Effect of Eight-week Swimming on Angiotensin II and its Receptor in Renal Tissue of Elderly Rats

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Abstract

The present study aimed to determine the effect of a regular aerobic training program on angiotensin II and its receptor in renal tissue of elderly rats. For this purpose, 14 elderly male rats (from 40 to 50 weeks old) with an initial body weight of 250-300g were randomly divided to two control and training groups (n = 7). Training program consisted of 8-week swimming, three days in a week, each lasted for 30 minutes. The rats were anesthetized with a Ketamine/Xylazine combination 48 hours after the last training session and after 10-12 hours of fasting. Renal tissues of the rats were isolated and kept at (-70)°C in the freezer for measuring angiotensin II and its receptor. Angiotensin II and its receptor were measured using the corresponding kit and ELISA Method. The collected data was analyzed using independent t-test to determine the difference between groups. The significance level was considered as P ≤ 0.05. The results showed that eight-week swimming significantly decreased angiotensin II level and its receptor in renal tissue of healthy elderly rats (P < 0.05). The results showed that eight-week swimming significantly decreased angiotensin II level and its receptor in rats. Then, swimming can be used as a solution to improve health and prevent diseases in elderly.

Keywords: swimming, angiotensin II, angiotensin receptor, male rats

Introduction

Mobility poverty and spread of diseases associated with immobility and elderly have disturbed healthy lifestyle in prevention of different diseases. Various studies have shown that sedentary lifestyle is majorly responsible for incidence of sudden death caused by renal disease, cardiovascular disease, cancer and diabetes (Tartibian et al., 2012). Elderly individuals have limited muscular strength and endurance due to declined physical state, which causes renal failure (Hosseini, 2004). Limited training duration, reduced physical capacity and increased functional disability can be cited as characteristics of elderly. Studies have shown that physical activity with appropriate intensity and duration prevent and treat many diseases. Therefore, training has many physiological benefits for elderly (Rambod et al., 2011; Birinder et al., 2006). In this regard, regular physical activity improves quality of life and body composition and prevents weight gain and cardiovascular diseases,
renal disease, fatty liver disease (hepatic steatosis), obesity and metabolic disorders like diabetes and hypercholesterolemia. As a result, physical activity in elderly individuals were addressed by scholars nowadays (Carr AJ et al., 2001). Exercise plays a major role in human health. It is reported that exercise plays an important role in pharmacokinetic properties of drugs. Physical activity and exercise increase blood circulation in the liver and accelerate biological transformation and excretion through the kidneys (Gibson et al., 2006; Gavras et al., 1988). Studies have shown that physical activity (exercise) increases activities of superoxide dismutase and catalase in elderly rats (Fischer et al., 2002). Angiotensin II and its receptor are influenced by physical activity, which causes vasoconstrictor and hypertension and release of aldosterone from adrenal cortex, which activates a part of renin-angiotensin system. Angiotensin converting enzyme is effective in treatment of such disorders as hypertension, heart disease and even diabetes. It is reported that this enzyme reduces the formation of angiotensin II, reduces metabolism of bradykinin and leads to dilation of arteries and veins as well as hypotension (Tartibian et al., 2012; Rambod et al., 2011, Nakas-Icindic et al., 2004). Studies have shown that appropriate physical activity inhibits pathological overexpression of angiotensin II and strengthens activity of nitric oxide (Jager et al., 2003; Kirsten et al., 2003). It also has been reported that regular physical activity reduces blood pressure (hypotension) by activating apelinergic system and increasing angiotensin II inhibitors in rats (Johnston et al., 1988). Therefore, physical (sport) activity is a non-pharmacological treatment used to reduce blood pressure. The present study sought to examine the effect of aerobic training on angiotensin II level and its receptor in renal tissue of healthy elderly rats.

**Materials and Methods**

In this study, 14 Wistar female rats (from 40 to 50 weeks old) with an initial body weight of 250-300 grams were selected in the research center for reproduction of laboratory animals in Islamic Azad University of Sari. The rats were transferred to the research environment for a week to get familiar with the environment and activities in the swimming pool. The rats were divided randomly into two training and control groups. Swimming aerobic exercise lasted for 8 weeks, 3 days in a weak, 30 minutes each day (Carr AJ et al., 2001). The rats performed no activity in the control group. Food and water were freely available during period of the study. The rats were anesthetized by intraperitoneal injection of Ketamine and Xylazine combination 48 hours after the last training session and after 11-12 hours of fasting. Renal tissues were isolated and kept at (-70)°C in the freezer for measuring angiotensin II levels and its receptor. The collected data was analyzed using independent t test at $p \leq 0.05$ significance level.

**Results**

The results showed that angiotensin II levels and its receptor were significantly decreased in the training group compared to the control group ($p<0.05$).

![Figure1. Changes in angiotensin II and its receptor in both control and training groups (*) indicates a significant difference between the two groups](image-url)
Discussion and Conclusion

Survey showed that increased age causes many diseases. Reduced physical activity, decreased muscular strength as well as structural changes in renal artery, vessels and nephrons decrease renal function. Glomerular filtration rate (GFR) also decreases due to above-mentioned factors, which increases the risk of chronic kidney disease CKD (Hedayat Allah et al., 2012). CKD increases inflammatory indices, changes innermost layer of the arteries and veins, increases level of collagen and calcium, causes atherogenic lipoproteins, increases oxidative stress and decreases kidney function (Rashki Komak et al., 2011). Decreased kidney function decreases excretion of sodium and water and changes the renin-angiotensin -aldosterone system, which impairs endothelial function and consequently leads to hypertension and cardiovascular diseases. Many subsequent diseases can be prevented if CKD was early diagnosed and treated (Rashki Komak et al., 2011). Chronic kidney disease is the most important cause of death, which is associated with increased activity of angiotensin II and receptor type 1 and 2 and subsequent increase in systolic and diastolic blood pressure. On the other hand, increased age is associated with increased oxidative stress, which stimulates expression of genes of angiotensin II type 1 and 2 receptors (Quiroz et al., 2008). On the other hand, increased age is associated with increased oxidative stress, which stimulates expression of genes of angiotensin II type 1 and 2 receptors. Results of the present study showed that eight-week regular aerobic swimming exercise significantly decreased angiotensin II and its receptor (respectively by 13.29% and 12.25%). These results showed that sport exercise decreases angiotensin II and its receptor by reducing tissue inflammation caused by increased age in healthy rats. Tartibian et al. (2012) showed no significant change in angiotensin II in the training group after 4 weeks. However, angiotensin II was significantly decreased after eight weeks of exercise (Tartibian et al., 2012). Results of the former study are consistent with those results obtained in this study. The scholars also showed that long-term swimming training (6 to 16 weeks) significantly decreased angiotensin II receptor cells and increased sodium excretion through kidneys and urine in sick rats (Sayin et al., 2007; Michela et al., 2009). It seems that exercise is an effective strategy for reducing kidney damage and kidney tissue protection against damage caused by oxidative inflammatory stress due to increased age.

Conflict of interest

The authors declare no conflict of interest

References

expression and doxorubicin accumulation in cardiac and skeletal muscle


