ORIGINAL ARTICLE

Exercise Induced Seasonal (Summer and Winter) Serum Cortisol Changes in Male students of Services Institute of Medical Sciences, Lahore and their Effect on Platelet Count

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ABSTRACT

Background: Cortisol being a stress hormone is released in larger quantity during exercise. After exercise it is found that cortisol causes an increase in platelet count.
Aim: To investigate the effect of resultant serum cortisol levels changes on platelet count.
Methods: In this 2 stage Cross-sectional study, 40 Male students, aged 18-28 years, of SIMS, Lahore were studied from January, 2010 to June, 2010. Data was collected before and after exercise during summer and winter seasons. Serum cortisol levels and platelet counts were evaluated.
Results: Comparing pre-exercise data of summer to winter, serum cortisol and platelet count were significantly higher before exercise in summer. Comparing post-exercise data of summer to winter, serum cortisol, and platelet count were significantly higher in summer.
Conclusions: It could be concluded that cortisol levels are elevated after exercise in both seasons and there was a rise in all the platelet count. Thus higher cortisol levels in summer may lead to a compromised body defence especially after exercise.
Keywords: Platelet count, cortisol, exercise

INTRODUCTION

Inner medulla and outer cortex comprised of adrenal gland. After synthesis adrenal medulla release catecholamines[1] which are epinephrine, nor-epinephrine and dopamine. On the other hand almost 50 different steroid hormones are produced by adrenal cortex which have different physiological activities[2] Cortisol, a C_{21} steroid hormone having average plasma fasting level is 13.9µg/dl[3].

90% of released plasma cortisol are attaches with corticosteroid binding globulin (CBG) and albumin (6%)[4]. CBG transport cortisol to its target organs and is also the reservoir of cortisol. Only free cortisol perform biological activity. Due to cortisol and CBG affinity it has highest plasma half life of 60-90 minutes[5].

For the normal health of human being cortisol help in stress regulation, metabolisms and immunologic mechanisms[6]. Cortisol level increases by various stresses like neurogenic or physical which helps in preventing and protecting the body from harmful effects of these stresses[7].

Platelets are also called thrombocytes having normal blood concentration ranges from 150,000 to 300,000 per microliter. They help in blood clotting[8] and contain various enzymes that are capable of forming adenosine diphosphate (ADP) and prostaglandin[9]. PHSC in bone marrow form megakarocytes[10] which are responsible to form minute platelets in bone marrow. The life span of plateles is about 8 to 12 days and after that they are removed by spleen macrophages[11].

From many stresses exercise is one of the important stress to which human body is exposed[12.] Cortisol increases blood platelet count[13]. In low intensity exercise cortisol levels may not be a significantly raised. On the other hand moderate to high intensity exercise may lead to an increase in cortisol secretion[14]. So in response to exercise induced stress there is increased production of cortisol to overcome this physical stress[15]. To handle overwork cortisol levels raise and suitable changes are made in the biochemical activities of the body. In initial phase of exercise the main source of energy is glucose, while in later phase of exercise the major source of energy is fat.

Many studies reported that in response to exercise changes occurs in blood cell count[16] and Cortisol increases blood platelet count[13]. Present study elucidate the effect of heavy exercise in summer and winter seasons on serum cortisol and blood cells in healthy young adult males

SUBJECTS AND METHODS

It was cross-sectional 2 stage study. Conducted from January, 2010 to June, 2010 on 40 young healthy male students aged 18-28 years. Male students of Services Institute of Medical Sciences (SIMS),

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Lahore. Students who were doing any regular exercises, having any acute or chronic illness including any endocrine disorder or on exogenous corticosteroid therapy were excluded from the study. And any Students preparing or appearing in any test or professional M.B.B.S. examination within one month of the date of sampling.

The intense dynamic exercise was performed on cycle ergometer (Magnetic bike, J.K. Exer. Company, Taiwan). All subjects performed exercise at the same time of the day in the months of January and June at the same maintained room temperature (22^0C -24 ^{0}C).

The exercise protocol included three sessions of 10-minutes exercise, on a cycle ergometer. Each exercise session was followed by 5-minutes rest. The intensity of exercise was assessed by monitoring heart rate during exercise. We labelled exercise as intense dynamic exercise when the heart rate of exercising student increased by 70% - 89%[17]. The blood sample was collected before and 30-minutes after completion of 3 sessions of exercise[15].

Five millilitre (ml) of blood sample was collected, pre- and post-exercise, in 5ml disposable syringe from the subjects by venepuncture with aseptic measures. Three ml of blood was transferred into EDTA vial for blood cell count. The remaining 2 ml of blood was allowed to clot in test tube and then centrifuged, serum was separated and stored in serum cups at a temperature of -20^0C for assessment of serum cortisol level[18].

Data Analysis

Data was entered into computer and analyzed using SPSS (Statistical Package for the Social Sciences) version 16.0. For continuous variables like Cortisol, and, Platelet count. Data was presented in tables, mean±Standard deviation(±SD) were presented. Paired t-test applied to determine significant differences between pre- and post-exercise levels of serum cortisol and blood cells. Independent sample t-test applied to find out significant intergroup differences under different climatic conditions. Level of 5% ($p < 0.05$) was used for significance testing and associations.

RESULTS

Results of this study conducted on forty healthy adult male students of Services Institute of Medical Sciences (SIMS), Lahore. subjects (n=40) before and after exercise in winter and in summer are given as under:

Comparison of serum levels of study variables before and after exercise in winter:

Before and after exercise the cortisol levels are observed to be significantly higher in after exercise than that of before exercise in winter. The p-value of cortisol is determined to be*<0.01* (312.13±50.67µg/dl Vs 344.22±44.72µg/dl) (Table 1).

Platelet count showed statistically significant (*p< 0.01)* increase post-exercise as compared to pre-exercise.(221.80±40.88×10^3/µLVs247.32±43.78×10^3/µL) (Table 1).

Comparison of serum levels of study variables before and after exercise in summer:

Compare to pre-exercise level, the post-exercise cortisol level is significantly higher (*p< V 0.01)* during the summer season. (364.70±79.20µg/dlVs414.75±58.60µg/dl) (Table 1).

Compared to pre-exercise count, platelets showed significant (*p<0.01)* increase in summer post-exercise. (241.72±45.83×10^3/µL Vs 274.07±47.32×10^3/µL) (Table 1).

Comparison of pre-exercise serum levels of study variables in summer and winter:

Pre-exercise, mean serum cortisol level is significantly (*p<0.01)* increased in summer compared to winter (364.70±79.20µg/dl Vs 312.13±50.67µg/dl). (Table 2). Platelets showed significantly (*p< 0.04)* increase count in summer as compared to winter, Pre-exercise. (241.72±45.83×10^3/µL Vs 221.80±40.88×10^3/µL) (Table 2).

Table 1: Comparison of serum levels of study variables before and after exercise in winter & Summer by using paired t-test

Variable	Pre-exercise (n= 40)	Post-exercise (n= 40)	*p-value*
Winter			
Cortisol (µg/dl)	312.13±50.67	344.22± 44.72	*<0.01**
Platelets1(×10^3/µL)	221.80±40.88	247.32±43.78	*<0.01**
Summer			
Cortisol(µg/dl)	364.70±79.20	414.75±58.60	*<0.01**
Platelets(×10^3/µL)	241.72±45.83	274.07± 47.32	*<0.01**

Results are expressed as mean±SD.
Cotisol normal value 7-28 µg/dl Morning, platelets normal 50×10^3/µL -400×10^3/µL
**p-value<0.05* was considered as statistically significant.

Comparison of post-exercise serum levels of study variables in summer and winter:

A statistically significant (*p< 0.01)* higher level of cortisol post-exercise is observed in summer when compared in winter. (414.75±58.60µg/dl Vs 344.22±44.72µg/dl) (Table 2). Post-exercise, platelet count is observed to be increased significantly (*p<0.01)* in summer as compared to winter. (274.07±47.32×10^3/µL Vs 247.32 ±43.78×10^3/µL) (Table 4).

Table 2: Comparison of pre-exercise serum levels of study variables in summer and winter & summer by using two independent sample t-test

Variable	Summer	Winter
Winter		
Cortisol(µg/dl)	*364.70 ± 79.20*	*312.13 ± 50.67*
Platelets(×10^3/µL)	241.72± 45.83	221.80 ± 40.88
Summer		
Cortisol(µg/dl)	414.75 ± 58.60	344.22 ± 44.72
Platelets(×10^3/µL)	274.07 ± 47.32	247.32 ± 43.78

Results are expressed as mean **±** SD.
**p-value <0.05* was considered as statistically significant.

DISCUSSION

In humans physical stress is produced by exercise, which depends on type, duration and intensity of exercise which causes different degree of stress. In human body during exercise all the systems like muscular, neurological, hormonal, , cardiovascular and pulmonary systems contribute collectively for maintaining proper oxygen supply to all body parts[19] . Hypothalamic pituitary adrenal axis (HPA-axis) is activated by exercise which produces major stress hormone, cortisol. Adrenal gland is also stimulated by sympathetic nervous system which can produces cortisol [20].

Cortisol perform its functions either by genomic actions via nuclear or cytoplasmic receptors or nongenomic actions via membrane reeptors[21]. Cortisol has major effect on all blood cell parameters specially on platlet count which increases in response to cortisol increase by any stress like exercise[22].

In humans clotting of blood or coagulation in is accomplished by Platelets. Coagulation depends on the the formation of platelet plug and fibrin clot by the platelets. Platelet count increases due to increase release of cortisol by stress [23]. Statistically significantly platelet count was raised when comparing pre exercise to post exercise in both summer and winter seasons . The same results were also claim by Qureshi*et al*[13].

CONCLUSION

It conclude that cortisol levels are elevated after exercise in both seasons and there was a rise in all the platelet count. Thus higher cortisol levels in summer may lead to a compromised body defence especially after exercise

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