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# The effect of an exhausting aerobic exercise session on plasma NT-proBNP and galectine-3 levels in male runners

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**Abstract**

*Introduction:* Brain natriuretic peptide (BNP) is an indicator released by the effect of increased intra-ventricular pressure and increased volume of ventricular myocarditis. Galectin-3 is a protein produced by the production of myocardial macrophages. The purpose of this study was to investigate the effect of an exhaustive aerobic exercise session on plasma NT-proBNP and galectine-3 levels in male runners.

*Material and Methods:* A total of 12 semi-professional male runners were selected as the subject. The Bruce test protocol was used to achieve the exhaustion. The blood sample was taken before and immediately after the completion of the exhaustive endurance exercise.

*Results:* The results indicated that galectin-3 was increased after the exhaustive endurance exercise ($P<0.05$); however for NT-pro BNP no significant change was observed.

*Conclusions:* Generally, the acute effect of exhaustive aerobic exercise on cardiac muscle function and the secretion of NT-pro

BNP and galectin-3 seem to be different. It seems that galectin-3 has a higher sensitivity. However, more research is needed in this regard.

Key words: NT-pro BNP, Galectin-3, exhaustive aerobic exercise.

## 1. Introduction

Heart failure is one of the most common diseases in industrialized countries, and affects 12 million people in the United States every year, of which 650,000 are infected with a new heart attack and 450,000 are subject to stroke. The rate of early-onset (30-day) deaths from acute myocardial infarction is about 30%, more than half of which occurs before reaching the hospital (1). According to the official statistics of the Ministry of Health and Medical Education in 2006, more than 40% of the deaths in the country are due to cardiovascular disease and more than 19% are related to heart attacks. It has been reported that 300 people die every day in the country due to cardiac complications. However, the risk of cardiovascular disease after men is 40 years old is 49% in men and 39% in women. About 50 years ago, the study on natriuretic peptides has begun as new indicators of heart disease. Brain natriuretic peptide (BNP) is an indicator released by the effect of increased intra-ventricular pressure and increased volume of cardiac muscle cells in the colon and is used as a marker for determining prognosis after a heart attack (2). N-Terminal pro BNP (NT-proBNP) has a high sensitivity and specificity in detecting heart failure and are used for diagnosis, screening, prognosis and monitoring of cardiac disease. Increasing their rates indicates the severity of the disease (3). Determining and measuring these indicators as a precaution and knowledge of the severity of the disease can help to avoid unnecessary admissions (4). Today, in some studies, screening for people at high risk for heart failure, such as diabetics and the elderly, initially examines the level of the NT-proBNP; subjects with a high level of NT-proBNP are then referred for echocardiography, which is more economically beneficial(5).

Recently, new factors have been introduced from the galectine family called galectin-3, which has been shown by research (6). In patients with heart failure, including cardiac ischaemia, galectin-3 can be clinically used (7). Although regular endurance exercise improves cardiovascular system, the effect of exhaustive aerobic exercise on cardiac muscle is not well known. Hättasch et al. (2013) reported that galectin-3 increases after the marathon (8). Salvagno et al. (2014) also noted that NT proBNP and galectin-3 increases after a 60-km ultramarathon (9). However, Geny et al. (1996) indicated that NT proBNP has no significant change after the acute aerobic exercise (10). Thus the purpose of this study was to investigate the effect of an exhaustive aerobic exercise session on plasma NT-proBNP and galectine-3 levels in male runners.

## Material & Methods

### *Subjects*

In this study, 12 semi-professional men aged 18 to 25 years old were selected as the subject for participation in this study. All subjects have participated in semi-professional competitions for more than 3 years at the national level. All subjects also performed 6 sessions of their exercises in the Athletics Track during the week.

*Exhaustive aerobic exercise*

The Bruce test protocol was used as the exhaustive aerobic exercise. This test includes 7 phases. This test is done on the treadmill and started with low intensity; every 3 minutes. The speed and the gradient (slope) of the device increased up to the level in which the subject could not perform the test anymore and became totally exhausted.

*Biochemical analyses*

Blood samples were collected before and immediately after the intense exercise. After the blood samples were taken, they were transferred to the laboratory for analysis by enzyme-linked immunosorbent assay (ELISA) method. Galectin-3 level was determined in duplicate via an ELISA kits (Hangzhou Eastbiopharm Co., LTD, China) with a sensitivity of 2.49 pg/ml. NT proBNP level was determined in duplicate via an ELISA kits (Biomedica Co., LTD, China) with a sensitivity of 64 pmol/ml.

*Statistical Analysis*

Results were expressed as the mean ± SD and distributions of all variables were assessed for normality using kolmogorov-smirnov test. Paired t-test was used to compute mean (± SD) changes in the variables pre and after the exhaustive aerobic exercise. Data were analyzed using SPSS software for windows (version 21, SPSS, Inc., Chicago, IL) and the significance level of this study was set at $P< 0.05$.

## Results

The result on NT proBNP level is shown in Figure 1. The results indicated that there is no significant change on NT proBNP after an exhaustive aerobic exercise session in male runners.

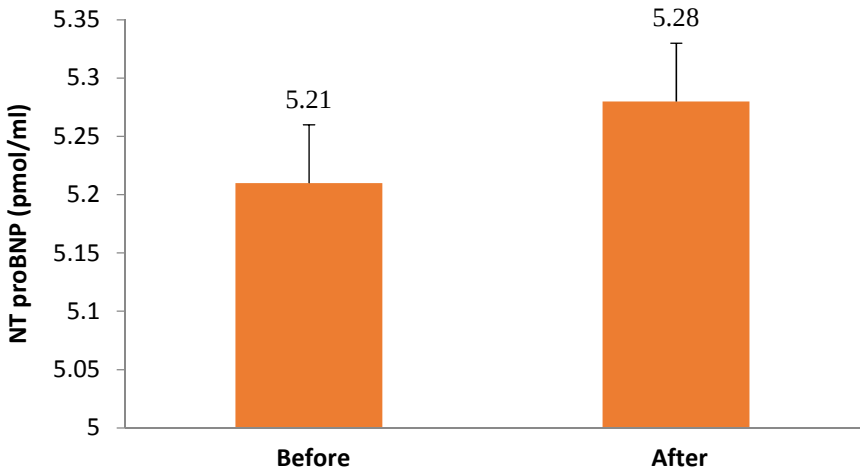


**Figure 1.** NT proBNP changes before and after an exhaustive aerobic exercise session

The result on galectin-3 level is presented in Figure 2. The results indicated that galectin-3 increase after an exhaustive aerobic exercise session in male runners.

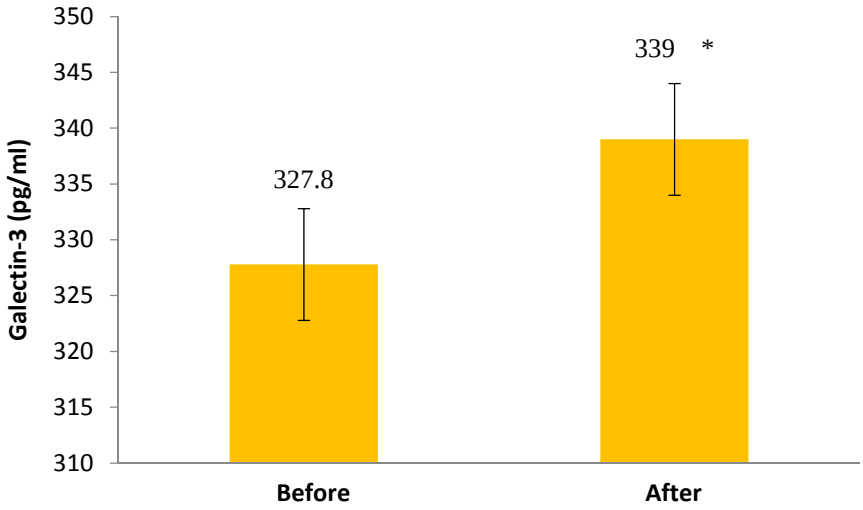


**Figure 2.** Galectin-3 changes before and after an exhaustive aerobic exercise session
* Significant differences (P<0.05)

## Discussion

The results of this study showed that there is no significant change in plasma NT proBNP level before and after the exhaustive aerobic exercise. The results of this study coincided with previous studies. Ahmadizad et al. (2012) demonstrated that there was no significant difference in NT proBNP after 12 weeks of resistance training in healthy men. They noted that changes in blood pressure, structure and cardiac function attributed to resistance training, no significant increase in functional cardiovascular variables, as well as changes in receptors and changes in sympathetic tone might some possible reasons for these results (11). Normandin et al. (2013) also did not find a significant difference in BNP between the two groups of patients with heart failure during endurance training (12). On the other hand, some studies showed a significant increase in NT proBNP level after a session of exercise. For example, Bordbar et al. (2013) showed a significant increase in plasma levels of NT-pro BNP after an endurance and resistance training session on healthy middle-aged men (13). Yurtdaş et al. (2012) reported a significant increase in the level of NT proBNP plasma levels during a session of exercise in patients with coronary artery disease (14).

Our results showed that galectin-3 increase after an exhaustive aerobic exercise session in male runners. The results of this study are in line with the research by Hättasch et al. (2013) and Salvagno et al. (2014) (8,9). Hättasch et al. (2013) reported that galectin-3 increases after the marathon (8). Salvagno et al. (2014) also noted that NT proBNP and galectin-3 increases after a 60-km ultramarathon (9).

Galectin-3 is a unique chimera-like protein belonging to the large family of galectins. The protein contains carbohydrate recognition and collagen-like domains, which support the binding to a large number of extracellular matrix proteins, carbohydrates and cell surface receptors (e.g., laminin, fibronectin, and tenascin) (15). Expression of galectin-3 has been detected in several tissues, albeit its synthesis is substantially amplified by a number of conditions, which also include heart failure (16). Interestingly, galectin-3 is not only being used as a reliable biomarker of cardiac dysfunction and adverse outcomes, but it is also directly implicated in a kaleidoscope of biological pathways that contribute to development and worsening of heart failure, thus including myofibroblast proliferation, collagen deposition and adverse cardiac remodeling (16). In addition, the evidence that inhibition of galectin-3 activity efficiently prevents cardiac inflammation, fibrosis, hypertrophy and dysfunction (17), has paved the way to a number of studies that have considered the hypothesis of developing specific anti-galectin treatments in the therapy of patients with heart failure and preserved ejection fraction (18). As regards the biology of galectin-3 after vigorous aerobic exercise, it is hence plausible that such a remarkable increase of expression and release into circulation may promote a deleterious mechanism of fibrosis that may involve both skeletal and cardiac muscles, i.e., the tissues that are mostly stressed during this type of demanding physical exercise (9).

## Conclusion

The results of this study showed that there galethecin-3 levels increase after an exhaustive aerobic exercise session; however, there was no significant change was observed in NT proBNP after the intervention. Therefore, it seems that galectin-3 has a higher sensitivity to inflammatory factors after exercise during diagnosis and diagnosis of heart failure than NT proBNP. The results of most studies suggest that the use of cardiac markers, including NT proBNP and galectin-3, in identifying heart failure or detecting damage in the heart tissue can be effective in prognosis and prevention of cardiovascular disease. Also, using these markers is very important because of its low cost and high performance in detecting heart failure. Therefore, the use of these variables can be effective for professional athletes in determining the intensity of an activity; usually sports competitions are held at a very high level, causing serious injuries (cardiac injuries) and ultimately death during the competition. Therefore, attention to this subject is periodically considered during the season of the tournament.

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**Conflict of interests:** No conflict of interests amongst authors.

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