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ORIGINAL ARTICLE

The Effects of One Session of Endurance and Speed Activity on Atrial Natriuretic Peptide (ANP) and Blood Pressure in Male Athlete Students

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KEYWORDS

Plasma ANP;
Speed endurance activity;
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ABSTRACT: Recent research establishes the heart as an endocrine gland capable of lowering blood pressure effectively through the secretion of hormones such as atrial natriuretic peptide (ANP). The purpose of this study was to determine the effect of endurance and speed activity on atrial natriuretic peptide (ANP) and blood pressure levels in male athlete students in Yazd. The statistical population for the study was male students at Yazd University, from which 90 male athletes with an average age of 23.42 and at least three years of experience in sports were randomly assigned to one of three endurance, speed, or control groups. The endurance group ran 3200 meters for 12 minutes, while the speed group ran 100 meters four times with rest intervals and at a heart rate of one-third of the target heart rate. Ten minutes before and ten minutes after the activity, blood samples were taken to determine plasma ANP. One session of endurance and speed activity significantly increased plasma ANP compared to the pretest stage ($p < 0.05$); additionally, there was a significant difference in plasma ANP and systolic and diastolic blood pressure between the group with speed activity and the control group as well as the control group with endurance activity ($p < 0.05$). The results demonstrated that both endurance and speed activity performed during single session increased plasma ANP and decreased systolic and diastolic blood pressure.

INTRODUCTION

Sports medicine can be used to prevent and treat various illnesses, most notably hypertension and cardiovascular disease. The American College of Sports Medicine recommendations, based on the participation of hypertensive patients and healthy individuals in their sports activities, demonstrate the critical nature of exercise and physical activity [1]. Numerous studies have been conducted on the neurohormonal mechanisms that are altered as a result of physical activity. Recent research indicates that the heart functions as an endocrine gland, that secreted hormones regulate blood pressure, blood volume, and sodium excretion, and that these peptides serve as independent markers of cardiovascular disease [2]. The atrial natriuretic peptide (ANP), which is secreted by granules in the atrial muscle cells of the heart during atrial dilation, assists in maintaining body fluid balance by affecting the kidneys and increasing urine volume and potassium excretion [3]. The atrial natriuretic peptide is a

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neutralizing mechanism that causes sodium excretion, weakens abnormal vascular cell growth, and vasodilation by controlling renin, angiotensin, aldosterone, and sympathetic nerve activity [4]. This hormone reduces blood pressure by increasing glomerular filtration and decreasing sodium reabsorption [5]. High blood pressure is associated with an increased risk of cardiovascular disease and is linked to an increased risk of death in patients with left ventricular hypertrophy and heart failure.

Hypertension also raises the chances of stroke, coronary artery disease, kidney disease, and death. While most people are aware that blood pressure monitoring is important, only a small percentage follow through. As a result, mortality is high as a result of this issue [6]. Since numerous clinical trials have demonstrated that pharmacotherapy for these disorders has adverse effects despite its beneficial effects, sports medicine experts recommend non-pharmacological methods such as exercise and physical activity to treat various diseases.

The American Heart Association recommends aerobic exercise instruction for patients with high blood pressure for 12 weeks, three to four times per week [1]. However, there are disparate and, in some cases, contradictory findings regarding the effect of exercise on ANP levels. For instance, a study titled *"Comparison of the Acute Response of Serum Atrial Natriuretic Peptide to Severe Anaerobic Activity in Healthy Athletic and Non-Athletic Men"* demonstrated that a single session of intense aerobic training significantly increases ANP in both the athletes and non-athlete groups [7]. The study found that one session of endurance and speed activity increased plasma ANP in male athletes [8]. Furthermore, it was demonstrated that a single session of vigorous aerobic exercise combined with the consumption of L-arginine significantly increases the serum ANP level in overweight and obese men [9]. In contrast, the results of a study examining the effect of one session of maximal aerobic activity on plasma ANP in two groups of healthy and chronic heart disease individuals revealed that aerobic exercise did not affect plasma ANP in either group.[10]. Given the relationship between ANP and blood pressure and the disparate research findings regarding the effect of activity on the two, this study aimed to evaluate the effect of two distinct methods of activity on the atrial natriuretic peptide (ANP) blood pressure.

MATERIALS AND METHODS

The current study is quasi-experimental and applied the pretest-posttest research method to compare the effects of a single session of endurance and speed activity on plasma ANP and blood pressure in male athlete students in Yazd, Iran. A total of 90 male students, ranging from 23 to 25, volunteered to participate in the study. The subjects had been participating in sports for at least three years. The samples were then randomly assigned to one of three groups (endurance group (n = 30), speed group (n = 30), or control group (n = 30). After completing a questionnaire regarding personal characteristics, medical history, medication use, and amount of daily activity, the subjects were informed about the study's purpose and procedures in a separate session. The participants completed the activity following a ten-minute warm-up period in a single exercise session. The endurance group completed a 3,200-meter course in 12 minutes. The 100-meter speed group was performed four times at rest intervals, with a target heart rate of one to three during rest, as well as systolic and diastolic blood pressure. Laboratory technicians took blood samples 10 minutes before the start of the activity and 10 minutes after the activity concluded at 5 p.m. to determine ANP blood concentrations. To compare pretest and posttest scores, the Paired Sample T-Test was used; to determine the difference between groups, a one-way analysis of variance (one-way ANOVA) was used; and the Tukey post hoc test was used to determine whether the results were significant.

RESULTS

Table 1 summarizes the subjects' characteristics. The research findings were analyzed using parametric tests after the Shapiro Wilk test was used to determine the normality of the data distribution ($p > 0.05$), listed in Table 2.

According to the results of the pretest's one-way analysis of variance, there is no significant difference between the groups' mean systolic blood pressure, diastolic blood pressure, and plasma ANP level ($p < 0.05$), and the groups are homogeneous, as shown in Table 3.

A comparison of the averages of the groups before and after exercise reveals that the group receiving speed and endurance training experienced a significant decrease in systolic and diastolic blood pressure ($p < 0.05$). However, no significant difference in these changes was observed in the control group ($p > 0.05$). The t-test results indicated a significant increase in ANP in the group receiving speed and endurance training ($p < 0.05$). However, as shown in Table 4, this change was insignificant in the control group ($p > 0.05$). The multivariate analysis of variance results showed a significant difference between the studied groups' mean systolic blood pressure, diastolic blood pressure, and plasma ANP level ($p < 0.05$). The Tukey post hoc test was used to evaluate the difference, and the results demonstrated a significant difference between the mean systolic and diastolic blood pressure, as well as the post-plasma level of ANP, in the speed and endurance training groups compared to the control group after a single training session ($p < 0.05$). However, the difference between the speed and endurance training groups, on the other hand, is not significant ($p > 0.05$).

Table 1. The characteristics of the subjects

Variable	Group	Sampling time	Average	Number	Standard deviation
Age (year)	Speed	-	23.25	30	1.98
	Endurance	-	23.39	30	2.50
	Control	-	23.62	30	2.64
Height (Cm)	Speed	-	176.1	30	3.77
	Endurance	-	176.3	30	4.20
	Control	-	174.7	30	6.46
Weight (kg)	Speed	-	67.6	30	7.46
	Endurance	-	68.75	30	4.65
	Control	-	71.65	30	7.91

Table 2. Comparison of measured variables before exercise intervention

	Control	Speed training	Endurance training	*p*
Systolic blood pressure	130.01±0.57	130.14±0.37	130.49±0.50	0.562
Diastolic blood pressure	70.61±0.41	70.54±0.63	70.46±0.48	0.342
ANP	10.31±0.07	10.2±0.38	10.18±0.46	0.472

Table 3. Comparison of measured variables before and after exercise intervention

Group/Variable	Endurance		*p*	Speed		*p*	Control		*p*
	Before	After		Before	After		Before	After	
Systolic blood pressure (mmHg)	130.49±0.50	120.80±0.63	0.031*	130.14±0.37	120.93±0.43	0.046*	130.1±0.57	130.14±0.34	0.56
Diastolic blood pressure (mmHg)	70.46±0.48	60.86±0.69	0.043*	70.54±0.63	60.97±0.55	0.043*	70.61±0.41	70.53±0.63	0.73
ANP	1.18±0.46	4.98±0.86	0.004*	1.20±0.38	4.28±0.18	0/008*	1.13±0.07	1.56±0.14	0.23

(*) Indicates a significant difference between before and after data (p <0.05)

Table 4. Intergroup comparison of the averages of systolic blood pressure, diastolic blood pressure, and ANP within the three groups after exercise intervention (Tukey post hoc test)

Groups	Groups	Systolic blood pressure	Diastolic blood pressure	ANP
Control	**speed**	0.039*	**0.008***	**0.005***
	endurance	0.039*	0.045*	**0.004***
speed	**endurance**	**0.468***	**0.702***	**0.923***

DISCUSSION

According to the findings of this study, one session of endurance activity resulted in a significant increase in the level of atrial natriuretic peptide (ANP), which is consistent with the findings of a study on 18 post-marathon athletes in which galactin and ANP levels were significantly increased following 62 kilometers of running [11]. Additionally, studies [8] and [12] corroborated the results of the current study. However, they examined the effect of a session of maximal aerobic activity on plasma ANP levels in two groups of healthy individuals and patients with chronic heart disease and found no evidence of a significant increase in ANP [10], which contradicted the present study's findings. Furthermore, according to the findings of this study, a session of speed activity resulted in a significant increase in the level of atrial natriuretic peptide (ANP) in male Yazd athletes. These findings corroborated those of a previous study entitled *"Comparison of the Acute Response of Serum Atrial Natriuretic Peptide to Severe Anaerobic Activity in Healthy Athletes and Non-Athlete Men."* The subjects in this study were 15 healthy male athletes and 15 healthy male non-athletes who volunteered and were available.

Both groups completed an anaerobic test in where they ran 35 meters at top speed with a ten-second rest interval between each interval. Blood samples were taken from subjects 10 minutes before and immediately after the activity to determine ANP. The results indicated that one session of anaerobic activity increased serum ANP significantly in both groups, with the athlete group significantly higher than the non-athlete group. Moreover, serum ANP values were significantly higher in the athlete group than in the non-athlete group [13], consistent with the current study. Additionally, a study titled *"The Effect of Intense Alternative Exercise and L-arginine Consumption on Serum Levels of Fibroblast Growth Factor 21 and Atrial Peptide Excreting Sodium in Overweight and Obese Young Men"* found that intense alternative exercise did not significantly increase the ANP level of overweight men in four groups of 40 men**.** However, when combined with L-arginine or consumed alone, these exercises significantly increased ANP levels in older men [9], consistent with the current study's findings.

On the other hand, the results of this study did not demonstrate a significant difference in the effect of a single session of endurance and speed activity on the level of atrial natriuretic peptide (ANP), which was consistent with the findings of another study that examined the effect of intense and long-term exercise on plasma ANP and BNP levels in healthy men [14]. Before and after endurance training, plasma ANP and BNP levels, catecholamine levels, blood lactate levels, and cardiac troponin were determined. Ten healthy men ran a 100-kilometer distance post-marathon in this study. The study's findings indicated that while all variables increased significantly following both training methods, the increase in BNP and ANP levels was highly correlated with the extent of cardiac troponin. The stimulus for increasing ANP can be the heart muscle contraction due to the increased heart size during sport exercises due to increased atrial dilation or increased central blood volume, which results in increased ANP hormone [15].

The effect of heart rate on ANP secretion is discussed in [16]. There is evidence that tachycardia-induced ANP secretion is stimulated [17]. Another study found a fourfold increase in ANP hormone levels during endurance activities at 33–66% of maximum heart rate and a six–sevenfold increase in maximal workload, as well as a significant relationship between heart rate and ANP, increase [18]. Additionally, both groups experienced significant reductions in systolic and diastolic blood pressure, which is consistent with the findings of several studies. The effects of endurance activity on systolic and diastolic blood pressure were examined in a review study, and it was concluded that endurance activity decreased systolic and diastolic blood pressure [19]. The precise mechanism by which exercise lowers blood pressure is unknown at the moment. According to the findings of this study, one of the reasons for blood pressure reduction may be an increase in ANP secretion as a result of exercise.

By controlling renin, angiotensin, aldosterone, and sympathetic nerve activity, increasing ANP secretion promotes sodium excretion, weakens abnormal vascular cell growth, and increases vascular dilation [20]. ANP is stored in the myocardial cells of mammalian atria and is found in trace amounts in the ventricles. It is released when tensile receptors are stimulated or when the atrial pressure of the heart is increased. ANP hormone stimulates urination and sodium excretion and regulates the osmotic pressure of body fluids and electrolytes in general. Moreover, it lowers blood pressure by relaxing the muscles that line the arteries [21].

CONCLUSIONS

The increase in ANP hormone can be influenced by activity-induced tachycardia. On the other hand, exercise can increase ventricular filling and stretch the ventricular walls by increasing blood volume and venous return, both induced by sympathetic activity and vascular contraction and the force of muscle contraction. Stretching the ventricular walls as a stimulus for natriuretic peptide hormone secretion is one of the known mechanisms underlying the increased ANP levels associated with an activity. This can effectively lower blood pressure due to exercise and can be considered one of the exercise-induced blood pressure reduction mechanisms.

CONFLICT OF INTERESTS

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