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Regular concurrent training had not significant effect on CRP Level in obese middle-aged men

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Abstract.

Introduction: C-reactive protein (CRP) is a marker of chronic systemic inflammation frequently used in cardiovascular disease risk assessment. The effect of concurrent training on this protein is not well known. Thus, this study was conducted to determine the effects of 8 weeks concurrent training on CRP level in obese middle-aged men.

Material & Methods: Twenty three sedentary obese middle-aged men participated in this study as the subject. The subjects were randomly assigned to concurrent training group (n=12) or control group (n=11). The subjects in concurrent training group performed endurance and resistance training on the same days, 3 days a week for 8 weeks.

Results: Body mass, body mass index (BMI) and waist hip ratio (WHR) were decreased ($P<0.05$) after 8 weeks concurrent training compared to the control group. For CRP level no significant changes were observed after the intervention.

Conclusion: Although concurrent training is the useful strategy for reduce obesity; CRP level was not affected by 8-week concurrent training in obese middle-aged men.

Key words: Concurrent training, CRP, Inflammation, Obesity

1. Introduction

C-reactive protein (CRP), a marker of systemic inflammation, is an independent predictor of cardiovascular disease (CVD) in both women and men (1,2). CRP levels are influenced by sex (3-5), smoking (3,6,7), obesity (5,8), alcohol intake (9) and regular exercise (10). CRP levels measured using the high-sensitivity assay may be useful in the assessment of cardiovascular health (11-18).

Numerous cross-sectional reports have observed an inverse relation between physical activity and CRP (19,20) while exercise intervention studies have had conflicting results. Previous studies had reported that CRP not effected (21), decreased (22) and/or increased (23,24) in response to the exercise. In addition, it has been suggested that weight loss, concurrent with exercise, may be responsible for the reduction in CRP, not exercise training *per se* (19). The primary limitation of existing studies of the CRP response to exercise training is that they were not designed specifically with CRP as an outcome. In addition, these studies were unable to control for potential confounding variables, were underpowered to examine changes in markers of inflammation, and included populations with normal CRP levels. Finally, there may be misclassification of the exercise intervention because exercise was not tightly controlled to account for the dose administered (21). Generally, physical fitness has been reported to be associated with CRP levels, independent of other traditional cardiovascular risk factors (25,26). These findings suggest that the beneficial effects of exercise on cardiovascular health may be mediated partially by a decrease in inflammatory status in individuals with or without cardiovascular disease. However, the effect of concurrent training on CRP level is not well known. Thus, this study was conducted to determine the effects of 8 weeks concurrent training on CRP level in obese middle-aged men.

2. Material & methods

Subjects

Twenty three sedentary obese middle-aged men with a mean (± SD) body mass index of 32.9 ± 2.4 kg/m^2, volunteered to participate in a 8 weeks concurrent study. All the subjects were asked to complete a personal health and medical history questionnaire, which served as a screening tool. All the subjects were completely inactive at least 6 month before the study and they were non-smokers and free from unstable chronic condition, including dementia, retinal haemorrhage and detachment; and they have no history of myocardial infarction, stroke, cancer, dialysis, restraining orthopaedic or neuromuscular diseases. Informed consent was given to all subjects and prior the study. The study was approved by the Marvdasht branch, Islamic Azad University Ethics Committee. The subjects were randomly assigned to one of the concurrent training group (n=12) or control group (n=11).

Exercise protocol

The concurrent training group performed 20-30 min endurance exercise at an intensity corresponding to 70-85% individual maximum heart rate and then performed circuit weight training per day. Resistance training was circularly performed in 8 stations and included 2-4 sets with 8-12 maximal repetitions at 65-80% of 1-RM in each station. Each circuit and set was separated by 2-3 min and 30 s rest respectively. The intervention was performed 3 days a week for 8 weeks.

Anthropometric and body composition measurements

Height was measured with a fixed stadiometer (Seca, Germany) and weight was measured with a regularly calibrated electronic scale (Seca, Germany). Body mass index (BMI) was calculated by dividing weight (kg) by height (m^2). Waist circumference was determined by obtaining the minimum circumference (narrowest part of the torso, above the umbilicus) and the maximum hip circumference while standing with their heels together. The waist to hip ratio (WHR) was calculated by dividing waist by hip circumference (cm).

Blood sampling and analyses

Fasting blood samples (5 ml) were collected from the antecubital vein at the same time before and 48 h after 8 weeks intervention. Serum obtained was frozen at -22 °C for subsequent analysis. CRP level was determined in duplicate via an enzyme-linked immunosorbent assay (ELISA) kits (Diagnostics Biochem Canada, Inc). The intra and inter-assay coefficients of variation for CRP were <5.7% and a sensitivity of 10 ng/ml.

Statistical analysis

Descriptive statistics were computed and and distributions of all variables were assessed for normality. Paired t-test was used to compute mean (± SD) changes in the variables in control and concurrent training group pre and after the intervention. Differences among groups were assessed by using independent- samples t-test. The level of significance in all statistical analyses was set at $P<0.05$. The statistical software program SPSS.17 for windows was used for all data analysis.

3. Results

Physical characteristics of the subjects are presented in Table 1. Before the intervention, there were no significant differences in body mass index, BMI and WHR among the groups. Body mass, BMI and WHR were decreased ($P<0.05$) after 8 weeks concurrent training compared to the control group.

Table 1. Anthropometric characteristics (mean ± SD) of the subjects before and after the training

	Control (mean ± SD)		Concurrent training (mean ± SD)	
	Pretraining	Posttraining	Pretraining	Posttraining
Body mass (Kg)	106.6 ± 4.7	106.5 ± 7.6	98.08 ± 6.9	94.5 ± 7.4*†
BMI (Kg/m^2)	34.1 ± 2.5	34.1 ± 3.3	31.8 ± 1.7	30.6 ± 1.4*†
WHR	0.95 ± 0.03	0.95 ± 0.04	0.96 ± 0.04	0.94 ± 0.04*†

*:$P<0.05$ for between-group differences.

†:$P<0.05$, pretraining *vs.* posttraining values.

The results also showed that CRP had no significant change after the intervention (Figure 1). No significant relationship was observed between CRP with body mass, BMI and WHR.

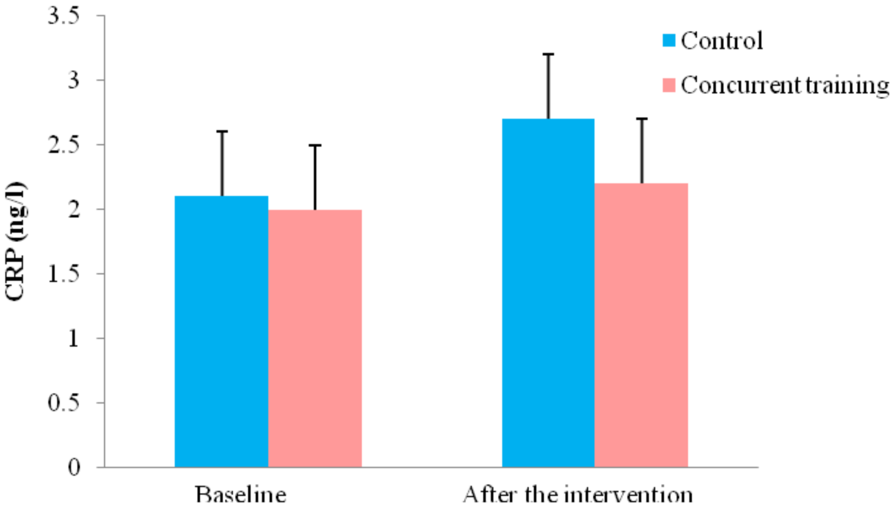

Figure 1. Change of CRP before and after the intervention

4. Discussion

Inflammation is considered an important pathogenic mechanism in both the initiation and progression of cardiovascular diseases (CVD) (27). One of the most commonly measured markers of inflammation in clinical settings is CRP (28,29). Plasma levels of CRP have been reported to be a strong independent predictor of risk of future myocardial infarction, stroke, peripheral arterial disease, and vascular death among individuals without known CVD (28).

On the other hand, obesity has been associated with elevated levels of CRP (30). In a study involving 892 middle-age subjects, CRP levels were inversely correlated with exercise capacity (31) as well as in 1660 subjects with metabolic syndrome (32). Physical activity and exercise reduces CRP levels by multiple mechanisms, including a decrease in cytokine production by adipose tissue, improved endothelial function and insulin sensitivity, and possibly an antioxidant effect (33), among other factors. Chronic inflammation may be modulated by metabolic variables, such as BMI (34,35) and lipid profile (36), which may also be influenced by regular exercise (37). Also, the impact of exercise on inflammation in populations with excess weight is controversial and how exercise training reduces inflammation and decreases CRP levels is not well defined. While various studies show that exercise reduces inflammation, specifically CRP (38,39), other studies found no change in this parameter (40,41). We hypnotized that exercise would reduce the body mass and BMI and decrease CRP in obese men. Our results demonstrated that although body mass, BMI and WHR were decreased ($P<0.05$) after the intervention, CRP levels had no significant changes after 8 weeks training. On the other hand, no significant relationship was observed between CRP level change with body mass, BMI and WHR after the intervention. The relationship between the changes of CRP level with body composition is not well defined. In line with our results, Kelley and Kelley (2006) reported that aerobic exercise does not reduce CRP levels in adults, but does improve measures of body composition and physical fitness (37). However, other researchers noted that engaging in exercise training is associated with a decrease in CRP levels regardless of the decrease in BMI and body fat percent (22,42). Behind the improvement on body composition, the other mechanisms might contribute on CRP reduction after the regular exercise. Exercise can reduce the release of cytokines such as IL-6 and TNF-α by adipocyte tissue, downregulating the sympathetic tonus (43). Exercise training and physical fitness have been associated with endothelial function by increased release of endothelium-derived nitric oxide (44). The increased production of nitric oxide by endothelial cells may reduce the effects of proinflammatory cytokines and decrease CRP levels (45).

We had some limitations in this study. We didn't measure the other inflammatory markers and cytokines and indeed we didn't measure nitric oxide in the present study. Additional research is needed to examine the mechanisms that effect on CRP regulation after the exercise.

5. Conclusion

In conclusion, although concurrent training is the useful strategy for reduce obesity; CRP level was not affected by 8-week concurrent training in obese middle-aged men.

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