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SEKİZ HAFTALIK HIZLI TEMPO YÜRÜYÜŞÜN ORTA YAŞLI ERKEKLERDE KARDİOVASKÜLER HASTALIK RİSK FAKTÖRLERİNE ETKİSİ

THE EFFECT OF EIGHT-WEEK BRISK WALKING ON CARDIOVASCULAR DISEASE RISK FACTORS IN MIDDLE-AGED MEN

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ÖZET

Çalışmamızın amacı sekiz haftalık hızlı tempo yürüyüş programının orta yaşlı erkeklerin aerobik kapasiteleri (VO2max), kan basınçları, bazı kan lipidleri, ve high-sensitive C-reaktif protein (hsCRP) düzeyleri üzerine etkisinin incelenmesidir. Bu amaçla, 40-60 yaşları arasında, 22 sağlıklı erkek çalışmaya alındı ve bunlardan 12'si egzersiz grubunu (EG) geri kalan 10'u ise kontrol grubunu (CG) oluşturdu. EG haftada beş gün, günde 30 dakikadan başlayarak 48 dakikaya kadar, sabit bir şekilde artan sürelerde, kalp atım sayısı yedeğinin (HRR) ~%69 şiddetinde ve ~6.68±0.14 km/s hızla yürüdü. VO2max, sistolik ve diastolik kan basınçları (SKB, DKB), total kolesterol (TK), trigliserit (TG), yüksek yoğunluklu lipoprotein kolesterol (HDL-C), düşük yoğunluklu lipoprotein kolesterol (LDL-C), ve hsCRP antrenman periyodundan önce ve sonra ölçüldü.

Hızlı tempo yürüyüş SKB ve LDL-C seviyelerinde istatistiksel olarak anlamlı bir azalmaya ($p < 0.05$), VO2max ($p < 0.01$) ve HDL-C seviyelerinde ise anlamlı bir artışa ($p < 0.05$) neden oldu. EG'de DKB ve hsCRP istatistiksel olmayan bir azalma eğilimi gösterdi ($p > 0.05$). Kontrol grubunda bu parametrelerin hiçbirinde istatistiksel olarak anlamlı değişiklikler gözlenmedi. Sonuç olarak, daha önce yapılan bazı çalışmaların aksine, bu çalışmada hsCRP seviyelerinde anlamlı bir azalma belirlenemedi. Ancak, aerobik kapasiteyi arttırmak ve kardiyovasküler hastalık riskini azalttığı belirlenmiş olan SKB ve lipid parametrelerinde olumlu değişiklikler yaratabilmek için hızlı tempo yürüyüş tavsiye edilebilir.

SUMMARY

The aim of the study was to investigate the effect of an eight-week brisk walking program on aerobic capacity (VO2max), blood pressures, some blood lipids, and high sensitive C-reactive protein (hsCRP) levels in the middle-aged men. For this aim, 22 healthy men with an age range of 40-60 years were enrolled in the study and 12 of them constituted the exercise group (EG) and the remaining 10 subjects were taken as the control group (CG). EG walked for eight weeks, five days per week from 30min per day steadily increasing up to 48min, at ~69% of Heart Rate Reserve (HRR), at the speed of ~6.68±0.14 km/h. VO2max, systolic blood pressure (SBP), diastolic blood pressure (DBP), total cholesterol (TC), triglyceride (TG), high-density lipoprotein cholesterol (HDL-C), low-density lipoprotein cholesterol (LDL-C), and hsCRP were measured before and after the training period.

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Brisk walking caused a statistically significant reduction in SBP and LDL-C levels ($p<0.05$), and a significant increase in VO2max ($p<0.01$) and HDL-C levels ($p<0.05$). DBP and hsCRP levels also tended to decrease in EG, although they did not reach a statistical significance ($p>0.05$). No significant change was observed in any of these parameters in CG. In conclusion, in contrast to some previous studies, no significant reduction could be documented in hsCRP levels in the present study. Nevertheless, brisk walking is advisable to increase aerobic capacity and to achieve favorable changes in SBP and lipid parameters, which were shown to decrease cardiovascular disease risk.

INTRODUCTION

Regular physical exercise has been proved to increase the concentration of high-density lipoprotein cholesterol (HDL-C) (1,2) and decrease the levels of total cholesterol (TC), trigliceride (TG), and low-density lipoprotein cholesterol (LDL-C) (3) thus protect people against coronary heart disease (CHD). Inflammatory mechanisms play a central role in all phases of atherosclerosis, and high sensitive C-reactive protein (hsCRP), as an inflammatory marker, may be causally involved in each of the stages by influencing some processes such as endothelial dysfunction and lipid-related effects (4). As a result, in recent years, there is growing evidence pointing hsCRP as a much better predictor of CHD than the conventional cardiovascular risk factors alone (5) and chronically elevated levels contribute independently to later risk of CHD (6). Although the exact mechanism of CRP in physical exercise could not be explained clearly, it was hypothesized by Mattusch et al. (7) that the baseline CRP concentration is affected by two antagonistic influences. While intense physical exercise produces micro injuries and a local inflammatory reaction in the musculature causing a delayed increase of the CRP concentration in the blood, regular physical training generates an anti-inflammatory reaction with a lowering effect on the CRP level. This might result from the enhanced antioxidative mechanisms after regular physical exercise (8,9). Therefore, many researchers have attempted to investigate the relationship between physical exercise and CRP concentrations. In a study by Mattusch et al. (7) favorable changes in hsCRP levels after 9 months of endurance training were determined. In addition, Smith et al. (10) found positive changes in CRP levels after 6 months of a supervised exercise program (2.5 hours of exercise per week). Fallon et al. (11) found out that CRP levels declined with regular soccer training. Geffken et al. (12) obtained lower levels of CRP with higher levels of total physical activity. Additionally, in two recent studies, Church et al (13) and Abramson et al. (14) clearly documented an inverse association of hsCRP levels and cardiorespiratory fitness levels. Since CRP is an inflammatory marker, these findings suggest that the association between exercise and reduced cardiovascular risk may be mediated by anti-inflammatory effects of regular physical activity (15).

Intervention studies have demonstrated the potential of brisk walking to improve fitness in sedentary men and women (16,17). Many studies have investigated the effect of regular walking exercises on blood lipids (2,18,19). Despite the existence of studies investigating the effect of intensive training programs on CRP levels of healthy people (7,11) or walking activities on CRP levels of patients with peripheral arterial disease (20), to our knowledge, there are no studies investigating how walking exercises done easily by vast groups can affect the CRP levels of healthy people. Therefore, the aim of this study is to examine whether brisk walking program of 8 weeks affects baseline hsCRP levels as well as other CHD risk factors of middle-aged men.

MATERIAL AND METHODS

Subjects : Volunteers aged between 40-60 years were recruited for the study. After a medical screening and activity questionnaire, some of them were excluded from the study if they had high resting blood pressure (>160 mmHg systolic or >95 mmHg diastolic), a previous history of cardiovascular disease or diagnosed CHD, smoking, being under medication known to influence plasma lipid levels, musculo-skeletal problems or injury, having diabetes mellitus, reporting a ±5 kg change in body weight during the previous year. Participants were allocated to exercise (EG) and control groups (CG); they were not randomized. To maintain compliance, subjects were allowed to choose which of the two groups (EG; n= 12, or CG; n=10) to join. After informing about the study design, each subject signed a consent form. Dietary intake was measured by using two dietary questionnaires developed by Block (21). There were no significant differences in pre exercise food intake between groups and they were asked not to change their dietary habits throughout the study. The ethical council of Celal Bayar University approved the study protocol.

Testing and measurements : Pre and post intervention period resting systolic blood pressure (SBP) and diastolic blood pressure (DBP) were measured. Body composition was measured using bioelectrical impedance analysis method (Tanita TBF-300) between 8.00-10.00a.m after a 12-hour fast; The Astrand - Ryhming test was performed on a calibrated bicycle ergometer (Monark 860, Varberg, Sweden) and their maximal oxygen consumption (VO2max) was predicted using Astrand-Ryhming nomogram (22). Fasting venous blood samples were collected from an antecubital vein (10 mL) in the sitting position after a 20-minute rest between 8:00 and 9:00a.m. TC, TG, HDL-C, LDL-C levels were determined in a Cobas Integra 800 auto analyzer (Roche Diagnostics, Germany) by enzymatic colorimetric method. hsCRP was measured by the nephelometric method (Dade Behring, Illinois, USA).

Exercise program : After completion of baseline testing, EG subjects walked on an outdoor track (400 m) for 8 weeks, 5 days per week. The exercise intensity was prescribed based on target heart rates (THRs): [Heart Rate Reserve (HRR) x work intensity (65-70%) + resting Heart Rate (resting HR)] (2). On the first four weeks, EG aimed to walk for 30, 33, 36, and 39 minutes at 65% HRR. On the second four weeks, they aimed to walk for 39, 42, 45, and 48 minutes at 70% HRR. To ensure compliance with the training intensity (walking speed), at least three heart rate readings were taken through use of Polar Pacer heart rate monitors (Polar Electro oy Finland) and Rates of Perceived Exertion (RPE) were also taken using a 15-point RPE scale (23) and total walking distances, heart rates and RPE were recorded on training logs by the supervisor in each exercise session. CG members were warned not to perform any regular physical activity apart from their routine daily activities.

Statistical Analysis: Intergroup comparisons were performed using the Mann-Whitney U test. The differences between pre and post intervention were determined by using the Wilcoxon test. All comparisons were considered statistically significant at $p<0.05$.

RESULTS

EG members who aimed to walk at 65-70%HRR had an average heart rate of ~142.03±8.15 beat.min-1 corresponding to ~69% of HRR) during the training. Mean walking speed for the whole program for EG was ~6.68±0.14 km/h.

The RPE reported by EG was 14.35±0.74. Total distance walked was 181177±7947m.

Pre-study characteristics of the subjects were not significantly different (Table I).

Table I. Pre-study physical and physiological characteristics of subjects (mean±SD)

	n	Age (yr)	Height (cm)	Body mass (kg)	BMI (kg/m^2)	Percent body fat (%)	VO_{2max} (mL.kg^{-1}.min^{-1})
EG	12	48.5±5.5	171.5±4.6	81.9±12.5	27.8±3.3	23.6±5.1	25.0±4.4
CG	10	45.2±2.8	174.0±7.9	78.7±13.4	25.9±3.6	21.6±4.4	25.6±5.3

EG= Exercise Group; CG= Control Group

VO_{2max} of EG increased with 8-week brisk walking ($p<0.01$) and it was statistically different from that of CG ($p<0.01$) (Table II).

Table II. Changes in physical and physiological characteristics of subjects following the intervention (mean + SD)

	EG (n= 12)			CG (n= 10)		
Variable	**Pre**	**Post**	**mean diff.**	**Pre**	**Post**	**mean diff.**
Body weight (kg)	81.9±12.5	82.0±12.5	0.06±1.0	78.7±13.4	78.5±14.2	-0.2±1.3
% Body fat (%)	23.6±5.1	24.7±4.9	1.0±1.2	21.6±4.4	22.2±4.9	0.5±0.9
BMI (kg/m^2)	27.8±3.3	27.8±3.3	0.0±0.3	25.9±3.6	25.9±3.8	0.01±0.3
VO_{2max} (mL.kg^{-1}.min^{-1})	25.0±4.9	30.3±6.7[a]	5.3±3.6[b]	25.6±5.3	25.7±4.0	0.008±3.5

[a]$p<0.01$ change from baseline; [b]$p<0.01$ vs CG;

SBP of EG reduced significantly ($p<0.05$); the decrease in SBP and DBP in EG differed significantly from the decrease observed in CG ($p<0.01$ and $p<0.05$, respectively). HDL-C increased and LDL-C decreased in EG ($p<0.05$). No significant changes were observed in TG levels in both groups of subjects. Insignificant decreases in EG and insignificant increases in CG were observed in terms of their hsCRP levels (Table III).

Table III. Changes in blood pressure and biochemical parameters of all subjects following the intervention (mean +SD)

Variable	EG (n= 12) Pre	Post	mean dif.	CG (n= 10) Pre	Post	mean dif.
SBP (mmHg)	137.5±13.1	120.8±10.8a	-16.6±11.5c	116.0±11.7	117.5±12.7	1.50±12.0
DBP (mmHg)	77.9±7.82	74.1±8.21	-3.75±6.44b	78.5±11.5	78.0±7.14	-0.50±12.5
TC (mg/dL)	225.6±37.4	211.9±34.0	-13.7±40.2	188.0±27.0	187.8±32.9	-0.20±14.7
TG (mg/dL)	154.9±67.9	183.5±113.0	28.58±92.9	116.8±54.1	124.9±55.4	8.10±16.7
HDL-C (mg/dL)	41.0±9.48	45.4±11.8a	4.41±6.08	33.4±6.93	35.9±7.80	2.50±3.92
LDL-C (mg/dL)	150.6±32.5	129.8±22.9a	-20.8±26.3	131.3±25.0	126.0±29.7	-5.30±13.8
HsCRP (mg/L)	2.65±1.22	2.47±1.61	-0.18±1.86	3.39±1.88	3.86±3.36	0.47±3.54

[a]p<0.05 change from baseline; [b]p<0.05 vs. CG; [c]p<0.01 vs. CG

DISCUSSION

In the present study we demonstrated that 8 weeks brisk walking period caused a prominent increase in VO2max and a significant decrease in SBP and a tendency to decrease in DBP, which were attributed as the positive effects of endurance training on CHD risk factors. Moreover, EG showed favorable changes in blood lipid parameters. However, we were not able to demonstrate any significant decrease in hsCRP levels in contrast to some previous studies (7,10-12).

Some studies have revealed a negative correlation between VO2max and CHD risk factors (24,25). Despite the short period, we were able to obtain a significant increase in the VO2max of our EG, which is in accord with the studies indicating higher fitness level is more protective against CHD (24,26). Exercise is shown to be effective in both prevention and treatment of hypertension (24). Although data from intervention studies suggest that longer training programs may produce larger reductions in blood pressure (BP) (27), the type, volume, and intensity of our exercise program may be suitable for middle-aged healthy men to have favorable reductions in BP.

In contrast to previous studies indicating weight loss and reductions in body fat as a result of regular physical activity (2,28), we found no changes in these parameters. Since HDL-C and LDL-C values of the EG changed positively, our findings confirm the results of Tran and Weltman (3), who suggested that weight loss is not a necessary consequence of regular aerobic exercise and not needed to achieve favorable alterations in plasma lipid levels. In parallel to literature findings, which indicate positive effects of exercise on HDL-C and LDL-C, (1,2,29) we found similar alterations in these parameters in EG. Previous research has shown that favorable changes can occur in TC only when this change is accompanied with a change in body weight. Since the body weight of EG did not change, the lack of difference in TC is parallel with the literature (2,30). No significant changes were observed in TG levels in both groups of subjects. Although it is not statistically significant, an increase was observed in TG levels of our EG (154.9±67.9 mg/dL vs. 183.5±113.0 mg/dL). This increase resulted from the fact that one of the EG members had an abnormally high post-exercise TG level (461.0 mg/dL). When the statistical computation was performed with the elimination of this member, the increase observed was found to be quite minimal (154.9±67.9 mg/dL vs. 158.27±76.7 mg/dL).

In recent years, hsCRP has been shown to be a strong independent risk factor for cardiovascular disease that adds to the predictive value of different types of risk models based on usual factors alone (5,31). Therefore, elevated levels of hsCRP are predictive of peripheral or coronary atherosclerosis (32). In the present study, in contrast to previous studies (7,10-12), we could not observe any statistically significant decrease in hsCRP levels in our EG group to which a moderate intensity exercise (brisk walking) was applied. Although we observed a tendency to decrease in hsCRP levels in EG, it did not reach a statistical significance (p>0.05). There is conflicted data for the effect of different intensity of exercise types on hsCRP levels. Although it has been accepted that intense physical exercise is associated with an inflammatory reaction in the blood as demonstrated by the delayed increase of acute phase proteins and among them C-reactive protein (33), in a recent study it was demonstrated that endurance training for nine months significantly decreased hsCRP levels (7) and the reduction in hsCRP was independent of total adiposity or fat mass (34). In general, regular moderate intensity exercise was shown to decrease hsCRP levels (7,10-12). In the present study, the lack of significant decrease in the hsCRP of EG might have resulted from the exercise regimen of our program including a rather short duration. We can speculate that, the favorable effect on hsCRP levels may be more prominent if the duration of the exercise program is lengthened. Moreover, data from several studies has shown reductions in hsCRP levels due to weight loss after the subjects undergo weight-loss programs (29,35). In our study, the subjects were advised to follow their usual dietary habits and not to follow a weight loss program. Thus, the lack of significant reduction in hsCRP might also have resulted form the lack of weight loss and not following a caloric-restriction diet.

In conclusion, brisk walking is advisable to increase aerobic capacity and to achieve favorable changes in BP and lipid parameters, which were shown to decrease cardiovascular disease risk. However, in contrast to some previous studies, no significant reduction could be documented in hsCRP levels in the present study. Future studies with large number of subjects performing different types, volume and intensity of exercises are necessary to draw firm conclusions on the effects of exercise on hsCRP levels.

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