

## Effect of endurance and strength exercise on release of brain natriuretic peptide

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### ABSTRACT

**Objectives:** The aim of this study was to investigate the effects of 8-week endurance and resistance exercise training on release of brain natriuretic peptide. **Materials and Methods:** Study population was categorized into 4 groups: Group-1 (n = 6) consisted of sedentary individuals who volunteered to complete 8-weeks of endurance exercise; Group-2 (n=6) consisted of sedentary individuals who volunteered to complete 8-weeks of resistance exercise. Three blood samples [for Terminal pro BNP (NT-Pro-BNP)] were taken before, immediately after exercise and after 8 weeks of exercise training. **Results:** NT-Pro BNP was significantly increased immediately after endurance exercise [from  $37.9 \pm 1.4$  pg/ml to  $52.1 \pm 1.5$  pg/ml;  $P = 0.002$ ] and was decreased to  $23.2 \pm 9.3$  pg/ml after 8 weeks of endurance exercise [ $P = 0.013$ ]. On the other hand, NT-Pro BNP showed no significant changes immediately after resistance exercise [from  $26.6 \pm 4.9$  pg/ml to  $24.1 \pm 4.5$  pg/ml;  $P = 0.553$ ]. In contrast, NT-Pro BNP was significantly increased to  $39.5 \pm 1.6$  pg/ml after 8 weeks of resistance exercise [ $P = 0.012$ ]. **Conclusion:** Endurance exercise training reduces circulating NT-Pro BNP concentration, which is likely a marker of reduced ventricular wall tension and improved myocardial function. In contrast, strength exercise induces significant increase in NT-Pro BNP, which could be partially attributed to myocardial damage.

**Key words:** Brain natriuretic peptide, endurance exercise, strength exercise

### INTRODUCTION

Brain natriuretic peptide (BNP) is principally synthesized and released by ventricular myocytes in response to myocardial wall stress.<sup>[1-3]</sup> BNP is then cleaved into N-Terminal pro BNP (NT-Pro BNP).<sup>[2]</sup> Both BNP and NT-Pro-BNP are detectable in the blood by several commercially available assays and have been found to have prognostic and diagnostic values in systolic and diastolic heart failure, acute coronary syndromes and stable

coronary artery disease.<sup>[4-8]</sup> The aim of this study was to investigate the effects of 8-week endurance and resistance exercise training on NT-Pro BNP release. We also investigated the effect of androgenic anabolic steroid abuse on NT-Pro BNP release.

### MATERIALS AND METHODS

#### Study population

Study population was categorized into 4 groups: Group-1 (n = 6) consisted of randomly-selected sedentary individuals who volunteered to complete 8-weeks of endurance exercise; Group-2 (n = 6) consisted of randomly-selected sedentary individuals who volunteered to complete 8-weeks of resistance exercise; Group-3 (n = 5) consisted of bodybuilders who denied any current or previous use of anabolic androgenic steroids; Group-4

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(n = 5) consisted of bodybuilders who were regularly using anabolic androgenic steroids for at least one month prior to the start of the study. All subjects were normotensive (blood pressure < 140/90 mmHg). The subjects of the research were all free of cardiovascular and pulmonary disease, alcohol use, and diabetes mellitus; and, were not taking any kind of medications and did not present with any abnormal electrocardiographic patterns. Each subject provided informed written consent. The study was approved by the university ethics committee.

### N-Terminal Pro Brain natriuretic peptide measurement

Three blood samples (for NT-Pro BNP) were taken before, immediately after 35 minute exercise and after 8 weeks of exercise training.

### Endurance exercise training protocol

The following exercise plan was designed: 1-Warm up (5 minutes of light treadmill walking at a power of 15 Watt); 2-High impact treadmill run (exercise rate subsequently increased by 10 W/min, Total time = 20 minutes); 3-Cool down (10 minutes). NT-Pro BNP was checked before and immediately after 35 minutes of exercise. After becoming familiar with the testing equipment, regular aerobic exercise three times a week for 45 minutes was performed by the subjects, and the NT-Pro BNP levels were checked after 8 weeks of exercise.

### Resistance exercise training protocol

This consisted of two sessions, one using resistance machines (15 minutes) and the other isometric exercises and dumbbells (20 minutes). NT-Pro BNP was checked before and immediately after 35 minutes of exercise. After becoming familiar with the testing equipment, resistance exercise three times a week for 30 minutes was performed by the subjects, and the NT-Pro BNP levels were checked after 8 weeks of resistance exercise.

### Statistical analysis

All values are presented as mean  $\pm$  Standard Deviation.

Comparisons within groups were made using paired *t*-test and one-way analysis of variance (ANOVA). For all analyses, *P*-value < 0.05 was considered as statistically significant.

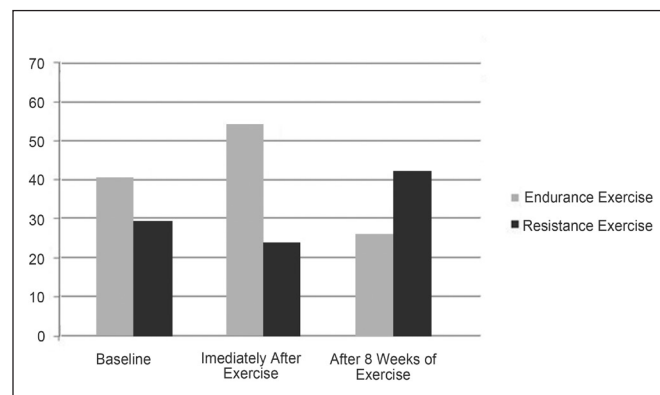
## RESULTS

### Baseline characteristics

Table 1 shows the baseline characteristics of the study population.

### Effects of different exercise training on N-Terminal Pro Brain natriuretic peptide

NT-Pro BNP was significantly increased immediately after endurance exercise (from  $37.9 \pm 1.4$  pg/ml to  $52.1 \pm 1.5$  pg/ml; *P* = 0.002) and was decreased to  $23.2 \pm 3.4$  pg/ml after 8 weeks of endurance exercise (*P* = 0.013). On the other hand, NT-Pro BNP showed no significant changes immediately after resistance exercise (from  $26.6 \pm 4.9$  pg/ml to  $24.1 \pm 4.5$  pg/ml; *P*=0.553). Further, NT-Pro BNP was significantly increased to  $39.5 \pm 1.6$  pg/ml after 8 weeks of resistance exercise (*P* = 0.012) [Figure 1]. One-way ANOVA analysis showed that resistance exercise had



**Figure 1:** Effects of different exercise training on N-Terminal Pro Brain natriuretic peptide (NT-Pro BNP). NT-Pro BNP was significantly increased immediately after endurance exercise [from  $37.9 \pm 1.4$  pg/ml to  $52.1 \pm 1.5$  pg/ml; *P*=0.002] and was decreased to  $23.2 \pm 3.4$  pg/ml after 8 weeks of endurance exercise [*P* = 0.013]. On the other hand, NT-Pro BNP showed no significant changes immediately after resistance exercise [from  $26.6 \pm 4.9$  pg/ml to  $24.1 \pm 4.5$  pg/ml; *P* = 0.553]. In contrast, NT-Pro BNP was significantly increased to  $39.5 \pm 1.6$  pg/ml after 8 weeks of resistance exercise [*P* = 0.012]

**Table 1: Baseline characteristics of the study population**

	Group-1 (n=6)	Group-2 (n=6)	Group-3 (n=5)	Group-4 (n=5)
Age (years)	54±11.2	57±11.5	24.2±2.5	23±2.2
Weight (kg)	75±6.8	68±7.5	80±6.9	89.8±6.5
Height (cm)	180±9.5	167±6.3	176±5.8	177±5.5
Body mass index (kg/m <sup>2</sup> )	23.1±1.8	24.3±2.2	25.8±2.5	28.3±2.6*

\**P* = 0.034

a greater effect on NT-Pro BNP release compared to the endurance exercise after 8 weeks of training ( $P = 0.011$ ).

### Effects of androgenic anabolic steroid abuse on N-Terminal Pro Brain natriuretic peptide

Bodybuilders regularly using androgenic anabolic steroids had significantly lower basal NT-Pro BNP levels compared with bodybuilders who did not use anabolic androgenic steroids ( $8.6 \pm 1.1$  pg/ml vs.  $32.7 \pm 2.7$  pg/ml;  $P < 0.001$ ). NT-Pro BNP showed no significant change immediately after resistance exercise in both groups of bodybuilders (anabolic steroid users and those without using of anabolic steroid,  $P = 0.42$ ).

## DISCUSSION

### Significance of N-Terminal Pro Brain natriuretic peptide in cardiovascular disease

NT-Pro BNP provides strong and independent prognostic information in patients with heart failure, stable coronary artery disease, acute coronary syndromes, and valvular heart disease; and, is a predictor of cardiac mortality.<sup>[4-8]</sup>

### Effect of endurance exercise on N-Terminal Pro Brain natriuretic peptide release

In the present study, effects of two types of strength and endurance training on NT-Pro BNP levels were studied. NT-Pro BNP levels showed significant increase after 35 minutes of endurance exercise. Our data was similar to the results of other researchers who showed significant increases in plasma levels of NT-Pro BNP after activities like marathon running, cycling and endurance triathlon.<sup>[9,10]</sup> Middleton *et al.* showed that both cardiac Troponin-T and NT-Pro BNP levels were significantly elevated after exercise, indicative of an increase in either left ventricular wall stress or left ventricular end-diastolic pressure.<sup>[11]</sup> Leers *et al.* proposed that post-exercise transient increases in NT-Pro BNP and Troponin-T may reflect myocardial stunning.<sup>[9]</sup> In the present research, we reported that NT-Pro BNP was decreased significantly after 8 weeks of endurance exercise. Previous reports strongly suggested that this reduction in circulating NT-Pro BNP concentration is likely a marker of reduced ventricular wall tension and improved myocardial function.<sup>[12]</sup> With respect to the fact that the functional status of the myocardium contributes to the physical capacity of an individual and the quality of life, reduced NT-Pro BNP after 8 weeks of endurance exercise should signal a valid benefit of exercise training.

### Effect of strength exercise on N-Terminal Pro Brain natriuretic peptide release

In the present study we found that NT-Pro BNP showed no significant change after 35 minutes of strength exercise; however, significant increase in NT-Pro BNP was found after 8 weeks of strength exercise, which may be a marker of strength exercise-induced subtle myocytes injury. We also investigated the effect of androgenic anabolic steroid abuse on NT-Pro BNP release. Bodybuilders regularly using androgenic anabolic steroids had significantly lower basal NT-Pro BNP levels compared with bodybuilders not using anabolic androgenic steroids. This finding may be due to higher body mass index (BMI) of bodybuilders using anabolic androgenic steroids. In the Framingham study, NT-Pro BNP levels were lower in subjects with higher BMI.<sup>[13]</sup> Decreased release of natriuretic peptides from the heart or increased clearance may be responsible for the association between higher BMI and lower natriuretic peptide levels.<sup>[13]</sup>

## CONCLUSION

Endurance exercise training reduces circulating NT-Pro BNP concentration which is likely a marker of reduced ventricular wall tension and improved myocardial function. In contrast, strength exercise induces significant increase in NT-Pro BNP which could be partially attributed to myocardial damage.

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