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Effects of Physical Stress and Maturational Changes on Hypothalamic Pituitary Adrenal Axis Function Through Cortisol Analysis

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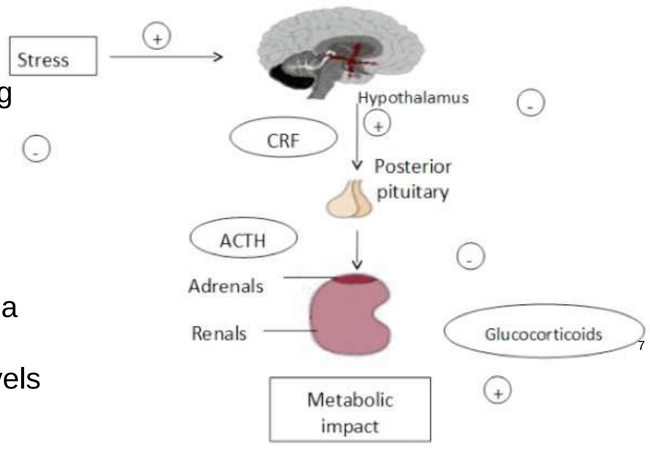
STATEMENT OF THE PROBLEM

Cortisol is a versatile hormone that possesses both catabolic and anabolic functions in the body, such as increasing the blood glucose levels through gluconeogenesis and metabolizing carbohydrates, proteins, and fats.[1234] Cortisol levels are controlled by communication of the hyptothalamic-pituitary-adrenal axix (HPA axis). Plasma concentration of cortisol adheres to a diurnal rhythm, meaning that cortisol levels are highest in the morning and taper off throughout the day.



Free cortisol levels in the body are most commonly measured by salivary assays.[5] External factors, such as stress, initiate the process that produces cortisol in the body. Stressors can be physical, psychosocial, or physiological/pathological in nature. Exercise will the be physical stressor that will be evaluated in this study. Currently, there is a shortage of studies investigating the impact of stress on HPA axis response and cortisol levels.[6] The insight gained from this study will lend greater understanding to the HPA axis function in response to stress and maturation. As greater understanding is achieved, this will lead to personalized medication profiles and therapeutic dosing regimens for patients with cortisol regulation disorders.

OBJECTIVES

- The purpose of this study is to investigate how cortisol levels change in response to stress in adolescents and geriatrics
- The goals of this study are to establish baseline diurnal cortisol concentration, establish the correlation between physical stressors and cortisol distribution, and to analyze kinetic parameters associated with cortisol distribution

HYPOTHESES

- Cortisol levels will increase in patients that undergo physical stress, such as exercise
- Cortisol levels will be higher in the adult population than in the geriatric population

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PROPOSED METHODS

Study Design:

- Prospective, exploratory design

Sample:

- Control group does not get physical stressor
- Treatment group does get physical stressor
- Control and Treatment groups are subdivided into Adult and Geriatric
  - Further broken down into male and female within Adult and Geriatric

Experimental Group Breakdown		
Control	Adult	n = 5 male
		n = 5 female
	Geriatric	n = 5 male
		n = 5 female
Treatment	Adult	n = 5 male
		n = 5 female
	Geriatric	n = 5 male
		n = 5 female

Data Collection:

- Establish cortisol kinetics by taking saliva samples every 15-20 minutes from 6-9 AM
- Establish baseline diurnal cortisol levels by taking 6 total saliva samples every 2 hours from 6 AM to 9 PM
- Remeasure cortisol kinetics and diurnal rhythms after 1 month and again after 9-12 months

Measurement:

- Measuring free cortisol levels from collected saliva samples using Salimetrics Salivary Cortisol Enzyme Immunoassay Kit

PROPOSED ANALAYSES

Using the procedures stated in the methods. The concentrations of unbound cortisol will be indirectly calculated using a 4-parameter logistic nonlinear regression model that will be put into semilog form. T tests will then be computed using SPSS to analyse the means of the different subgroups.

PROJECT TIMELINE

- Measurements will be taken over the course of a year
- Once all the samples are collected we will begin carrying out the assays to measure free cortisol levels
- Based on results of the assays we will carry out data analysis to determine the significance of our study
- The entire will be completed within 2 and half years

LIMITATIONS

- Participants may not consistently follow exercising regimen
- Participants may exercise in the afternoon rather than the morning
- Participants may drop out before we can collect long-term data
- Limited generalization because of the convenience sampling and small sample size

FUTURE DIRECTIONS

- The results of this study will provide foundational research that will lead to more personalized therapies for patients with altered HPA axis function