

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

Somayeh Bordbar, Mohammad Ali Babaee Bigi¹, Amir Aslani¹, Eskandar Rahimi, Nader Ahmadi

Fars Sciences and Research Branch, Azad University, Shiraz, ¹Cardiovascular Research Center, Shiraz University of Medical Sciences, Shiraz, Iran

Address for correspondence: Dr. Amir Aslani, Cardiovascular Research Center, Shiraz University of Medical Sciences, Shiraz, Iran. E-mail: draslani@yahoo.com

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 ± 1.4 pg/ml to 52.1 ± 1.5 pg/ml; $P = 0.002$] and was decreased to 23.2 ± 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 ± 4.9 pg/ml to 24.1 ± 4.5 pg/ml; $P = 0.553$]. In contrast, NT-Pro BNP was significantly increased to 39.5 ± 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.^[1-3] BNP is then cleaved into N-Terminal pro BNP (NT-Pro BNP).^[2] 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.^[4-8] 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

Access this article online	
Quick Response Code:	Website: www.jcdronline.com
	DOI: 10.4103/0975-3583.91599

($n = 5$) 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 ± 1.4 pg/ml to 52.1 ± 1.5 pg/ml; $P = 0.002$) and was decreased to 23.2 ± 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 ± 4.9 pg/ml to 24.1 ± 4.5 pg/ml; $P = 0.553$). Further, NT-Pro BNP was significantly increased to 39.5 ± 1.6 pg/ml after 8 weeks of resistance exercise ($P = 0.012$) [Figure 1]. One-way ANOVA analysis showed that resistance exercise had

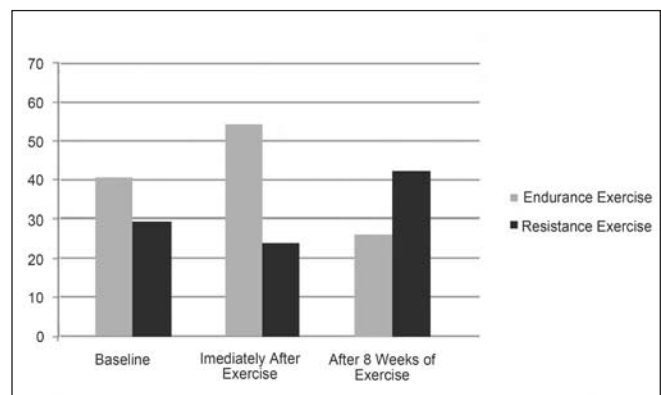


Figure 1: Effects of different exercise training on N-Terminal Pro Brain natriuretic peptide (NT-Pro BNP). NT-Pro BNP was significantly increased immediately after endurance exercise [from 37.9 ± 1.4 pg/ml to 52.1 ± 1.5 pg/ml; $P = 0.002$] and was decreased to 23.2 ± 3.4 pg/ml after 8 weeks of endurance exercise [$P = 0.013$]. On the other hand, NT-Pro BNP showed no significant changes immediately after resistance exercise [from 26.6 ± 4.9 pg/ml to 24.1 ± 4.5 pg/ml; $P = 0.553$]. In contrast, NT-Pro BNP was significantly increased to 39.5 ± 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 \pm 11.2	57 \pm 11.5	24.2 \pm 2.5	23 \pm 2.2
Weight (kg)	75 \pm 6.8	68 \pm 7.5	80 \pm 6.9	89.8 \pm 6.5
Height (cm)	180 \pm 9.5	167 \pm 6.3	176 \pm 5.8	177 \pm 5.5
Body mass index (kg/m ²)	23.1 \pm 1.8	24.3 \pm 2.2	25.8 \pm 2.5	28.3 \pm 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 ± 1.1 pg/ml vs. 32.7 ± 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.^[4-8]

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.^[9,10] 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.^[11] Leers *et al.* proposed that post-exercise transient increases in NT-Pro BNP and Troponin-T may reflect myocardial stunning.^[9] 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.^[12] 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.^[13] 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.^[13]

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.

REFERENCES

1. Maisel A. B-type natriuretic peptide levels: A potential novel "white count" for congestive heart failure. *J Card Fail* 2001;7:183-93.
2. Hall C. Essential biochemistry and physiology of (NT-pro) BNP. *Eur J Heart Fail* 2004;6:257-60.
3. Lubien E, DeMaria A, Krishnaswamy P, Clopton P, Koon J, Kazanegra R, *et al.* Utility of B-natriuretic peptide in detecting diastolic dysfunction: Comparison with Doppler velocity recordings. *Circulation* 2002;105: 595- 601.
4. Almeida SS, Azevedo A, Castro A, Friões F, Freitas J, Ferreira A, *et al.* B-type natriuretic peptide is related to left ventricular mass in hypertensive patients but not in athletes. *Cardiology* 2002;98:113-5.
5. Mizuno Y, Yoshimura M, Harada E, Nakayama M, Sakamoto T, Shimasaki Y, *et al.* Plasma levels of A and B type natriuretic peptides in patients with hypertrophic cardiomyopathy or idiopathic dilated cardiomyopathy. *Am J Cardiol* 2000;86:1036-40.
6. La Villa G, Stefani L, Lazzeri C, Zurli C, Guerra CT, Barletta G, *et al.* Acute effects of physiological increments of brain natriuretic peptide in humans. *Hypertension* 1995;26:628-33.
7. McDonagh TA, Robb SD, Murdoch DR, Morton JJ, Ford I, Morrison CE, *et al.* Biochemical detection of left-ventricular systolic dysfunction. *Lancet* 1998;351:9-13.
8. Kinnunen P, Vuolteenaho O, Ruskoaho H. Mechanisms of atrial and brain natriuretic peptides from rat ventricular myocardium: Effect of stretching. *Endocrinology* 1993;132:1961-70.
9. Leers MP, Schepers R, Baumgarten R. Effect of a long distance run on

- cardiac markers in healthy athletes. Clin Chem Lab Med 2006;44:999-1003.
10. Neumayr G, Pfister R, Mitterbauer G, Eibl G, Hoertnagl H. Effect of competitive marathon cycling on plasma N-terminal pro-brain natriuretic peptide and cardiac troponin T in healthy recreational cyclists. Am J Cardiol 2005;96:732-5.
 11. Middleton N, Shave R, George K, Whyte G, Forster J, Oxborough D, *et al.* Novel application of flow propagation velocity and ischaemia modified albumin in analysis of postexercise cardiac function in man. Exp Physician 2006; 91:511-9.
 12. Berent R, von Duvillard SP, Crouse SF, Auer J, Green JS, Sinzinger H, *et al.* Short-term residential cardiac rehabilitation reduces B-type natriuretic peptide. Eur J Cardiovasc Prev Rehabil 2009;16:603-8.
 13. Minami J, Nishikimi T, Matsuoka H. Plasma brain natriuretic peptide and N-terminal pro atrial natriuretic peptide levels in obese patients: A cause or result of hypertension? Circulation 2004;110:e76.

How to cite this article: Bordbar S, Bigi MB, Aslani A, Rahimi E, Ahmadi N. Effect of endurance and strength exercise on release of brain natriuretic peptide. J Cardiovasc Dis Res 2012;3:22-5.
Source of Support: Nil, **Conflict of Interest:** None declared.

Author Help: Online submission of the manuscripts

Articles can be submitted online from <http://www.journalonweb.com>. For online submission, the articles should be prepared in two files (first page file and article file). Images should be submitted separately.

- 1) **First Page File:**
Prepare the title page, covering letter, acknowledgement etc. using a word processor program. All information related to your identity should be included here. Use text/rtf/doc/pdf files. Do not zip the files.
- 2) **Article File:**
The main text of the article, beginning with the Abstract to References (including tables) should be in this file. Do not include any information (such as acknowledgement, your names in page headers etc.) in this file. Use text/rtf/doc/pdf files. Do not zip the files. Limit the file size to 1024 kb. Do not incorporate images in the file. If file size is large, graphs can be submitted separately as images, without their being incorporated in the article file. This will reduce the size of the file.
- 3) **Images:**
Submit good quality color images. Each image should be less than **4096 kb (4 MB)** in size. The size of the image can be reduced by decreasing the actual height and width of the images (keep up to about 6 inches and up to about 1800 x 1200 pixels). JPEG is the most suitable file format. The image quality should be good enough to judge the scientific value of the image. For the purpose of printing, always retain a good quality, high resolution image. This high resolution image should be sent to the editorial office at the time of sending a revised article.
- 4) **Legends:**
Legends for the figures/images should be included at the end of the article file.