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Original Article

Effects of exercise on growth hormone concentrations of female students in Madonna University

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Abstract

Human growth hormone is secreted in a pulsatile fashion, generally following a circadian rhythm. The growth hormone concentrations of 25 female students of Madonna University, Elele within ages groups 19-27years were determined before (Pre) and after (Post) exercise. 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 5.45 $\pm$ 0.97 ng/ml in pre exercise and 13.89 $\pm$ 1.77 ng/ml in post exercise ($P<0.05$). There was no significant increase in growth hormone pre and Post exercise at different age groups 19-21years (13.91± 9.51 ng/ml and 14.78 ± 3.09 ng/ml), 22-24 (6.73 ±1.73 ng/ml and 11.73 ± 1.97ng/ml) and 25-27(4.77 ± 2.10ng/ml and 19.61 ± 7.54ng/ml).The study has shown that exercise can affect concentration of growth hormone in females.

1. Introduction

Human growth hormone (HGH) represents a family of proteins rather than a single hormone and over 100 forms of GH have been identified in plasma [1], with apparently different physiological functions [2]. In the circulation, the dominant form of GH is a 22kD protein. However, approximately 10% of circulating GH is a 20kD protein and there are also various lower molecular weight fragments of GH [1]. All of these may be immunoactive in some GH immunoassays. However, in order for GH to be biologically active, it must be able to dimerize two GH receptors on the cell surface. This requires that two specific binding regions of the GH molecule be present in order to bind to two GH receptors. The proportion of intact GH molecules in the circulation varies between 50–95% of immunoactive GH, as measured by polyclonal competitive radio immunoassays (RIA) [3]. Thus, polyclonal RIAs tend to yield serum GH concentrations that are higher than many of the assays employing monoclonal antibodies. However, the various commercially available monoclonal assays in use today employ different antibodies with different specificity for the various molecular forms of GH [4]. Thus, the measurement of GH concentration using various assay techniques can result in vastly discrepant results.

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 [5]. 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 [6]. 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 [7].

The key hormones affected by both types of exercise are insulin and glucagon, growth hormone or HGH, and testosterone [6]. These key hormones are designed genetically to help with improving muscle mass. Once stimulated, they are responsible for improving our 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 [9]. As the growth hormone levels increase with the initiation of exercise, insulin levels begin to drop and glucagon levels begin to rise [10]. It is this drop in insulin levels and rise in glucagon and glucose, which helps stimulate the release of growth hormone.

The ideal sequence of exercising would include a period of approximately twenty minutes of aerobic exercise, before weight lifting. Weight lifting directly enhances HGH levels. Heavy weight lifting, like dead lifts, squats, and bench presses are the best [11]. Performing 5 to 8 reps, 3 sets, at maximum effort is best [9]. With this type of exercise plan, by dropping insulin levels and raising glucagon levels, growth hormone is stimulated to be released in greater quantities. By controlling the glucose levels present and keeping the glucose levels lower, growth hormone is also stimulated more effectively [8].

The combined effects of stimulation of growth hormone occurs both aerobically and anaerobically and, in effect, the two peaks can be added together to therefore induce a greater stimulus to the pituitary to release its own growth hormone naturally [9].

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

2. Materials and Method

2.1 Subjects

The blood samples were obtained from 25 females students of Madonna University, Elele, who were within the ages of 20-30 before and after different types of exercises were performed. The blood samples were collected using Venepuncture into plain containers, the serum was separated and stored in a refrigerator at 2-8°C.

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2.2 Reagents

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

2.3 Determination of Growth Hormone (GH) Level

2.3.1 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).

2.3.2 Procedure

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.

2.4 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).

3. Results

In table 1, the growth hormone concentration of males before exercise which is 5.45±0.97 but after the exercise was carried out became significantly higher than those of the female subjects which is 13.89±1.77. There was significant difference between the two means ($P<0.05$) as shown in table 1 below.

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

Parameter	Pre-exercise (ng/ml)	Post-exercise (ng/ml)	T	P
Growth Hormone	5.45 ± 0.97	13.89 ± 1.77	-5.280	0.000

The level of GH secretion for female subjects of different age groups varied significantly according to table2. Pre-exercise value of female subjects within age group 19-21years which was 13.91±9.51 **ng/ml** was significantly higher than the values for other age groups which were 6.73±1.73 **ng/ml** for group 22-24years and 4.77±2.10 **ng/ml** for age group 25-27. However, after the exercise, the value for age group 25-27years which was 19.61±7.54 **ng/ml** was significantly higher than the values for the other age groups which are 14.78±3.09 **ng/ml** for 19-21 and 11.73±1.97 **ng/ml** for 22-24.

Table 2: Secretion of GH in female subjects of different age groups before and after exercise

Age group (year)	Pre-exercise (ng/ml)	Post-exercise (ng/ml)	T	P
19-21	13.91± 9.51	14.78 ± 3.09	-0.089	0.931
22-24	6.73 ±1.73	11.73 ± 1.97	-2.604	0.025
25-27	4.77 ± 2.10	19.61 ± 7.54	-1.986	0.185

4. 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 female 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. Secretion of growth hormone (GH) in the pituitary is regulated by the neurosecretory nuclei of the hypothalamus. The result of this study showed that GH concentration increased significantly after exercise. This is similar to the study of Lassare et al [12] which reported that exercise stimulates GH release in young adults. 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 [11].

Apart from the normal higher basal concentration and magnitude of GH release in younger women when compared to men, women have an anticipatory GH response towards exercise as shown in this study which might retard the effects on exercise on their growth hormone concentrations. For the different female subjects, there was no significant increase in growth hormone concentration after exercise in females between ages 19-21 and 25-27 but for those within the age group 22-24, there was a significant increase in their growth hormone concentration. In the study of Clasey *et al*[13], it was reported that many physiologic factors alter pulsatile GH secretion, including age, gender, body composition, sleep, nutrition, exercise and serum concentrations of gonadal steroids, insulin and IGF-I. Among these various factors, the amount of abdominal visceral fat is the most important predictor of the 24-hour integrated GH concentration so insignificant increase in growth hormone levels might not be due to low intensity or short duration exercises, but other physiological factors. Increasing HGH, the human growth hormone, is beneficial for gaining muscle and lean tissue & reducing fat at any age [14]. Many of the physical and personal changes that are part of the aging process are the result of the age related decline in Human Growth Hormone, HGH, levels [15]. The consensus of medical research is that increasing the secretion of HGH has a significant positive effect on the symptoms of aging [16].

5. Conclusion

This study has shown that Growth hormone secretion increases significantly after exercise in female students..

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