

The Effects of an Acute Training Protocol on the Amount of VIP Hormone Secretion and Lipid Profile of Plasma in Male Rats

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Original Article

Abstract

Introduction: Hypertensive disease is a medical term for high blood pressure. It makes the heart work more natural conditions. The most important effect of VIP hormone on cardiovascular system is vasodilatation. The aim of this research is to study the effects of an acute training protocol on the amount of VIP hormone secretion and lipid profile of plasma in male rats.

Methods: 30 male rats were accidentally selected from the rats held in the animal laboratory of Shiraz university of Medicine Sciences, and they were randomly divided into two groups, the experimental group (n=15, weight=200-250gr, age=1 month) and the control group (n=15, weight=200-250gr, age=1 month). The experimental group rats were trained acutely for 4 weeks, 3 sessions per week (in sum there were 12 sessions) based on overload principle on an animal treadmill, with the control group received no training at all. Following a general anesthesia by Ether, a 5cc blood sample was drawn from the heart of the rats by an animal surgeon, 24 hours after final exercise session and 12 to 14 hours after fasting. For data analysis, t-test and SPSS 18 software were used.

Results: The results illustrate that after 4 weeks of acute training, there was no significant difference between experimental and control groups.

Conclusion: On the basis of these finding, it could be concluded that 4 weeks of acute exercise could not change the amount of VIP hormone secretion and level of HDL, LDL and VLDL of plasma in rats.

Key words: Exercise, Hormone, Lipoprotein.

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Introduction:

Hypertension is a medical term for high blood pressure which is well known as a common disease. High blood pressure results in the heart working harder than normal conditions, because it has to pump the blood against a higher flow resistance.

Also, hypertension applies a high pressure on arteries and arterioles and in the long term, this pressure can result in heart enlargement, hardness and decrease of the elasticity of the arteries. These conditions can result in conditions like atherosclerosis, heart attack, heart failure, stroke and renal failure (1).

VIP or vasoactive intestinal polypeptide hormone, is a peptide hormone containing 28 amino acid residues which is encoded by the VIP gene and it was first discovered in pig's duodenum (2).

VIP was first known as a gastrointestinal hormone but today it is considered as a neuropeptide in the central and peripheral nervous systems (3). Its most important effect on cardiovascular system is vasodilatation, causing the relaxation of arterial smooth muscles, which in turn causes the dilation of vessels and capillaries. This dilation of vessels would affect the connection between arterial median pressure, cardiac output and peripheral vascular resistance (2). According to research conducted, level of VIP in the plasma of healthy individuals who have regular physical activity is higher in contrast to healthy individuals without any regular physical activity (4). Also, it has been shown that after an aerobic exercise, level of VIP in serum increases significantly (3). In conditions like hypertension, this vasodilatation effect can reduce the blood pressure. One of the factors contributing in high blood pressure is the lipid profile, which in these case, lipoproteins have a special significance. Lipoproteins are composed of triacylglycerols, cholesterol, phospholipids and proteins. Formation of lipoprotein is necessary, because triglycerides are insoluble in water. There is a layer of proteins in lipoproteins which increases the solubility of the lipid. Based on their density, lipoproteins are categorized into HDL1, LDL2 and VLDL3 (5).

Regular physical activity can reduce the level of LDL and increase the level of HDL in the blood and is effective in reducing the sediments in the blood vessels and protects them from atherosclerosis (hardening of arteries) and clogging (6). It is reported that in hypertension patients, regular physical activity can lower the blood pressure and is effective in their treatment (5).

Some research results indicate that physical activity affects the VIP hormone. Anastasiou et al (2009) reported that VIP level depends on the energy release, like fasting and physical activity. And also, in glucose-dependent action, VIP can change insulin and glucagon levels (2). On the other hand, Galbo et al (1979) who studied 6 athletic young men reported that no significant increase in VIP level of plasma accrued after a cycling activity with submaximal intensity (7).

In another study, Nicholls et al (2003) studied the VIP levels in patients with acute heart failure and

showed that acute physical activity for a short time can significantly reduce the level of VIP (5). On the other hand, Leik et al (1986) found that in patients with angina, cycling for 7 to 10 min with the intensity more than 400 to 1350 W can significantly increase the VIP level in plasma (8). Also, in another study by Hall et al (1982) on horses, it's reported that after an 8 kilometer run, the VIP in plasma increases significantly (9).

Exercise dilates blood vessels, increases blood circulation and decreases the blood pressure. In this regard, exercise is a suitable way for preventing hypertension and high blood pressure induced strokes. Thus, there exist great bodies of research on effects of exercise on health which show that exercise is one of the factors for keeping a good health and reducing risk factors of cardiovascular diseases and also increases life expectancy (10).

Since cardiovascular diseases are one of the leading causes of death in modern societies, especially our country, and its treatment have a high yearly cost, therefore finding preventive solutions can be of a great help for patients and medical society. In this regard, it is useful to find the best physical exercise for reducing this risk factor.

Given these conflicting results and the importance of VIP and lipoproteins function and their interactions in vascular function, it seems that our research is necessary. This research is studying the effect of a 4 week acute training program on healthy rats, trying to clarify that how an acute activity can affect the VIP and lipoproteins in the plasma and if 4 weeks of acute training can be an appropriate stimulus for VIP production in the body.

Methods:

This is an experimental study. In this study 30 male Sprague dawley rats (one month old) were received from the animal laboratory of Shiraz University of Medicine Sciences. These rats were randomly categorized in 2 groups of 15, one experimental group and one control group. These animals were trained on a treadmill for a week. They were kept in clear polycarbonate cages (Razi rad co.) in 22 ± 2 C°, $5\% \pm 5$ humidity and 12:12 h dark-light cycle. Also, we used a water cooler, a mute ventilator and a humidifier to control the temperature and humidity. Their food was dry animal feed pellet with a specific combination of nutrients to meet the animals' needs (Pars Animal Feed Co.) and the rats

had free access to the food. In all the steps of the study, water was provided in special bottles for lab animals. For weighting, we used a scale built by A&D Company (Japan). Since transferring the animals would result in stress and change in their physiological condition, we avoided any transferring and all the steps of the study were completed in animal laboratory of Shiraz university of Medicine Sciences.

The introduction program included 3 sessions of walking and running with 5 to 8 m/min and zero degree tilt for 5 to 10 min. our training schedule is presented in table 1. All the subjects were tested after 12-14 h of fasting and 24 hr after the last exercise. For blood tests, rats were anesthetized with ether and a 5cc blood sample was drawn from the heart of the rats by an animal surgeon with a special syringe and Heparin. We used an ELISA kit (Phoenix Peptide, USA) to test the VIP level. Descriptive statistics were used for calculating the descriptive indicators, including mean, standard deviation and percents. For analyzing the data, the t-test was used.

To calculate the statistics, SPSS software, version 18 was used and we also used Graph Pad software

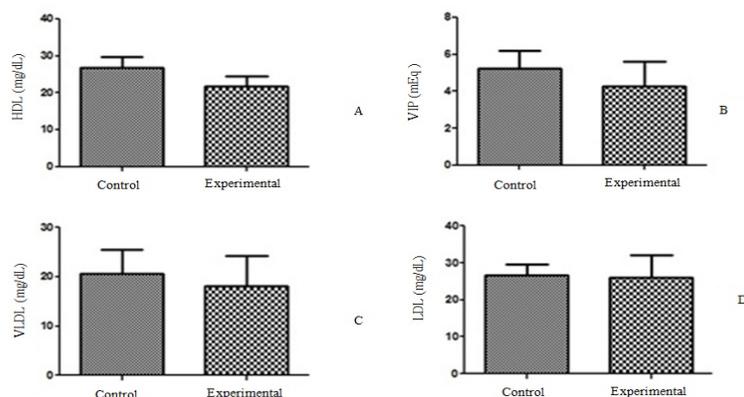
for drawing the graphs.

Results:

In this study, the effect of 4 weeks of acute training on levels of VIP hormone, HDL, LDL and VLDL in plasma were studied. Our results show that the mean VIP level in subjects after 4 weeks of acute training was equal to 4.2627 mEq for experimental group and 5.2188 for the control group. These results showed that there is no significant difference in VIP level between 2 groups ($t=2.243$, $pvalue<0.756$). In addition, the average amount of HDL in plasma was 21.7 mg/dL in the experimental group and 26.75 mg/dL in control group which show no significant difference ($t=4.833$, $pvalue<0.951$). Moreover, average amount of LDL in plasma was 26.12 mg/dL and 26.6 mg/dL in experimental and control groups respectively, which also show no significant difference ($t=0.274$, $pvalue<0.103$). The mean VLDL level in plasma was 18.18 mg/dL and 20.65 mg/dL in experimental and control groups, respectively. Again, there is no difference between these two groups ($t=1.233$, $pvalue<0.514$) (Figure 1).

Table 1- Training Protocol (17,18)

Week	1	1	1	2	2	2	3	3	3	4	4	4
Day	Sat	Mon	Wed									
Intensity (m/min)	30	30	30	40	40	40	50	50	50	60	60	60
Incline	0	0	0	0	0	0	0	0	0	0	0	0
Duration (min)	8	8	8	7	7	7	6	6	6	5	5	5



Graph 1- Mean level of VIP, HDL, LDL, VLDL of plasma in experimental and control groups

Conclusion:

This research seeks to study the effects of an exercise program on VIP hormone concentration and other cardiovascular disease risk factors, and our results show that four weeks of acute exercise has no significant effect on the amount of VIP hormone secretion and levels of HDL, LDL and VLDL of plasma. In explaining the results we can state that different exercise programs can have different effects on risk factors of cardiovascular diseases and therefore finding a good exercise regimen is extremely important for keeping people healthy and increasing the life expectancy in the society. This research shows that our exercise program can not influence the studied risk factors significantly. However, some researchers that used different programs have reached to more positives results and observed more significant changes upon exercising (11-13).

These results are consistent with previous studies. Leik et al (1986) stated that in patients with angina who exercised with 400 to 1350 W powers for 7 to 15 min on a bicycle, no significant increase in VIP level was detected (8). According to our results, it seems that initial condition of subjects (healthy or sick) has no effect on the excitation threshold of VIP secretion, but it is the intensity and duration of the training that make a difference. In this regard, in another study by Galbo et al (1979) on 6 athletic young men, it was concluded that in rest and after a cycling with submaximal intensity, no significant increase in VIP level of plasma is detectable (7). One of the results of such studies is the response of VIP hormone to acute training. Turkmen et al (2005) found out that after an acute physical activity, the increase in VIP of plasma in healthy and sick individuals is about 100 percent (12). In this regard, there are two issues to consider. First, when the training is hard and acute, we can expect an increase in VIP level. Second, measuring time is also important, i.e. in order to detect the possible change in VIP level, the blood sample should be drawn after the physical activity. It should be considered that the aim of this study was to analysis the adaptability of subjects towards physical activity and to achieve this goal, we should have done the measurements 24 hr after the last training session. In another study by Ronaldi et al (2008), VIP levels in 7 marathon runners in runs with submaximal and maximal intensity were measured and the results showed that after both runs, there was

a significant increase in VIP level of plasma (13). In that study, VIP level of subjects increases after both trainings. The reason why VIP increases after submaximal training depends on the level of physical fitness of subjects; i.e. when subjects are athletic individuals which have a good physical fitness, VIP also increases after the submaximal training. Effectiveness of physical activity is affected by characteristics of physical activity interventions and interpersonal differences. The second possible mechanism is the increase in diameter of large arterioles, small arterioles and conduit arteries after physical training (14). In addition, another important dimension of capillary changes due to physical activity is the onset and sustaining the angiogenesis. Angiogenesis is an important adaptation in arteries which leads to formation of conducting arteries in order to compensate for the clogged arteries (15). This adaptation happens after years of training which is reported in Ronaldi et al (1980) study on marathon runners.

On the other hand, 8 weeks increasing endurance training in which the intensity and duration of exercise was increasing over time, showed a significant decrease in LDL and significant increase in HDL (17). In this instance we can add that exercise intensity and longer duration were responsible for the change in lipoproteins concentration which is why these results are not consistent with our study.

According to the National Institute of Heart, Lung and Blood, changing the life style is the only treatment we need for artherosclerosis. Physical activity can protect the body from different risk factors for artherosclerosis, including hypertension, obesity, insulin resistance and glucose intolerance, high triglyceride, and lipoprotein concentration (14). In this study, 4 weeks of acute training is not enough to make any changes in lipoprotein levels and to study the effects of training on lipoproteins, a longer period is needed. In general, the effect of lipoproteins is essentially smaller than the effect of medication. Nonetheless, the effect of physical activity along with other factors such as diet and weight lost can be more (15).

Finally, according to results of previous research and our study, we can state that the level of physical fitness of individuals (especially those who have physical adoptability) can affect the production of VIP and their response to training. Also, 4 weeks is not enough for adaptation in VIP levels. Therefore, it

is suggested that use the training protocol with different intensity and duration. On the other hand, it seems that 4 weeks of acute training cannot be a stimulus to change the level of lipoproteins. In addition, since the changes in VIP and lipoproteins are not significant. We cannot conclude any relationship between them.

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تأثیر یک برنامه تمرینی پر شدت بر میزان ترشح هورمون VIP و نیمرخ لیپیدی پلاسما در موش‌های صحرائی نر

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چکیده

مقدمه: بیماری پرفشارخونی یک اصطلاح پزشکی برای بالا بودن فشارخون می‌باشد که باعث می‌شود قلب بیشتر از حد طبیعی کار کند. بیشترین تأثیر هورمون VIP در سیستم قلبی عروقی خاصیت گشادکنندگی عروق می‌باشد. هدف از این پژوهش، بررسی تأثیر چهار هفته تمرین پر شدت بر میزان ترشح هورمون VIP و نیمرخ لیپیدی پلاسما در موش‌های صحرائی نر می‌باشد.

روش کار: تعداد ۳۰ سر موش با دامنه وزنی ۲۰۰-۲۵۰ گرم و سن یک ماهه به طور تصادفی از بین موش‌های موجود در آزمایشگاه حیوانات دانشگاه علوم پزشکی شیراز انتخاب و به طور تصادفی به دو گروه تجربی و کنترل (هر گروه به ۱۵ سر موش) تقسیم شدند. گروه تجربی به مدت ۴ هفته و هر هفته ۳ جلسه - در مجموع ۱۲ جلسه تمرین پر شدت - با رعایت اصل اضافه بار روی تردمیل مخصوص حیوانات دویدند و گروه کنترل در این مدت هیچ گونه تمرین ورزشی انجام نمی‌دادند. در پایان، ۲۴ ساعت پس از آخرین وهله تمرینی و پس از ۱۲ تا ۱۴ ساعت حالت ناشتا، مقدار ۵ میلی لیتر خون از قلب موش‌ها (پس از بی‌هوشی) توسط کارشناس و جراح حیوانات گرفته شد. داده‌های حاصل از تحقیق با استفاده از آزمون t و نرم‌افزار SPSS 18 مورد تجزیه و تحلیل قرار گرفت.

نتایج: یافته‌های تحقیق حاکی از آن است که بعد از ۴ هفته تمرین پر شدت، تفاوت معنی‌داری بین گروه تجربی و گروه کنترل مشاهده نشد.

نتیجه‌گیری: به طور کلی، با توجه به نتایج به دست آمده می‌توان گفت که ۴ هفته تمرین پر شدت موجب تغییر میزان ترشح هورمون VIP و میزان HDL، LDL و VLDL پلاسما نمی‌شود.

کلیدواژه‌ها: تمرین، هورمون، لیپوپروتئین.

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