Cortisol level Response To Aerobic Versus Resistive Exercises In Hypertensive Patients

Aisha A Hagag*, Hany F Elsisi*, Mary W Fawzy , Nada M Hafez *****

*Department of physical therapy for cardiovascular/respiratory disorders & geriatrics, faculty of physical therapy, Cairo university

**Department of Internal Medicine, Faculty of Medicine Cairo University.

***Department of physiotherapy at Elwady Medical center , Maadi.

ABSTRACT

Background: There is a great deal of variability in cortisol level with regard to type, intensity, volume and frequency of exercise. **Purpose:** to compare the effect of aerobic versus resistive exercises on serum cortisol level in hypertensive patients. **Methods:** Forty mild essential hypertensive male patients with age range from 40-50years, with SBP ranged from (140-159) mm Hg and DBP from (90-99) mm Hg (Class I HTN), participated in this study .They were chosen from out patients clinic of faculty of physical therapy, Cairo university. Subjects were assigned randomly into two groups, equal in number. Their cortisol level was measured before , after 1st session and after 8 weeks of training program for both groups. **Group A** :20patients performed aerobic exercises in form of treadmill walking exercise for 40 minutes at Intensity which was detected by "Karvonen equation". **Group B** :20 patients performed resistive exercises at intensity : 40 %to 60% of 1-RM.. All patients perform 3 sessions per week for 8 weeks. **Results:** Serum cortisol level before training in comparison to post1 (after 1st session) show no significant difference in both groups. Serum Cortisol level after training (post2-after 8 weeks) in comparison to before training significantly decreased in Group A and in Group B and this decrease in favor of group A ,and there was significant difference in post training serum cortisol level between two groups. **Conclusion:** Aerobic exercise can lower serum cortisol level more than resistive exercise in hypertensive patients after 8 weeks of training and both of them has no effect on acute response to exercises in hypertensive patients.

Key words: (Serum Cortisol level, Hypertension, Aerobic exercise, resistive exercise).

INTRODUCTION

Coronary heart disease and ischemic as well as hemorrhagic stroke are the most common complications of raised blood pressure. Worldwide raised blood pressure is estimated to cause 7.5 million death, about 12.5% of the total of all annual deaths.[1]

Hypertension (HTN) is found in about one third of adults in most communities in the developed and developing world . HTN is the most common chronic condition dealt with by primary care physicians and other health practitioners. There is a close relationship between the risk of cardiovascular events, strokes, and Kidney disease and BP Level.[2]

Glucocorticoids are essential to life ,since they have a lot of functions in human's body as they maintain blood pressure by increasing the action of vasoconstrictors, help us to resist stressors. Under normal circumstances they are keeping blood glucose levels fairly constant so help the body adapt to intermittent food intake and they influence the energy metabolism of most body cells . However, severe stress evokes a dramatically higher output of glucocorticoids. Glucocorticoid hormones include cortisol (hydrocortisone), cortisone, and corticosterone, but only cortisol is secreted in significant amounts in humans[3]

Increasing metabolic substrate availability, maintaining normal vascular integrity and protecting the organism against exaggerated response of the immunological system to exercise-induced muscle damage are the most beneficial effects of glucocorticoids in humans . Adrenal cortex of the suprarenal glands secret Cortisol which is the important one of glucocorticoids in humans that plays important roles both during and after exercise, such as helping gluconeogenesis.[4]

Stress activate one of the most important system in body which is called The Hypothalamic-Pituitary-Adrenal Axis (HPA Axis) . It is also known as the limbic- hypothalamic-pituitary-adrenal axis because the limbic brain plays an important role in the perception of various forms of stress and in control of HPA axis. Although often considered as an elaborate feedback system, the endpoint of which is the release of the glucocorticoid cortisol.[5]

During stressed or agitated states the body release cortisol hormone so-called "stress hormone". But this hormone is more than a simple marker of stress levels – it is necessary for the functioning of almost every part of the body. Excesses or deficiencies of this crucial hormone are also lead to various physical symptoms and disease states.[6]

Any stress in the body whether physical (such as exercise, illness, trauma, surgery, or temperature extremes) or psychological lead to cortisol secretion .[7]

Cortisol response varies depending on exercise intensity and duration, fitness level , nutritional status, and even circadian rhythm. Cortisol output increases with exercise intensity. prolonged marathon running, long-duration cycling, and hiking High are types of exercise which increase secretion of cortisol . Cortisol also increases at relatively low levels of sustained exercise and remains elevated for up to 2 hours in recovery [8]

Over the last decades the importance of regular physical activity in essential hyper tension has been extensively investigated and has emerged as a major modifiable factor contributing to optimal blood pressure control .Aerobic exercise exerts its beneficial effects on the cardiovascular system by promoting traditional cardiovascular risk factor

regulation, as well as by favorably regulating sympathetic nervous system (SNS) activity, molecular effects, cardiac, and vascular function. Benefits of resistance exercise need further validation. On the other hand, acute exercise is now an established trigger of acute cardiac events. A number of possible pathophysiological links have been proposed, including SNS, vascular function, coagulation, fibrinolysis, and platelet function [9].

There is a direct relationship between cortisol and blood pressure as with cortisol excess, arterial pressure increases ; with cortisol deficiency, arterial pressure decreases; since Cortisol up-regulates α-1 receptors on arterioles , increasing their sensitivity to the vasoconstrictor effects of norepinephrine . [10]

Aim of study: The study was designed compare the effect aerobic and resistive exercise on serum cortisol level in hypertensive patients.

Methodology

Subject: Forty mild essential hypertensive patients from non smoker males with age range from 40-50years, with SBP ranges from (140-159) mm Hg and DBP from (90-99) mm Hg (ClassI HTN), participated in this study .All subjects was assigned randomly into two groups, equal in number. **Group A** :20patients performed aerobic exercises. **Group B** :20 patients performed resistive exercises. They signed a consent form and the study was approved by the ethical committee for scientific research.

Exclusion criteria:

Patients were excluded if they had the following conditions or diseases :

Musculoskeletal diseases which may affect their physical activity, Smokeing, Auditory or visual problems, Diabetes mellitus and ischemic heart disease.

Procedures:

Assessment procedure

cortisol level was measured for all subjects before , after 1st session by 2 hours and after 8 weeks of training program for both groups.

pre and post 2 corisol samples were taken at 8 a.m

Group A :20 patients performed aerobic exercises in form of treadmill walking exercise at Intensity which was detected by "karvonen equation" Target heart rate = resting HR+60-80%(max. HR.- resting HR.) . The total duration of exercise session was 40 minutes and consisted of warming up phase of slow walking on treadmill for 5 minutes , training phase 30 minutes of high speed walking and cooling down for 5 minutes . Pulse rate was measured through using pulseoximeter watch. Exercise session was done 3 days per week for 8 weeks.

Group B :20 patients performed resistive exercises at intensity : 40 %to 60% of 1-RM.(maximum weight that patient can lift one time without fatigue) . Duration of exercise session was 30 minutes. Each muscle group had 3 sets each set consisted of 10-15 rep. and there was a rest period between each rep. about 15 seconds and 1 minute rest between each set . Resisted exercises included the following (Knee flexion, knee extension, hip flexion, hip extension, hip abduction, hip adduction, abdominal muscles, shoulder flexion, shoulder abduction and elbow flexion exercise. Exercise session was done 3 days per week for 8 weeks

Statistical Procedures:

In this study, the descriptive statistics (the mean, the standard deviation, maximum, minimum and range) were calculated for all subjects in the study including height, weight, BMI, SBP, DBP and Cortisol Level variable.

Paired sample t-test was used to compare the difference before and after treatment results of Cortisol Level in each group. ($p<0.05$) and ANOVA test was used to compare before and after training program results in the study groups for all variable. [11]

RESULTS AND DISCUSSION

The results obtained showed that Serum cortisol level before training in comparison to post1 (after 1st session) show no significant difference in both groups. Serum Cortisol level after training (post2-after 8 weeks) in comparison to before training significantly decreased in Group A and in Group B and this decrease in favor of group A .

Table 1: General characteristics of patients in both groups (A&B)

Items	Group A	Group B	Comparison		S
	Mean ± SD	Mean ± SD	t-value	P-value	
Age (years)	44.9±2.53	46.25±2.98	-1.541	0.132	**NS**
Body mass (Kg)	68.85±6.3	71.07±6.48	-1.101	0.278	**NS**
Height (cm)	159.12±4.03	161.1±7.34	-1.054	0.298	**NS**
BMI (kg/m^2)	27.08±1.86	27±2.02	0.122	0.904	**NS**
Systolic blood pressure (mmHg)	151.6±6.15	148.3±7.28	1.548	0.13	**NS**
Diastolic blood pressure (mmHg)	94.21±4.18	91.75±2.93	1.876	0.069	**NS**

Values are expressed in means±SD, NS: non significant

Table 2: Descriptive statistics and 2×3 mixed design ANOVA for Cortisol level at different measuring periods at both groups.

Cortisol level	Pre treatment (Mean ±SD)	Post one (Mean ±SD)	Post two (Mean ±SD)
Group A	14.92±3.47	14.68 ±3.54	10.16±1.68
Group B	12.95 ±2.24	13.56±2.46	11.86±2.29
Multiple pairwise comparisons (Post hoc tests)among different measuring periods for Cortisol level at both groups			
p-value	**Pre Vs. Post one**	**Pre Vs. Post two**	**Post one Vs. Post two**
Group A	0.999	0.0001*	0.0001*
Group B	0.246	0.002*	0.038*
Multiple pairwise comparison tests (Post hoc tests) for the Cortisol level between both groups at different measuring periods			
Group A Vs. group B	**Pre treatment**	**Post one of treatment**	**Post two of treatment**
P-value	0.069	0.26	0.014*

*Significant: $P \leq 0.05$

The results of the current study are in agreement with Beni et al . [12]who investigated the effect of selected aerobic training on serum immunoglobulin levels, testosterone and cortisol hormones in young men. this aerobic training was done three sessions per week for 8 weeks with intensity between 65% and 75% of the maximum heart rate, while the control group did not participate in the training program during the study period. The findings showed that aerobic training led to significant decrease of cortisol (p=0.007) in the experimental group compared with the control group .

Also the results of this study come in agreement with Sanavi and Kohanpour[13] who assessed the effects of different intensities of sub-maximal aerobic exercise on serum cortisol and free testosterone on 17 trained , the treatment was 3 sessions of aerobic exercise consisting of 30 mins running on treadmill with 3 different intensities of 70%, 80% and 90% of maximal heart rate, Serum cortisol levels assessment showed significant elevation following increasing of exercise intensity at post-exercise ($p=0.025$) immediately after exercise at the intensity of 90% of MHR was higher than the other intensities. One hour after exercises cortisol value at intensity of 90% of MHR was higher than the other intensities.

concerning to acute response of cortisol , Walker et al. [14] , Drummond et al. [15] and Jablu et al. [16] found that cortisol response didn't change after the acute session.

However, Alghadir et al.[17] who evaluated the effect of 4 weeks moderate aerobic exercise (65%-75%) on outcome measure of saliva stress hormones and lactate levels on sixteen healthy students volunteers performed an exercise test of moderate intensity for 4 weeks, three times per week. The exercise was treadmill walking. After 4 weeks of exercise, there were significant increase in cortisol. While Goto et al. [18] who performed resistive exercise on 10 healthy young males found that there was no significant difference in the cortisol concentration before and after resistive exercise. However our study in disagreement with Heaney et al. [19] who found that cortisol concentration is modulated by acute exercise, and significantly decreased immediately by 1-2h post-exercise sessions.

CONCLUSION

Aerobic exercise can lower serum cortisol level more than resistive exercise in hypertensive patients after 8 weeks of training and both of them has no effect on acute response of cortisol in hypertensive patients.

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استجابة مستوي الكورتيزول للتمرينات الهوائية مقابل تمرينات المقاومة في مرضي ضغط الدم المرتفع \ ندي محمود محمد حافظ - أ 0م0د عائشه عبد المنعم حجاج استاذ مساعد بقسم العلاج الطبيعي لاضربات الجهاز الدوري التنفسي والمسنين، كليه العلاج الطبيعي - جامعه القاهره . ا.م.د. هاني فريد عيد مرسي السيسي. استاذ مساعد بقسم العلاج الطبيعي لاضربات الجهاز الدوري التنفسي والمسنين، كليه العلاج الطبيعي - جامعه القاهره. ا.م.د. ماري وديع فوزي استاذ مساعد بقسم الباطنه كليه الطب جامعه القاهره.(رساله ماجستير 2018).

المستخلص

هناك علاقه قويه بين نوع وشده وحجم وتردد التمارين واستجابه الكورتيزول لها ، ولذلك تهدف هذه الدراسه الي تحديد الفرق بين استجابه الكورتيزول لكل من التمرينات الهوائيه وتمرينات المقاومه في مرضي ضغط الدم المرتفع. الذي تتراوح اعمارهم بين 40 الي 50 عاما. من الرجال البالغين غير المدخنين، الذين شاركوا واتموا الدراسه حيث تم تطبيق الدراسه عليهم لمده ثمانيه اسابيع بمعدل ثلاث جلسات اسبوعيا ، وقد تم اختيارهم من العياده الخارجيه بكليه العلاج الطبيعي جامعه القاهره.وقد اشتملت المجموعه الاولي علي عشرون شخصا من البالغين ذو مرض ضغط الدم المرتفع الذين شاركوا واتموا برنامج التمرينات الهوائيه في شكل السير علي المشايه الالكترونيه لمده اربعون دقيقه ذات الشده المتوسطه (65%-80%) من عدد ضربات القلب القصوي.والمجموعه الثانيه علي عشرون شخصا من البالغين ذو مرض ضغط

الدم المرتفع الذين شاركوا واتموا برنامج تمرينات المقاومه بشده (40%-60%) من الحد الاقصي للتكرار.وكانت نتائج الدراسه بعد اتمام فتره التمرين هي انخفاض نسبه الكورتيزول في الدم في المجموعه الاولي و المجموعه الثانيه انخفاضا ذو دلاله احصائيه وقد استخلصت نتائج هذه الدراسه بافضليه التمرينات الهوائيه لتقليل نسبه الكورتيزول بالدم في مرضي ضغط الدم المرتفع.

الكلمات الداله : الكورتيزول - ضغط الدم المرتفع- التمرينات الهوائيه- تمرينات المقاومه.