PHYSICAL
EDUCATION
OF STUDENTS

EFFECT OF 8 WEEKS OF AEROBIC OR RESISTANCE TRAINING ON BLOOD PRESSURE IN NON-PHYSICAL EDUCATION MALE STUDENTS

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Annotation. ***Aim*:** Nowadays increasing blood pressure is the most important risk factor of coronary, cerebral and renal vessel diseases. The benefits of aerobic exercise (AE) training on blood pressure (BP) but the effects of resistance training are less well delineated. The purpose of this study was to determine the impact of resistance or aerobic training on haemodynamics in non-physical education male students. ***Methods*:** The target population consisted entirely of male students of University of Guilan. Among them 40 male's non- athlete were recruited and randomly assigned to 8 weeks of either resistance (RE) or AE training. Before and after training, BP, were measured. Statistical analysis was performed by student t – test. ***Results*:** The results show that resting systolic BP (SBP) decreased following both training modes (SBP: RE, pre 128±1.9 vs post 121±2.3; AE, pre 129±4.2 vs post 123±3.3 mm Hg, P=0.005; diastolic BP: RE, pre 77±2.4 vs post 73±2.1; AE, pre 78±3.4 vs post 74±2.9 mm Hg, P=0.001). Although both RE and AE training decreased BP; were not significant differences among RE and AE training decreased BP. ***Conclusion*:** Both RE and AE training decreased BP in non athlete males. Therefore, promotion in physical activity level could be an effective way to decrease hypertension in non-physical education males.

Key words: aerobic training, resistance training, blood pressure, students.

Introduction

In the past few decades a great deal of attention has been focused on the relationships between hypertension and Physical activity (Kearney et al. 2004). Hypertension is an important public health challenge in both economically developing and developed countries (Kearney et al. 2004; Alsairafi et al. 2010). Worldwide prevalence estimates for hypertension may be as much as 1 billion individuals, and approximately 7.1 million deaths per year may be attributable to hypertension (Alsairafi et al. 2010). The importance of controlling high blood pressure (BP) has been reemphasized in a recent report of the Joint National Committee on Prevention, Detection and Treatment of High Blood Pressure (Chobanian et al. 2003), and a new category termed 'pre-hypertension' has been established, because systolic (SBP) and/or diastolic blood pressure (DBP) greater than 120/80 mm Hg still increase the risk of cardiovascular complications (Kearney et al. 2004; Alsairafi et al. 2010). Lifestyle changes, such as the adoption of appropriate exercise habits, are especially important for treatment and prevention hypertension (Pescatello et al. 2004; Hagberg et al. 2000). It has also been observed that an elevated BP is associated with markedly increased risk for numerous cardiovascular pathologies such as CHD, intermittent claudicating, congestive failure and stroke (Pollock et al. 2000). Furthermore, fitness levels are known to correlation with BP in Adolescents and young adults (Hagberg et al. 2000; Kannel et al. 1978). Many studies have reported Dynamic, moderately in-tense aerobic exercise (AE) is recommended for the prevention and treatment of high BP (Pescatello et al. 2004; Kelley et al. 1994), and it has been found to decrease SBP by 10 mm Hg and DBP by 7 mm Hg in hypertensive individuals (Seals et al. 1997). The reductions in BP following AE have been shown to occur after only 1–2 weeks in individuals with elevated BP (Pollock et al. 2000). Currently, resistance exercise (RE) is recommended as a complement to aerobic training programmers (Pescatello et al. 2004; Pollock et al. 2000) and offers many benefits for the people, including the prevention and treatment of hypertension and cardiovascular diseases (Chidsey et al. 1962; Pollock et al. 2000). A meta-analyses reported that dynamic resistance training reduced SBP and DBP of 4.6 and 3.8 mm Hg, respectively (Kelley. 1997), in normotensive adults, but the haemodynamic effects of dynamic resistance training have not been studied in a hypertensive population. There is also evidence that combined AE and RE training programs can improve endothelial function (Clarkson et al. 1999); however, there is only one recent study that has shown an attenuated response to resistance forearm training in a cohort of hypertensive subjects, yet their results may have been confounded with the protocol acceptance of BP medications (Clarkson et al. 1999; McGowan et al. 2006). Many previous studies have investigated the prevalence of hypertension in selected populations in both developing and developed countries. However there is relatively little information on the prevalence of hypertension in college student and considering the potential disparate results of RE, coupled with a paucity of research regarding the effect of RE in patients with elevated BP without pharmacological intervention, there is considerable need for research studies in this area. For this reason the purpose of this study was to compare the effect of 8 weeks of aerobic or resistance exercise training on blood pressure in non-physical education male students.

Materials and methods

Subjects

The target population consisted entirely of male students of University of Guilan in Iran. Among them 40 male's non- physical education (NPE) students with hypertension selected randomly and none of the subjects were taking any medication, including antihypertensives or aspirin, and all were non-smokers. The condition of the study was

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thoroughly explained to all subjects, and written informed consent was subsequently obtained. The protocol was approved by the Ethics Committee of University of Guilan.

Study design

Subjects reported to the Human Performance Laboratory in University of Guilan for three separate visits. The first visit consisted of group randomization, health history and physical activity questionnaires, and tests of height, weight, maximal aerobic capacity or 10 repetition maximal (10 RM) test and measurement equipment familiarization. At visit 2, subjects rested in a supine position for 15 min, BP measurements. Subjects reported back to the laboratory for their post-training measurements (visit 3) between 24 and 48 h following the completion of the last exercise session. To avoid diurnal variation, all measurements were repeated at the same time of day in the post-prandial state (43 h) and in the same order as pre-measurements.

Anthropometrics

Whole-body plethysmography (Bod Pod; Life Mea-surement Inc., Concord, CA, USA) was used to assess body composition (Katch et al. 1967), and body weight was measured using the Bod Pod scale. Height was measured using a stadiometer to the nearest 0.5 cm, and body mass index was calculated as weight (kg) per height ^{2}(m^2).

Haemodynamic monitoring

Blood pressure was measured by a trained investigator by standard sphygmomanometry following a quiet rest for 15 min in the supine position. SBP and DBP were measured manually at the brachial artery after the resting period and at the start of each testing session using the first and fifth Korotkoff sounds, according to American Heart Association standards (Kirkendall et al. 1981). HR was taken from the calculation of successive R-R intervals from the three lead EKG. An investigator, blinded to grouping and condition variables, entered the data into the computer.

Exercise training

The AE training consisted of 30 min of treadmill exercise at 65% of their previously determined VO_{2peak}, 3 days per week for 8 weeks. The 10 RM provided the basis for individual load resistance for the dynamic resistance training sessions. The resistance training exercises consisted of leg press, chest press, leg extension, lat pulldown, leg curls, shoulder press, bicep curl, tricep press and abdominal crunch, all performed on Life Fitness machine (Life Fitness Inc., Schiller Park, IL, USA) training equipment. Each subject completed 3 sets of 10 repetitions at 65% of their 10 RM, 3 days per week for 8 weeks. Each RE session took approximately 45–50 min to complete. Subjects were asked to refrain from any exercise outside of their aerobic or resistance prescription.

Statistical Analysis

SPSW statistical software (version 18) was used to analyze. Both descriptive (mean and standard deviation) and inferential statistical were used to analyze the data t – test was computed to test for any significant difference in the BP measurement of the AE and RE groups.

Results

Subjects

Subject anthropometric data are present in table 1. The results show that no significant differences in any of the subject characteristics before training. The results in table 2 show that resting systolic BP (SBP) decreased following both training modes. Although both RE and AE training decreased BP; were not significant differences among RE and AE training decreased BP.

Table 1

Subject characteristics

	Aerobic training (n=20)	Resistance training (n=20)
Age	21.4±3.2	22.1±2.8
Height (cm)	170.3±5.5	172.4±4.7
Weight (kg)	75.6±6.9	76.5± 5.4
Body Mass Index (kg/m^2)		

Table 2

Variables resting haemodynamic variables

	Aerobic training (n=20)		Resistance training (n=20)	
	pre	post	pre	post
SBP (mmHg)	128±1.9	121±2.3*	129±4.2	123±3.3*
DBP (mmHg)	77±2.4	73±2.1*	78±3.4	74±2.9*

*Significant interaction between training modes ($P < 0.05$)

Discussion

The aim of the present study was to compare the effect of 8 weeks of aerobic or resistance exercise training on blood pressure in non-physical education male students with hypertension University of Guilan in Iran. The results show that in 8 weeks of exercise training can decrease resting systolic BP (SBP): RE, pre 128±1.9 vs post 121±2.3; AE, pre 129±4.2 vs post 123±3.3 mm Hg, P=0.005; and resting diastolic BP (DBP): RE, pre 77±2.4 vs post 73±2.1; AE, pre 78±3.4 vs post 74±2.9 mm Hg, P=0.001)), which is identified as the primary goal in hypertension therapy. Our findings are similar to those reported in the Heritage family study (Wilmore et al. 2001), which showed small changes (< 3 mm

Hg) in resting SBP and DBP in normotensive to mildly hypertensive subjects following a longer and progressively more intense training programme (20 weeks, 55–75%VO_{2max}). Hagberg et al., (1989), also demonstrated a decrease in SBP (20 mm Hg) in hypertensive men following 9 months of low- to moderate-intensity aerobic training, with a concomitant decrease in DBP (11–12 mm Hg) (Hagberg et al. 1989). Based on previous studies, it was hypothesized that the association between exercise and BP was not linear (Chidsey et al. 1962; Kelley et al. 2000). The literature demonstrates the benefits of physical exercise (aerobic activity) (Whelton et al. 2002) or strength-training activity (Kelley et al. 2000), on the BP, physical activity is being considered as one important component in the non-pharmacological treatment of hypertension (Hagberg et al. 1989; Whelton et al. 2002). Hagberg et al., (2000), on their review of 15 studies supported the recommendation that exercise training is an important initial or adjunctive step that is highly efficacious in the treatment of individuals with mild to moderate elevations in BP (Hagberg et al. 2000). One previous study reported that 4 months of endurance training in middle-aged men resulted in no changes in resting SBP ando5 mm Hg decrease in resting DBP (Van et al. 1996). Our 3–4 mm Hg decreases in DBP and SBP parallel those recently reported in a meta-analysis by Fagard., (2006), who has shown that AE decreases in BP in normotensives of 3.0 (SBP) mm Hg and 2.4 (DBP) mm Hg with even greater reductions in resting BP in hypertensives (6.9 and 4.9 mm Hg in SBP and DBP, respectively) (Fagard. 2000). Also, the studies reported 4 mm Hg mean decreases in SBP and DBP are in line with those published in a second meta-analysis of resistance training effects on resting BP (Kelley et al. 2000). One previous study compared 6 months of RE and AE and found only modest benefits from AE on SBP or DBP in older men and women (Cononie et al. 1991). The discrepancy between these findings and ours may be due to the older ages of their subjects (70–79 years) when compared to our cohort and their RE intensity choice (one set to failure of 8–12 repetitions, 3 days per week). Vianna et al., (2012), reports that 4-month program of guided physical activity consisting of three moderate-intensity exercise sessions per week (each of 60 min duration) did not result in changes in BMI or BP of older participants (Vianna et al., 2012). Exercise is considered as a natural, inexpensive, feasible, and effective means of control for hypertensions and is a primary lifestyle measure required to lower BP in NPE male students. Insulin is a hormone with many functions, and the fasting serum level of insulin is increased in subjects with a low fitness level as well as in subject with a high BMI. Besides its effect on glucose transportation, insulin has an anabolic effect on fat storage in the fat cells (Barbagallo et al. 2003; Dela. 1996). Insulin affects appetite regulation through the change in substrates in the blood, and effect on BP regulation ((Barbagallo et al. 2003). It is known that insulin sensitivity increases with aerobic training and the effect is local in the trained muscle. In a one-leg training model, Dela et al., (1996), showed an increase in insulin sensitivity in the trained leg, but no change in the untrained leg (Dela. 1996). Insulin sensitivity may therefore is one of the key mechanisms behind the association found between BP, BMI, and fitness. The results of present study both AE and RE training can decrease mean arterial pressure, without a concomitant mean weight loss in either group.

Conclusion

Based on these finding, we wish to recommend that part of the preventive measures, secondary college NPE the male students in Iran should be provided with the opportunity to engage in regular and appropriate exercise programmed in order to keep their weights and high BP within desirable levels. Furthermore, there is a need for appropriate health education emphasizing the importance of cardiovascular health at this level of education.

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