood pressure values despite no monitoring method being used.
Keywords: physical activity, pedometer, blood pressure

ÖZ

Giriş: Modern, elektronik ve trend bir yöntem olarak pedometre kullanımının fiziksel aktiviteye ve dolayısıyla kan basıncına etkisi çalışmamızın araştırma konusudur.
Yöntem: Kontrol, yürüyüş (PAC) ve pedometre (PAC-PED) gruplarına katılımcılar random atanarak kişiselleştirilmiş fiziksel aktivite reçete edildi. PAC grubuna yaptıkları egzersizleri verdiğimiz kartlara not ederek, PAC-PED grubuna ise pedometreyle egzersizleri takip etmelerini istedik. Kontrol grubu ise takibe alınmadı.
Bulgular: Kontrol grubuna 14, PAC grubuna 7, PAC-PED grubuna 7 hasta random atandı. Tüm katılımcıların yaş ortalaması 51,2 ± 14,5, cinsiyete göre kadınların oranı %82,1, erkeklerin %17,9 saptandı. Katılımcıların kan basıncı ortalaması sistolik ve diyastolik için sırasıyla 118,4 ± 19,4 ve 72,3 ± 13,7, IPAQ puanı ortalama 900,6 ± 852,6 saptandı. Katılımcılar ortalama 2,1 ± 1,3 (0,65 – 6,33) ay takip edildi. Grupların önceki ve sonraki kendi kan basıncı değerleri arasında fark olmadı. Ancak PAC-PED grubu ile kontrol grubu arasında kan basıncı ortalama farkları arasındaki (ortalama kan basıncı değişimi) değerleri arasında anlamlı fark saptandı.
Sonuç: Kişiselleştirilmiş fiziksel aktivite verilen hastalarda kan basıncı düşüş olmamaktadır. Ancak takip kartı yerine pedometre kullanılmaması hiçbir takip metodu kullanılmamasına karşı kan basıncı değerleri üzerine olumlu etkisi olabilmektedir.
Anahtar Kelimeler: fiziksel aktivite, pedometre, kan basıncı

Received	Accepted	Published Online	Corresponding Author	E-mail
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Introduction

Hypertension (HT) is an increase in arterial blood pressure (ABP) above normal values and is a blood pressure (BP) regulation disorder. Hypertension is diagnosed when systolic blood pressure (SBP) exceeds 130 mm Hg and / or diastolic blood pressure (DBP) exceeds 80 mm Hg. HT, which affects 1 billion people in the world and is assumed to reach 1.5 billion for 2025, is present in approximately 16 million people in our country [1,2]. The prevalence of HT aged 20 years and older was 32.3% in women and 30.9% in men [3].

HT is divided into two groups as essential (primary) and secondary hypertension. Genetic factors, age, excess weight, low birth weight birth history, presence of insulin resistance, excess sodium intake, renal sodium retention, excessive sympathetic activity and sedentary life are among the essential etiologies of HT. In the etiology of secondary HT, there is an identifiable organic cause (s). Blood pressure measurements for the diagnosis of HT can be made in a clinical or home setting or ambulatory. Among these, ambulatory blood pressure measurement (SANS) is superior in determining the risk of HT organ injury and predicting clinical outcomes. Considering the prevalence of hypertension in societies, it is thought that its treatment will have significant positive effects on public health. Myocardial infarction (MI), coronary artery disease (CAD), systemic atherosclerosis, congestive heart failure (CHF), stroke (stroke), retinopathy and nephropathy are among the major complications of this disease.

Treatment in HT begins with lifestyle change, adding pharmacological treatment options in cases where the desired BP cannot be achieved, or initiating concomitant pharmacological treatment in addition to lifestyle changes at high BP values. Lifestyle changes include weight loss (weight control), dietary habits change, salt restriction, alcohol consumption reduction, smoking cessation, and physical exercise. Physical activity of men (77%) and women (87%) have insufficient physical activity according to Turkey Chronic Disease Risk Factors research [4]. One of the major obstacles to effective treatment and lifestyle changes in struggle against chronic diseases is insufficient health literacy [5]. This has been reported to pose a risk, particularly for wrong drug use [5]. It was observed that an adequate level of physical activity was achieved with an awareness of increased body mass index [6]. Considering the lack of awareness about the prevalence and treatment of HT in our country, it is also important to raise awareness of individuals in terms of effective physical activity.

The aim of this study was to evaluate the effects of personalized physical activity counseling (PAC) and pedometer-assisted physical activity counseling (PAC-PED) on blood pressure in patients admitted to the Family Medicine Outpatient Clinic.

Methods

The population of this prospective and interventional study consisted of patients who applied to Family Medicine Polyclinic of Canakkale Onsekiz Mart University Medical Faculty Hospital. The patients were divided into three groups as control (K), physical activity counseling (PAC) and pedometer-assisted physical activity counseling (PAC-PED). Patients who were eligible according to the study criteria were included in the study (Table-1).

Table 1. Study criteria

Inclusion criteria	Exclusion criteria
• 18 years and over	• Changes in the treatment plan in the last 2 months • SBP <120 and> 160 mm Hg in outpatient clinic measurements • Disease or disability to prevent compliance with the study methods (dementia, housebound, psychiatric illness to disrupt reality assessment) • Patients with secondary HT, Type 1 DM • Pregnancy • Use of steroids or other similar pharmacological agents for any reason • A disease (such as Congestive Heart Failure, Coronary Heart Disease, Rheumatoid Arthritis, Gout, Gonarthrosis) or disability that prevents regular exercise • Patients who report that can not participate in regular exercise

Data collection tools

Data were collected with short form of International Physical Activity Questionnaire (IPAQ), anthropometric measurements, blood pressure Holter and pedometer. A questionnaire prepared by the researchers for the study include the demographics and medical history details of the participants were used. In order to determine the comprehensibility of the questionnaire, 10 patients who applied to the outpatient clinics of Canakkale 18 Mart University Hospital for various reasons, were subjected to trial application and then corrected.

Anthropometric measurements

The body weight of all participants was measured by lightweight clothing without shoes, with an electronic weighing set with precision of 100 g. Height measurement was made with 1 cm precision without shoes in front of tape measure attached to vertical wall. Body mass index (BMI) was calculated by dividing body weight by the square of the height (kg / m2).

International Physical Activity Questionnaire (IPAQ)

In 1996, in order to determine physical activity levels; IPAQ survey developed by Michael Booth; It is designed in two forms as short and long. The short form of this questionnaire was used in the study. Short form (7 questions) provides information about the time spent in walking, moderate-severe and severe activities. The time spent in sitting is considered as a separate question and measures sedentary elapsed time. The total score of the short form is calculated by the sum of duration (minutes) and frequency (days) of walking, moderate intensity, and severe activities. A score in MET-minutes is obtained from this total score. A Met-minute is calculated by multiplying the minute of the activity with the MET score. As a result of the calculations, physical activity level is classified as follows [7].

Category I: Under 600 MET-min / week, named as sedentary

Category II: Range from 600 to 3000 MET-min / week, named as minimum actives

Category III: Over 3000 MET-min / week, named as very actives

Ambulatory blood pressure measurement

Microlife Watchbp Analyzer O3 (Microlife Corporation, Taipei, Taiwan) branded Holter device was used for 24 hours ambulatory BP follow-up.

Pedometer

It calculates the number of steps with a device carried on the waist. If the step length information is entered in the device, it also measures the distance covered. The number of steps is stored daily. In this way, physical activity from walking type can be measured. [8] In our study, unlike conventional pedometer, the Omron HJ model (OMRON Corporation, Kyoto, Japan), which shows the physical activity at 100 steps / min and maintained on the screen for at least 10 minutes, was used.

Exercise prescription

In addition to providing the patient with theoretical information such as warming - active exercise - cooling and maximum heart rate, individualized exercise was prescribed according to the individual's conditions, lifestyle and activities.

Conduct of the study

Verbal information was given to the patients who were found to be eligible according to the criteria of the study and consent was obtained from those who accepted the study to participate in the study. Patients were randomly assigned to the groups. Then, the patients were taken to the interview rooms prepared for the study and the questionnaires were filled after the contact information was obtained. The questionnaire was read to the patients by the researcher and the answers were recorded by the researcher. BP measurements of the patients were recorded. Then, PAC group was given physical activity counseling and a follow-up card to note their exercises, PAC-PED group was given physical activity counseling and a pedometer was used to monitor the duration and severity of the exercises. The control group was followed up with physical activity counseling, without an exercise follow-up card or pedometer. At the end of the study, BP measurements were taken with the patients starting from the start date of the study. As a result, each patient had the opportunity to have an intervention time to the extent of his / her own motivation. Since the process of the study was continued with the motivation of the patient, the effect of the pedometer on the motivation of the patient in exercising was manifest. The results were compared with the input and output measurements of the participants and the change in BP was calculated.

Ethical Approval

The study was approved by the Canakkale Onsekiz Mart University Faculty of Medicine Clinical Research Ethics Committee with decision numbers 2015-06-02 and 2018-21-13. The aim of the study was to inform the patients about where and how to do it and their written and verbal consents were obtained.

Statistical analysis

Differences between groups were calculated by ANOVA. Repeated data in the same group were compared with Wilcoxon signed rank test. Demographic characteristics were expressed as chi-square, mean, percentage and interval values.

Results

The mean age of all participants (n = 28) was 51.2 ± 14.5 years (range 25 to 81 years). The ratio of female participants was 82.1% (n = 23, mean age = 48.2 ± 13.0 and age range: 25 - 79), while the male participant rate was 17.9% (n = 5, mean age = 65.0 ± 13.8, age range: 44 - 81 years). The mean blood pressure of the participants was 118.4 ± 19.4 and 72.3 ± 13.7 for systolic and diastolic, respectively, and the mean IPAQ score was 900.6 ± 852.6.

In all groups, the common feature of the participants was that the marital status of most of them was married, women/gender, never smoked, and had the opportunity to exercise at home or near and at work or commute. Number of participants and demographic data by groups are given in Table-2 in detail.

Table 2. Demographics

	Control n=14		PAC n=7		PAC-PED n=7		Test Value	p
	Mean	Range	Mean	Range	Mean	Range		
Age, mean	52.0 ± 17.2	25 – 81	53.3 ± 10.3	40 – 72	47.4 ± 13.1	26 – 67	0.315[F]	0.733
Gender: Male	2 (%14.3)		1 (%14.3)		2 (%28.6)		0.730χ	0.694
Female	12 (%85.7)		6 (%85.7)		5 (%71.4)			
Level of Education, years	13.9 ± 6.7	4 – 20	9.1 ± 5.0	4 – 16	13.7 ± 5.1	4 – 20	1.612[F]	0.220
Marital Status: Single	3 (%21.4)		0		1 (%14.3)			
Married	8 (%57.1)		7 (%100)		6 (%85.7)		5.786χ	0.216
Widow/Divorced	3 (%21.4)		0		0			
Occupation: Unemployed	0		0		0			
Employee	3 (%21.4)		1 (%14.3)		0			
Tradesman	1 (%7.1)		0		0			
Student	0		0		0			
Officer	3 (%21.4)		0		2 (%28.6)		8.975χ	0.344
Farmer	0		0		0			
Housewife	2 (%14.3)		4 (%57.1)		1 (%14.3)			
Retired	5 (%35.7)		2 (%28.6)		4 (%57.1)			
Smoking: Never smoked	10 (%71.4)		6 (%85.7)		4 (%57.1)			
Smoking	3 (%21.4)		0		2 (%28.6)			
Quit, less than 6 months	0		0		0		4.095χ	0.393
Quit, more than 6 months	0		1 (%14.3)		1 (%14.3)			
Opportunity to Exercise:								
At home or near	12 (%85.7)		6 (%85.7)		6 (%85.7)		0.166χ	0.920
At work or commute	3 (%21.4)		1 (%14.3)		1 (%14.3)			

[F], ANOVA test value; χ, Chi-square value

There was no significant difference between the groups in terms of blood pressure and IPAQ score at the beginning of the study (Table-3).

Table 3. Intergroup comparison at the beginning of the study

	Control		PAC		PAC-PED		F	p
	Mean (min-max)	95% Confidence Range	Mean (min-max)	95% Confidence Range	Mean (min-max)	95% Confidence Range		
Systolic	125.0 ± 22.2 (103 - 169)	112.2 - 137.8	117.1 ± 16.4 (94 – 143)	102.0 - 132.3	106.6 ± 9.2 (98 – 125)	98.0 – 115.1	2.338	0.117
Diastolic	74.6 ± 13.9 (52 - 105)	66.6 – 82.7	76.4 ± 12.8 (62 – 99)	64.6 – 88.2	63.3 ± 11.9 (50 – 80)	52.3 – 74.3	2.213	0.130
IPAQ score	570 ± 594 (0 – 2115)	211 – 929	1661 ± 1056 (594 – 3618)	685 – 2638	753 ± 626 (198 – 2106)	175 – 1332	5.085	0.014*

BMI, Body mass index; F, ANOVA test value *, p<0.05

There was no significant difference between the pre- and post-blood pressure measurements of the patient groups. The mean follow-up was 2.1 ± 1.3 (0.65 - 6.33) months (Table-4).

Table 4. Change in blood pressure by groups

Groups	Duration (months)		Before	After	Z	p
Control	2.0 ± 0.8	**Systolic**	125.0 ± 22.2	129.4 ± 13.9	-0.894	0.372
		Diastolic	74.6 ± 13.9	81.0 ± 9.6	-1.779	0.075
PAC	3.1 ± 2.0	**Systolic**	117.1 ± 16.4	123.3 ± 7.2	-0.847	0.397
		Diastolic	76.4 ± 12.8	78.1 ± 5.2	-0.254	0.799
PAC-PED	1.3 ± 0.8	**Systolic**	106.6 ± 9.2	113.0 ± 3.7	-1.859	0.063
		Diastolic	63.3 ± 11.9	72.1 ± 4.9	-1.355	0.176

Z, Wilcoxon signed rank test value

However, when the change in blood pressure values between the groups before and after was compared; the difference between the mean values of baseline blood pressure values was not significant, but at the end of the study there was a significant difference between the control and PAC-PED groups in both systolic and diastolic values (Table 5).

Table 5. Change in blood pressure between groups

Variable	(I) Group	(J) Group	Mean Difference (I-J)	p*	95% Confidence Range Lower Limit	Upper Limit
SBP1	Control	PAC	7.857	0.634	-13.47	29.19
		PAC-PED	18.429	0.100	-2.90	39.76
	PAC	Control	-7.857	0.634	-29.19	13.47
		PAC-PED	10.571	0.542	-14.06	35.20
	PAC-PED	Control	-18.429	0.100	-39.76	2.90
		PAC	-10.571	0.542	-35.20	14.06
SBP2	Control	PAC	6.143	0.446	-6.27	18.55
		PAC-PED	16.429*	0.008	4.02	28.84
	PAC	Control	-6.143	0.446	-18.55	6.27
		PAC-PED	10.286	0.194	-4.05	24.62
	PAC-PED	Control	-16.429*	0.008	-28.84	-4.02
		PAC	-10.286	0.194	-24.62	4.05
DBP1	Control	PAC	-1.786	0.954	-16.94	13.37
		PAC-PED	11.357	0.169	-3.80	26.51
	PAC	Control	1.786	0.954	-13.37	16.94
		PAC-PED	13.143	0.168	-4.36	30.65
	PAC-PED	Control	-11.357	0.169	-26.51	3.80
		PAC	-13.143	0.168	-30.65	4.36
DBP2	Control	PAC	2.857	0.709	-6.09	11.80
		PAC-PED	8.857	0.053	-.09	17.80
	PAC	Control	-2.857	0.709	-11.80	6.09
		PAC-PED	6.000	0.333	-4.33	16.33
	PAC-PED	Control	-8.857	0.053	-17.80	0.09
		PAC	-6.000	0.333	-16.33	4.33

SBP1-SBP2, 1st and 2nd systolic blood measurement; DBP1-DBP2, 1st and 2nd diastolic blood measurement; *One Way ANOVA, Tukey Post Hoc analysis

Discussion

In this study, we tested whether or not using a pedometer affects blood pressure. According to our results, using a pedometer or follow-up card does not directly reduce blood pressure. A Canadian-based pedometer-based intervention study for sedentary workers showed that although participants had a significant reduction in body mass index and waist circumference parameters, but they did not make a difference on blood pressure [9]. The pedometer they used in their studies did not have any feature that would encourage

the participants to walk at a certain speed and time - as in the pedometer we used in our study. The limitation in gait activity in terms of speed and duration may also limit or limit the effect on blood pressure.

In this study on normotensive individuals, although there was a significant difference in physical activity levels between groups at baseline, we did not find the same difference in blood pressure changes. In a cross-sectional study comparing the physical activity levels of hypertensive and normotensive individuals based in Saudi Arabia, normotensive individuals were found to be more physically active than hypertensive patients [10]. Exercise of recommended severity has been shown to lower blood pressure by 2-7 mmHg in both normotensive and hypertensive patients [11]. However, it can be said that a positive effect of blood pressure is below 2-7 mmHg even if the recommended exercises are not performed with a pedometer or a follow-up card.

The pedometer or follow-up card may be a pioneer or a means of achieving the recommended intensity of exercise, although we can stress that the effects on blood pressure may be limited. A meta-analysis of the pedometer showed positive effects of pedometers in achieving the daily step goal [12]. Moreover, awareness of gait behaviors has been shown to increase self-motivation and thus gait behavior [13-16].

It can be difficult to influence blood pressure by simply exercising and by ignoring body weight. It was reported that moderate exercise recommended for weight loss was compensated by diet in studies where the body weight did not change with a pedometer. [17-21].

Limitations

The diets of the patients in our study group were not questioned and were not standardized. Suggestions of physical activity are likely to be done frequently during the day and can be measured by pedometer walking, brisk walking, jogging, step climbing and so on. was evaluated. Other physical activities may be limited by the method of the study.

In the intervention groups PAC and PAC-PED groups, the number of patients calculated by the standard deviation of previous studies could not be reached. Therefore, the patients in the control group remained relatively high. We believe that despite the low number of patients, we have achieved significant results due to the fact that the study discipline is not compromised and the control group is sufficient.

Strengths of our study; patients were not given the number of daily steps for cardiovascular health surveillance, but the duration of physical activity in one session and the rate of steps per minute during that time. Patients did not require a specific study period to participate in the study or to continue the study, so that the study was carried out with self-motivation. Using a much more advanced device than the pedometer used in other studies, the patients' exercise at a speed of 100 steps and more per minute and 10 minutes or more was considered. The study ended with relatively few patients due to self-motivation of the study, loss of pedometers and lack of sufficient pedometer.

Conclusion

In the present study, the sur- term finding was a significant difference between the pedometer and the control group in terms of systolic and diastolic blood pressure values. Although blood pressure values did not decrease in each of the three study groups, the change in blood pressure in pedometer users was found to be different from in the control group. This difference can carry a blood pressure control value in favor of the pedometer. Further research on this will further clarify this situation.

Conflict of interest: None

Financial disclosure: This study was supported by Çanakkale Onsekiz Mart University Scientific Research Projects Coordination Unit. Project Number: TTU-2016-578

Acknowledgments: I would like to thank Sinem Bilgen Kocaoğlu for his contribution in data collection.

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