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Effects of Exercise on Growth Hormone Concentrations of Male Students in Madonna University

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ABSTRACT

The growth hormone concentrations of 25 male students of Madonna University, Elele within the age group of 19-27years were determined pre and post exercise and compared. Growth hormone levels were assayed using the commercially available Human Growth Hormone quantitative test kit whose principle is based on a solid phase enzyme-linked immunosorbent assay (ELISA). The data generated was calculated statistically using statistical package for social sciences (SPSS) version 17. The result showed significant difference in 4.23 ± 0.90 ng/ml in pre exercise and 15.13 ± 1.83 ng/ml in post exercise ($P<0.05$).There was significant increase in growth hormone pre and Post exercise at different age groups 19-21years(3.61 ± 0.90 ng/ml and 16.18 ± 4.40 ng/ml), 22-24(2.35 ± 0.77 ng/ml and 14.64 ± 2.09 ng/ml) and 25-27 (9.71 ± 2.91 ng/ml and 14.65 ± 4.14 ng/ml). The study has shown that exercise can affect concentration of growth hormone.

Introduction

Growth hormone (GH or HGH) also known as somatotropin, or somatropin, is a peptide hormone that stimulates growth, cell reproduction and regeneration in humans and other animals (Giustina and Veldhuis, 1998). Growth hormone is a 191-amino acid, single-chain polypeptide that is synthesized, stored, and secreted by Somatotropic cells within the lateral wings of the anterior pituitary gland. It is secreted by the anterior pituitary in a pulsatile pattern. GH secretion is regulated by two hypothalamic peptides: GH releasing hormone (GHRH), which stimulates GH synthesis and secretion, and somatostatin, which inhibits GH release without affecting GH synthesis (Giustina and Veldhuis, 1998). Many of the metabolic effects of GH are mediated by insulin-like growth factor (IGF)-I, which is synthesised in the liver under GH control and exerts a rapid negative feedback on GH release. In addition, recent data suggest that a GH secretagogue receptor, expressed in somatotroph cells in the anterior pituitary and hypothalamus, may also mediate the stimulation of GH secretion via a signal transduction pathway that is distinct from that of GHRH. Both synthetic GH-releasing peptides (GHRPs) and endogenous GHRP-like neuropeptides (e.g. ghrelin) may activate this receptor and the endogenous GHRP-like neuropeptides may be involved in the regulation of GH secretion (Kojima *et al*., 1999). It is a type of mitogen which is specific only to certain kinds of cells. Secretion levels are highest during puberty and decrease during adulthood and are directly related to aging.

Exercise is any bodily activity that enhances or maintains physical fitness and overall health and wellness (Stampfer *et al*., 2000). It is performed for various reasons including strengthening muscles and the cardiovascular system, honing athletic skills, weight loss or maintenance as well as for the purpose of enjoyment (Manson *et al*., 2001). Exercise is a potent stimulus for growth hormone (GH) release and a single bout of exercise can result in marked elevations in circulating GH concentrations (Manson *et al*., 2001). The magnitude of the GH response to exercise will vary according to the type, intensity and duration of exercise as well as factors such as the age, gender, body composition and fitness status of the individual performing the exercise (Connor *et al*., 2005). However, the mechanisms regulating GH release in response to exercise are not fully understood. Exercise can be divided into two major categories: aerobic exercise (jogging, walking, stair stepper, treadmills, etc.) and anaerobic exercises or resistive exercises which would include weight lifting and/or calisthenics (Stampfer *et al*., 2000).

The key hormones affected by both types of exercise are insulin and glucagon, growth hormone or HGH, and testosterone (Connor *et al*., 2005). These key hormones are designed genetically to help with improving muscle mass. Once stimulated, they are responsible for improving our muscle mass, our strength and our speed and agility (Wilmore and Knuttgen, 2003). Within thirty minutes after exercise, the pituitary releases a surge of HGH, which this peaks in approximately fifteen to twenty minutes. Within another half-hour, these levels have dropped back, again, to baseline level. It is this surge of HGH, which help to build muscle mass and decreases body fat (Borer *et al*., 2009). As the growth hormone levels increase with the initiation of exercise, insulin levels begin to drop and glucagon levels begin to rise (Franckson, 1965). It is this drop in insulin levels and rise in glucagon and glucose, which helps stimulate the release of growth hormone.

These are the responses that occur during aerobic exercise (Franckson 1965). It is for these reasons that it is more beneficial to begin aerobic exercises before resistive exercises. In this state, the release of glucagon and insulin levels help to

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stimulate the release of growth hormone, not only from the aerobic exercise itself but also will further help improve the release of growth hormone and testosterone when resistive exercises or weight lifting is begun.

The aim of this research is to determine the effects of intense exercises on growth hormone levels in male students of Madonna University.

Materials and Method

Subjects

The blood samples were obtained from 25 males students of Madonna University, Elele, between the ages of 20-30 before and after different types of exercises were performed. The blood samples were collected with plain containers, the serum was separated and stored in a refrigerator at 2-8^{o}C till analysis.

Reagents

Commercially prepared Growth hormone reagents were obtained from Diagnostics automation incorporated Calabasas, USA.

Determination of Growth Hormone (GH) Level

Principle: The HCG quantitative test kit is based on the principle of a solid phase enzyme-linked immunosorbent assay. The assay system utilizes a polyclonal anti-HCG antibody for solid phase (microtiter well) immobilization and a mouse monoclonal anti-ferritin antibody in the antibody –enzyme (horseradish-peroxidase) conjugate solution. The test sample is allowed to react simultaneously with the antibodies, resulting in HGH molecules being sandwiched between the solid phase and enzyme-linked antibodies. After 60 minute incubations at room temperature, the wells are washed with water to remove unbound labelled antibodies. The colour development is stopped with the addition of 2N HCL, and the colour is changed to yellow and measured spectrophotometrically at 450nm. The concentration of HGH is directly proportional to the colour intensity of the test sample (Enzyme Linked Immunosorbent Assay).

Procedures: The desired numbers of coated wells were secured in the microtiter plate. 50µl of the standard, specimens and controls were carefully dispensed into the appropriate wells. 100µl of the Enzyme Conjugate Reagent was dispensed into each well respectively. The content of each well was thoroughly mixed for 30 seconds, and incubated at room temperature (22^{o}C) for 60 minutes. The incubation mixture was removed by flicking plate content into a waste container, and the microtiter wells were rinsed and flicked 5 times with washing buffer (IX). The wells were stroked sharply onto absorbent paper or paper towels to remove all residual water droplets. 100µl of TMB (Tetra-methyl benzidine) substrate was dispensed into each well, gently mixed for 5 seconds and incubated at room temperature in the dark for 20 minutes. The reaction was stopped by adding 100µl of Stop Solution to each well and gently mixed for 30 seconds. (It is important to make sure that all the blue color changes to yellow color completely). Optical density (OD) was read at 450nm with a microtiter reader within 30 minutes and unknown extrapolated from the calibration curve prepared using the known standard.

Statistical Analysis

The biochemical data were subjected to some statistical analysis as the Mean (X), standard deviation (SD), standard error of mean (SEM) and student's t-test using Statistical Package for Social Sciences (SPSS) version 17.The results were expressed in Mean± standard error of mean (SEM).

Results

In table 1, the growth hormone concentration of males before exercise which is 4.23±0.90 ng/ml was significantly lower than the growth hormone concentration male subjects which is 15.13±1.83 ng/ml

Table 1. Secretion of GH in male and female subjects before and after exercise

Gender	Pre-exercise(ng/ml)	Post-exercise (ng/ml)	T	P
Growth Hormone	4.23 ± 0.90	15.13 ± 1.83	-4.729	0.000

Table 2 below showed that the level of GH secretion for male subjects of different age groups varied significantly. The pre-exercise value for age group 25-27 which is 9.71±2.1 ng/ml was significantly higher than those for age groups 19-21 which is 3.61±0.90 ng/ml and 22-24 which is 2.35±0.77 ng/ml. The post-exercise value for age group 19-21of 16.18±4.40 ng/ml was significantly higher than the post-exercise values for the other age groups which include 14.65±4.14 ng/ml for age group 25-27 and 14.64±2.09 ng/ml for age group 22-24.

Table 2. Secretion of GH in male subjects of different age group before and after exercise

Age group (year)	Pre-exercise (ng/ml)	Post exercise (ng/ml)	T	P
19-21	3.61 ± 0.90	16.18 ± 4.40	-3.083	0.018
22-24	2.35 ± 0.77	14.64 ± 2.09	-5.751	0.000
25-27	9.71 ± 2.91	14.65 ± 4.14	-0.779	0.480

Discussion

Exercise is a potent stimulus for GH release and both aerobic and resistance exercise result in significant, acute increases in GH secretion. The level of GH release depends on the intensity of the exercise and the age of the individual carrying out the exercise. In this study, 25 male between the ages of 19-27 had their basal GH concentrations analyzed and then they were subjected to different types of exercise with varying intensities. The result of this study showed that GH concentration increased significantly after exercise. This is similar to the study of Lassare et al., (1974) which reported that exercise stimulates GH release in young adults. The hormonal response to anaerobic exercises or weight lifting is different from the aerobic exercise response. The two key hormones responsive to aerobic exercise are growth hormone and testosterone. At the end of a weight lifting session, within minutes, both testosterone and growth hormone are stimulated to be released. Within thirty minutes growth hormone and testosterone have hit their maximum peak (Cohen and Williamson, 1991).

These variations therefore could be due to the differences in exercise types, exercise intensity and body composition as all subjects are young adults. Furthermore, the result of this study also indicated that there is a significant difference between the pre and post-exercise growth hormone concentrations of male subjects within the ages of 19-21 and 22-24. There was no significant increase in the growth hormone concentration of the male subjects within the age group 25-27 after exercise.

Secretion of growth hormone (GH) in the pituitary is regulated by the neurosecretory nuclei of the hypothalamus. These cells release the peptides Growth hormone-releasing hormone (GHRH or *somatocrinin*) and Growth hormone-inhibiting hormone (GHIH or *somatostatin*) into the hypophyseal portal venous blood surrounding the pituitary. GH release in the pituitary is primarily determined by the balance of these two peptides, which in turn is affected by many physiological stimulators (e.g. exercise, nutrition, sleep) and inhibitors (e.g. free fatty acids) of GH secretion (Bartholomew *et al.*, 2009). A number of factors are known to affect GH secretion, such as age, sex, diet, exercise, stress, and other hormones (Powers, 2005).

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Conclusion

The study has shown that Growth hormone secretion increases significantly after exercise as long as the oxygen demand to availability ratio of the individual is increased. Due to the declining levels of GH with age, exercise serves as an alternative to GH supplementation and also provides other health benefits.

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