Exercise and Psychological Stress: How Does Exercise Promote the Alleviation of Stress?

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INTRODUCTION

•Many studies in the past have been done to examine the relationship between stress and exercise (Crews & Landers, 1987; De Geus, van Doornen, De Visser, & Orlebeke, 1990; Holmes & Roth, 1985).

•Resting adrenocorticotropin hormone levels have been found to be significantly higher in sedentary men at rest when compared to highly fit men (Duclos, Corcuff, Rashedi, Fougere, and Manier, 1997).

•**Hypothesis:** Cortisol levels will be higher in low fit individuals at rest, in reactivity to, and during recovery from stress.

• Reactivity to and recovery from stress have also been researched. However, studies have shown mixed results.

•In regards to reactivity, Dishman and Jackson (2000) found that exercise training results in greater reactivity to stress. Conversely, a recent study examined stress reactivity in aerobically trained versus strength trained individuals and found no significant difference between groups in regards to cardiovascular reactivity (Sloan, Shapiro, De Meersman, Bagiella, Brondolo, McKinley, Crowley, Zhao, Schwartz, & Myers, 2011). Since Sloan et al. (2011) merely examined aerobic versus strength trained groups, this study was conducted to determine the relationship of adrenocortical reactivity between high and low fit individuals.

•**Hypothesis:** High fit individuals will have a greater reactivity to stress.

•In regards to recovery time from stress, Jackson and Dishman (2006) found that highly fit individuals have a faster recovery from stress when compared to low fit individuals. Spalding, Lyon, Steel, and Hatfield (2004) confirmed this affirmation. Since hypothalamic-pituitary-adrenal (HPA) axis is also activated in response to mental challenge, it is possible that adrenocortical stress reactivity may be moderated by fitness level.

•**Hypothesis:** High fit individuals will have a faster recovery from stress than low fit individuals.

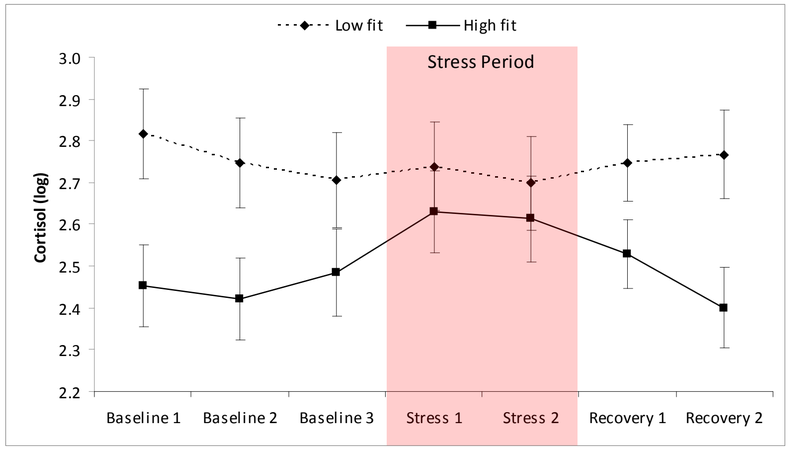

Figure 1: Comparison of Cortisol Levels in High and Low Fit Individuals

*Baseline 1= Baseline at 30 minutes
*Baseline 2= Baseline at 45 minutes
*Baseline 3= Baseline at 60 minutes
*Stress 1= Following public speaking and mental arithmetic
*Stress 2= Following cold pressor
*Recovery 1= Recovery at 15 minutes
*Recovery 2= Recovery at 45 minutes

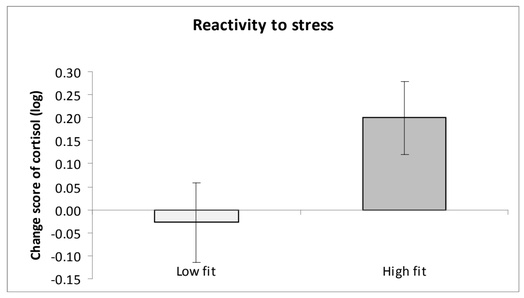

Figure 2: Reactivity to Stress

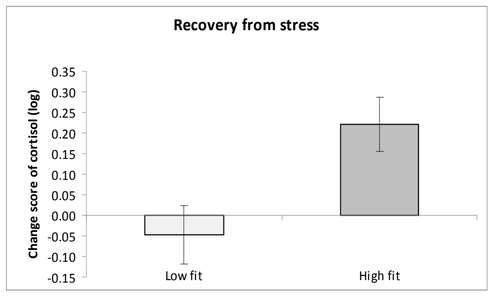

Figure 3: Recovery from Stress

METHODS

Through an independent study and employment as a research assistant in the Duluth Medical School, access to data from a larger study completed previously was accessed.

Participants

•19 women and 26 men

•A phone screening was performed and participants were asked questions such as: current or recent history of medical or psychiatric disorders, current medication use, and their weight (within ±30% of Metropolitan Life Insurance norms).

•If the participant met all of the previous criteria, they read and signed the consent form approved by the Institutional Review Board of the University of Minnesota.

Apparatus

•The fitness questionnaire requested the average number of hours each participant performed aerobic and anaerobic exercise in a week. The total hours of aerobic and anaerobic exercise per week were summed and split at the median to determine the high and low fit groups.

•The median exercise hours were five hours per week.

•Public speaking, mental arithmetic, and cold pressor tasks were used to create stress for the participant. These tasks have been used on numerous accounts in the past and have been found to reliably elicit adrenocortical reactivity (e.g., al'Absi et al., 1997; 2002).

•Saliva samples were the primary means of analyzing cortisol levels.

Procedure

Saliva samples were collected in the following time periods and durations.
•Baseline: 60 minutes
•Stressors: 30 minutes (public speaking, mental arithmetic, and cold pressor)
•Recovery: 45 minutes

Data Analysis

•Cortisol concentration was analyzed using a 2 (Group: Hi fit, Low fit) x 7 (Time: 3 samples during the baseline, 2 samples during stress, 2 samples during recovery) repeated measures analysis of variance (ANOVA).

•The first three periods were taken when the subject was at baseline. Period four included the reaction in cortisol levels to the psychological stressor. Period five involved the reaction in cortisol levels to a physical stressor. Next, period six and seven were both recovery periods.

•Greenhouse-Geisser correction was applied when sphericity was violated. In addition, cortisol values were log transformed to meet the assumption of normality. SPSS version 19.0 was used for data analysis.

RESULTS

•In the current sample, 21 participants were placed in the low fit group while 24 individuals were placed in the high fit group. There was a significant Group x Time interaction in cortisol concentration ($F_{4.1,\ 174}$ =2.595, p= 0.036).

•It was also found the high fit group had a greater stress reactivity ($F_{1,\ 42}$ =3.780, p=0.059) and a faster recovery ($F_{1,\ 42}$ =7.656, p=0.008) when compared to the low fit group.

DISCUSSION

•A significant difference in cortisol levels was found between the high and low fit groups as seen in Figure 1. This finding is similar to that of Duclos et al. (1997) in that low fit individuals were found to have higher overall cortisol levels.

•It was found that training promotes greater reactivity to a stressful situation and also a faster rate of recovery in adrenocortical responses as seen in Figures 2 and 3. These results support previous findings (Dishman & Jackson, 2000; Jackson & Dishman, 2006; Spalding et al., 2004).

•Lastly, a significant difference in overall cortisol levels was found between high and low fit groups. High fit individuals were found to react to and recover from a stressor more quickly as opposed to low fit individuals.

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