



# ETERNO™

## YOUTH BODY TRANSFORMATION

## Micro & Macro Nutrients to Support IGF-1 and Healthy Hormone Levels

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ETERNO contains highly bioavailable Zinc mono-L-methionine sulphate, Zinc aspartate, Magnesium aspartate and vitamin B6. These ingredients are proven to support hormone health, including noticeable increases in Insulin like Growth Factor - 1 (IGF-1) and Free Testosterone.

Selected hormones were assessed in response to a nightly supplementation regimen, over an 8-week period, with pre-post measures. A double-blind randomized study was conducted with the proprietary ingredients including 30 mg zinc mono-L-methionine aspartate, 450 mg magnesium aspartate, and 10.5 mg of vitamin B-6. Plasma zinc and magnesium levels were 0.90 to 1.04  $\mu$ /ml; 19.43 to 20.63 mcg/ml and P (0.84 to 0.80  $\mu$ g/ml; 19.68 to 18.04  $\mu$ g/ml, respectively ( $P < 0.001$ ).

Free testosterone in the control group increased 44.2  $\mu$ g/ml (43% increase) compared to a decrease of - 14.4  $\mu$ g/ml (10% decrease) in the placebo group for an overall increase against placebo of 53.2%. IGF-1 notably did not decrease, as occurs with aging, and increased against the placebo group a total of 25.4 %. IGF-I may mediate the action of GH on skeletal muscle as a paracrine agent.

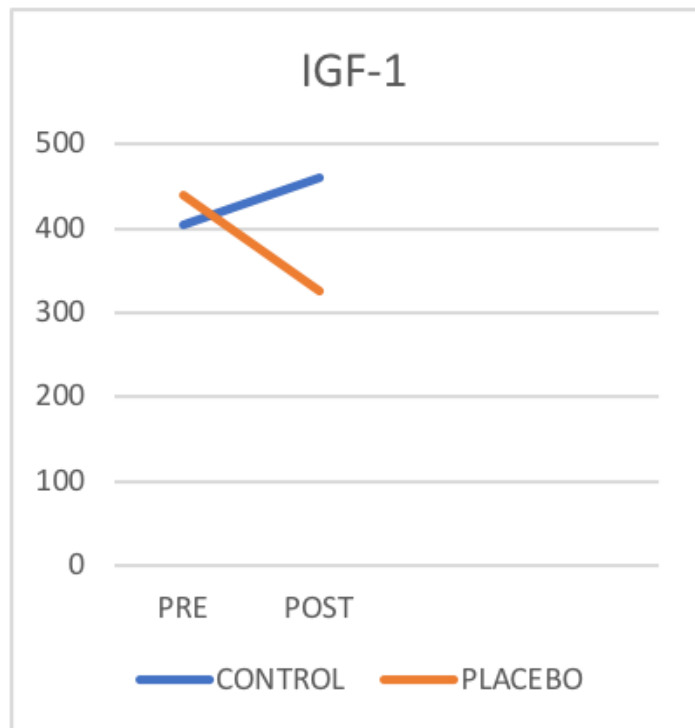
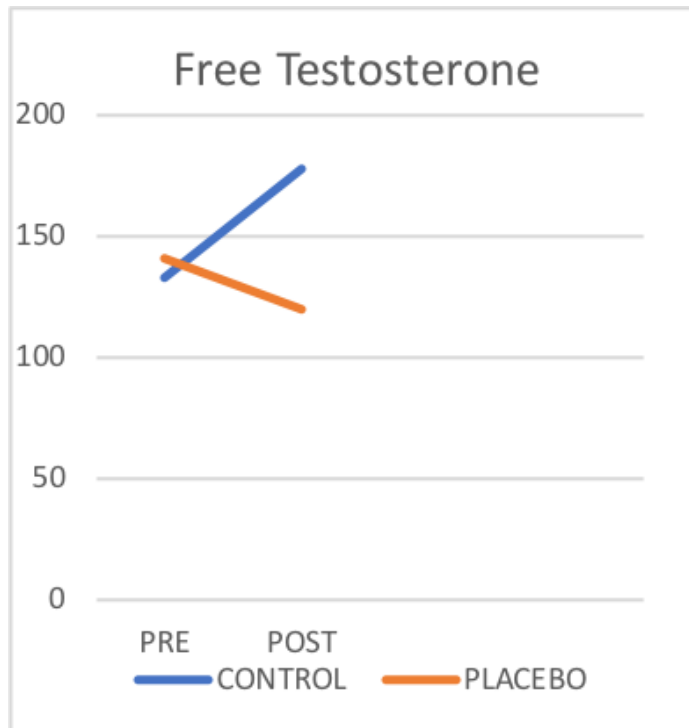
The results of supplementation with this highly bioavailable Zinc mono-L-methionine sulphate, Zinc aspartate, Magnesium aspartate and vitamin B6 on anabolic hormone profile in participants indicates an amelioration of the anabolic hormones so that the ZMA® group had increased concentrations of total testosterone, free testosterone, and IGF-I compared to plateaus or drops in the placebo group.

ETERNO<sup>TM</sup>

## Plasma Insulin Growth Factor-1 (IGF-1)

## Plasma Free Testosterone

ng/  
ml



"ETERNO contains amino acids and herbal ingredients that positively influence metabolic pathways that naturally produce growth hormone in the body."

# The Journal of Exercise Physiology

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Zinc (Zn) and magnesium (Mg) may enhance levels of Insulin-like Growth Factor-I (IGF-I)(1); and zinc, in particular, may contribute to elevating serum testosterone (2). Both IGF-I and testosterone are anabolic factors that enhance muscle function and physical performance. Testosterone's role in physical performance enhancement has been studied for a number of years. The IGF-I response to intense muscular activity has not been well defined, relatively. Training may lead to a short-term catabolic state hormonally expressed by reductions in IGF-I. Baseline serum concentrations of testosterone, GH, and IGF-I were unaffected by 16-wk resistive training program which elicited an approximate 40% increase in muscular strength in men, 60±4 yr. It was intimated that training-induced increases in IGF-I could occur in muscle without altering serum IGF-I concentration (3). A condition named somatopause due to decreased IGF-I and GH has been identified with aging. To countermeasure somatopause, 33 moderately obese women (67.1±5.2 yr), self-injected IGF-I. Weight loss with muscle strength increases were greater in IGF-I group due to training (12-wk: walk 3 days, Zinc-Magnesium Supplementation, Hormones and Strength 27 strength trained 2 days) (4). IGF-I may mediate the action of GH on skeletal muscle as a paracrine agent. In male rats, larger mean muscle weight and fiber cross-sectional area occurred when functional overload was combined with GH/IGF-I administration, and myonuclear number increased concomitantly with fiber volume. Increases in myonuclear numbers in rats may be a prerequisite for prolonged and substantial skeletal muscle fiber hypertrophy (5).

IGF-I plus exercise resulted in an increase in the size of each predominant fiber type (I, IIa). In contrast, the nutrients, Zn and Mg, may not be at optimal status in physically active individuals to facilitate function of these anabolic factors. Zn losses may be exacerbated through exercise (6), both long duration and high intensity, sweating (7), and inadequate intake (8).

Additionally, exogenous testosterone administration results in significant reductions of Zn (9). Also, Mg has a putative effect on muscle strength in clinical applications and previously untrained individuals (10). Mg may be reduced due to intense and/or long-term exercise (10). These diminutions in Zn and Mg may lead to a situation of latent fatigue with decreased endurance (7,10,11). A special aspect of the zinc-magnesium supplement used in this study was the inclusion of vitamin B6 to enhance the absorption of Zn and Mg (12,13), in addition to the known properties of vitamin B6 in protein metabolism. Both of these minerals have been reported by the USDA to be low in typical diets: 68% of diets have less than two-thirds of the RDA for Zn and 39% contain less than two-thirds of the RDA for Mg. Some dietary surveys of athletes have demonstrated that these nutrients may meet the RDAs (2,14). It may be necessary for athletes to supplement these nutrients in order to get dietary adequacy through meeting the RDA, or beyond, for physical performance effects. The purpose of this study was to assess the effect of a novel Zn, Mg, and vitamin B-6 formulation (ZMA) on anabolic hormones and muscle function in varsity football players during their spring football practice season. METHODS After approval of the project by the Western Washington University (WWU) Human Subjects Committee, the study commenced with the recruitment of subjects who were solicited for a randomized, double blind supplementation study.

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Fifty-seven participants were involved in the initial testing which included anthropometric data, a 3-day diet analysis with Nutritionist IV software to determine dietary intake of nutrients of interest, a venipuncture blood draw, and muscle isokinetic torque and power assessments. All investigators were appropriately trained in the various aspects of the testing protocols. Anthropometric data collection was supervised by an individual trained in kinanthropometric troika methodology.

A Certified Nutrition Specialist conducted the nutrition analysis. The blood draws were completed by trained phlebotomists. The isokinetic data was collected by trained and experienced testers, one with 15 years' experience. Twenty-seven participants completed the supplementation regimen and testing, so their data were included in the analysis. Activity consisted of supervised spring football practice. All tests were performed pre-post the spring practice season, for a total supplementation period of seven weeks. The first week was familiarization with the practice routine and the assessments were made at the first and eighth weeks. No intervening samples were taken because of the variability of such elements as zinc and magnesium for tissue saturation or steady state to be reached, approximately 3-5 weeks depending on baseline status. All subjects were tested between 0700 and 1030, with the isokinetic testing held between 1030 and 1330. Since the study was randomized, double-blinded, the tests were not controlled by group although it was attempted to test each subject at the same time of day, pre-post. Subjects reported to the lab, in the vicinity of the weight room, weekly to pick up their supplements.

Subjects had been randomly assigned to one of two groups: control who took a placebo and treatment Zinc-Magnesium Supplementation, Hormones and Strength 28 who took the supplement, the equivalent of 30 mg zinc monomethionine aspartate, 450 mg magnesium aspartate, and 10.5 mg vitamin B-6. All subjects took three capsules nightly between dinner and bedtime. Failure to comply with the supplementation regimen resulted in subjects being dropped from the study. The subjects were asked to not take any other nutrient supplements during the course of the study. This request was monitored by-weekly questioning when they picked up their supplement/placebo. A 10-hour fasting blood sample was obtained early morning via venipuncture before any physical activity was undertaken. Blood samples were prepared for analysis of plasma zinc and magnesium, and serum insulin-like growth factor-1 (IGF-I), total testosterone, free testosterone, and percent testosterone. The specimen-preparation method used for plasma zinc and magnesium analysis was a 50/50 nitric/perchloric acid digestion.

The instrumentation used in the analysis was an inductively coupled plasma atomic emission spectrometer (ICP/AES) (Applied Research Laboratories, Dearborn, MI; model 34000 simultaneous ICP). The detection limits of the ICP-AES for Zn and Mg are 0.009 and 0.014 parts per million (ppm), respectively. The ICP-AES inter-assay precision was determined from 20 assays on human plasma pools. The standard deviation and coefficient of variation (%CV) were 0.05 ppm and 5.9% for Zn and 1.0 ppm and 4.4% for Mg. Following organic extraction, a competitive radioimmunoassay (RIA) which uses the I125 isotope as the competing antigen was the method used in the analysis of total and free testosterone. The instrumentation used was a dialysis beta counter. The precision for the quality control samples ranged from a high of 335 ng/dL with a standard deviation (SD) of 27 and %CV of 8.0% to low sample of 13.8 ng/dL with SD 1.26 and %CV of 9.2%. IGF-I analysis was done through a combination of equilibrium dialysis, extraction, chromatography, and radioimmunoassay (RIA) with use of a gamma counter. The sample reproducibility for this methodology ranges from high pool of  $688 \pm 22.6$  ng/mL and %CV of 3.3%, to a low pool ng/mL SD of 10.1 and %CV of 8.3%. These quality control values meet the acceptable criterion of coefficient of variation of less than 15.0%.



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Torque and power measurements were pre-formed with the lower extremity on a BIODEXÓ isokinetic dynamometer. The set-up was adjusted for each subject, and the same subject positions were recorded to use pre and post. Three trials were given at two separate settings: 180 °/s and 300 °/s. Torque and power data were recorded from the best trial. Means and standard deviations were calculated. A MANOVA was used to assess the mineral and hormone data sets. ANCOVA was used to test for muscle attributes of torque and power.

## DISCUSSION

Participants were solicited for a randomized, double-blind supplementation study. Of 57 subjects who initially volunteered for the study, 27 successfully followed the nightly supplement regimen over the course of the study and completed the testing sessions. The attrition was due to the need for compliance not only with the supplement and placebo regimen, but also with subsequent blood sampling. The resultant groups were 15 subjects on the placebo and 12 with the supplement treatment. The supplement was ZMA, a novel preparation of 30 mg zinc monomethionine aspartate, 450 mg magnesium aspartate, and 10.5 mg vitamin B-6. Post blood samples and muscle function measures were obtained for comparison to the baseline testing. The results of ZMA supplementation on anabolic hormone profile in participants indicates an amelioration of the anabolic hormones so that the ZMA group had increased concentrations of total testosterone, free testosterone, and IGF-I compared to plateaus or drops in the placebo group. Free testosterone levels have been positively correlated with IGF-I levels (15) and muscle mass (16). Previous research has demonstrated that testosterone responds to intense muscular activity through a decline over time (17) or no significant change (18). Elevated levels of testosterone may be accounted for by exercise-induced changes in plasma volume, therefore no significant differences are demonstrated when hemoconcentration is considered. The subjects in this study were well hydrated in a temperate environment, and tested at least 24 hours after the last strenuous workout of spring football practice. The preliminary evidence from the results of the present study indicates that simple nutritional supplementation with ZMA may improve the anabolic hormone profile of athletes engaging in intense physical activity. Zinc plays an essential role in androgen metabolism and interaction with steroid receptors (19). Zinc deficiency in male rats reduced circulating luteinizing hormone and testosterone concentrations, by 34% and 68%, respectively. The livers of zinc-deficient rats exhibited a higher aromatization of testosterone to estradiol than did those of controls (19). Concentration of hepatic estrogen receptors in the liver cytosol was significantly higher in zinc deficiency. Zinc deficiency has deleterious effects similar to those of alcohol or castration on hepatic androgen metabolism and aromatization of androgens. Zinc deficiency caused a 41% reduction in the number of androgen binding sites and a 57% increase in the number of estrogen receptors. Zinc maintains the structural integrity of DNA and plays an important role in synthesis of nucleic acid and protein (2). In the present study, the reverse action of deficiency, Zn supplementation, was used to determine effects on anabolic hormones, with positive effects demonstrated on testosterone. Direct muscle function studies with manipulation of zinc status over a short time interval of 3 weeks demonstrated that zinc status positively alters the total work capacity of skeletal muscle in humans (20). The present study results contribute to those findings, although the preparation used in this study was more complex including magnesium and vitamin B-6 as well as zinc.

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Exquisite sensitivity of circulating IGF-I to nutrients has been observed. Nutrition is one of the main regulators of circulating IGF-I, which is lowered by energy and/ or protein deprivation (21). Enhanced nitrogen balance is demonstrated in caloric restriction with IGF-I administration. IGF is putatively strongly linked to diet, specifically carbohydrate content in caloric restriction. Although most research attention has been on the energy and macronutrient content of the diet, there have been studies that evaluated specific nutrients on IGF-I levels. When purported growth hormone enhancers, arginine and lysine, were administered together with a strength training program, there was no change in resting levels of IGF-I (22). The strongest associations may be between IGF-I and micronutrient levels. Increase in growth velocity in growth-retarded children resulted from zinc supplementation associated Zinc-Magnesium Supplementation, Hormones and Strength 33 with a 70% increase in plasma IGF-I concentration (23). Zinc and magnesium deficiencies lead to marked growth retardation. In a study using rats, dietary zinc and magnesium were manipulated to assess effects on IGF-I (1). When animals were deprived of magnesium, serum magnesium was reduced 76% and serum IGF-I decreased 60% from baseline. Then, diets were replete with magnesium. The serum magnesium normalized, then 2 weeks later, IGF-I reached control levels. When animals were deprived of zinc, serum zinc was reduced 80% and serum IGF-I decreased 69% from baseline. With dietary zinc repletion, serum IGF-I improved 194%. The researchers concluded that decreased IGF-I was not attributed to reduced energy intake, but seems to be a specific effect of nutritional deficiency of magnesium and/or zinc. Growth retardation in hypocaloric states may be due to magnesium or zinc deficiency mediated through reduced serum IGF-I. Serum changes of magnesium and zinc might be of importance as a mediator for regulating serum IGF-I levels. These studies on specific nutrients, specifically zinc and magnesium, were corroborated with the results of the present study. The element levels were low at the start of the study and increased, but remained within the normal laboratory ranges. Supplementation with ZMA, a novel zinc-magnesium combination, resulted in increased plasma element concentrations and concomitant stabilization of IGF-I levels compared to the placebo group, which demonstrated significant reductions in IGF-I mean values over the training period. Both zinc and magnesium supplementation have been shown to significantly decrease the levels of the catabolic "stress" hormone, cortisol. In a double-blind, randomized study of 23 triathletes, serum cortisol was lower in the magnesium-supplemented group before and after competition compared to controls (24).

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The authors concluded that the magnesium supplementation resulted in a reduced stress response without affecting competitive potential. In addition to increasing the subjects' anabolic hormone levels, the ZMA may have had an anti-catabolic effect as well. It would be beneficial to include cortisol measures in future studies. Related to the improved hormone profile were enhanced posttest values of muscle measures with ZMA. There were relatively greater values with ZMA than placebo in lower extremity isokinetic torque and functional power (180 °/s and 300 °/s, except for torque at 300 °/s) compared to baseline measures as demonstrated in Figure 2. There is extensive evidence that the anabolic hormones supported by the nutriture of the ZMA supplementation are involved in muscle anabolism and related force production changes (2, 10, 20, 21, 23, 24). Virtually every tissue type is capable of autocrine production of the IGFs. Elevated IGF-I may contribute to hypertrophy response, possibly via mobilization of satellite cells to provide increases in muscle DNA, maintaining some critical DNA-to-protein ratio (25). Increased IGF-I production coincides with increases in muscle DNA and precedes measurable increases in muscle protein. IGF-I may be acting to directly stimulate processes such as protein synthesis and satellite cell proliferation, which result in skeletal muscle hypertrophy. Purported ability of IGF-I to stimulate both anabolic and myogenic effects in vitro suggests it as a component of cellular-level signaling system in skeletal muscle. After acute exercise, IGF-I receptor mRNA was elevated. The main function of IGF-I is to regulate cellular growth and metabolism; IGF-I stimulates DNA synthesis, cell proliferation, and protein synthesis. The anabolic effects of testosterone are mediated primarily through protein synthesis and retarding muscle catabolism, as has been clearly defined over the years (26). Related to the ZMA supplementation-induced enhanced blood profile of zinc, magnesium, and anabolic hormones were significant increases in isokinetic torque and power measurements. The ZMA group increases were significantly different than the placebo group. On a relative scale, the 10%-range increases in quadriceps torque and 12.7% to 15.2% increases in quadriceps power for ZMA supplementation were comparatively greater compared to the -0.8% to 2.4% change in quadriceps Zinc-Magnesium Supplementation, Hormones and Strength 34 torque and 8.6% to 10.8% change in quadriceps power for the placebo group. There was a baseline difference in muscle torque and power as a result randomization, which resulted in higher values for the placebo group versus the treatment group at the outset. Further statistical analysis was applied so that the significant differences between groups were noted when analyzed with an ANCOVA. Both groups had overall increases in the training and supplementation period, but the ZMA supplementation resulted in greater increases compared to the placebo. The results of the study are intriguing, since ZMA supplementation was associated with improved anabolic hormone profile and muscle function in already strength-trained varsity collegiate football players. Further research on applications of the novel ZMA compound and related contributing mechanisms would elucidate the effects demonstrated in this preliminary study.



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## Abstract

### PURPOSE OF REVIEW:

To describe the effect of an acute bout of exercise on growth hormone responses and to discuss the effect of L-arginine supplementation on growth hormone responses.

### RECENT FINDINGS:

Recent studies have shown that resting growth hormone responses increase with oral ingestion of L-arginine. Most studies using oral arginine have shown that arginine alone increases the resting growth hormone levels at least 100%, while exercise can increase growth hormone levels by 300-500%. The combination of oral arginine plus exercise attenuates the growth hormone response, however, and only increases growth hormone levels by around 200% compared to resting levels.

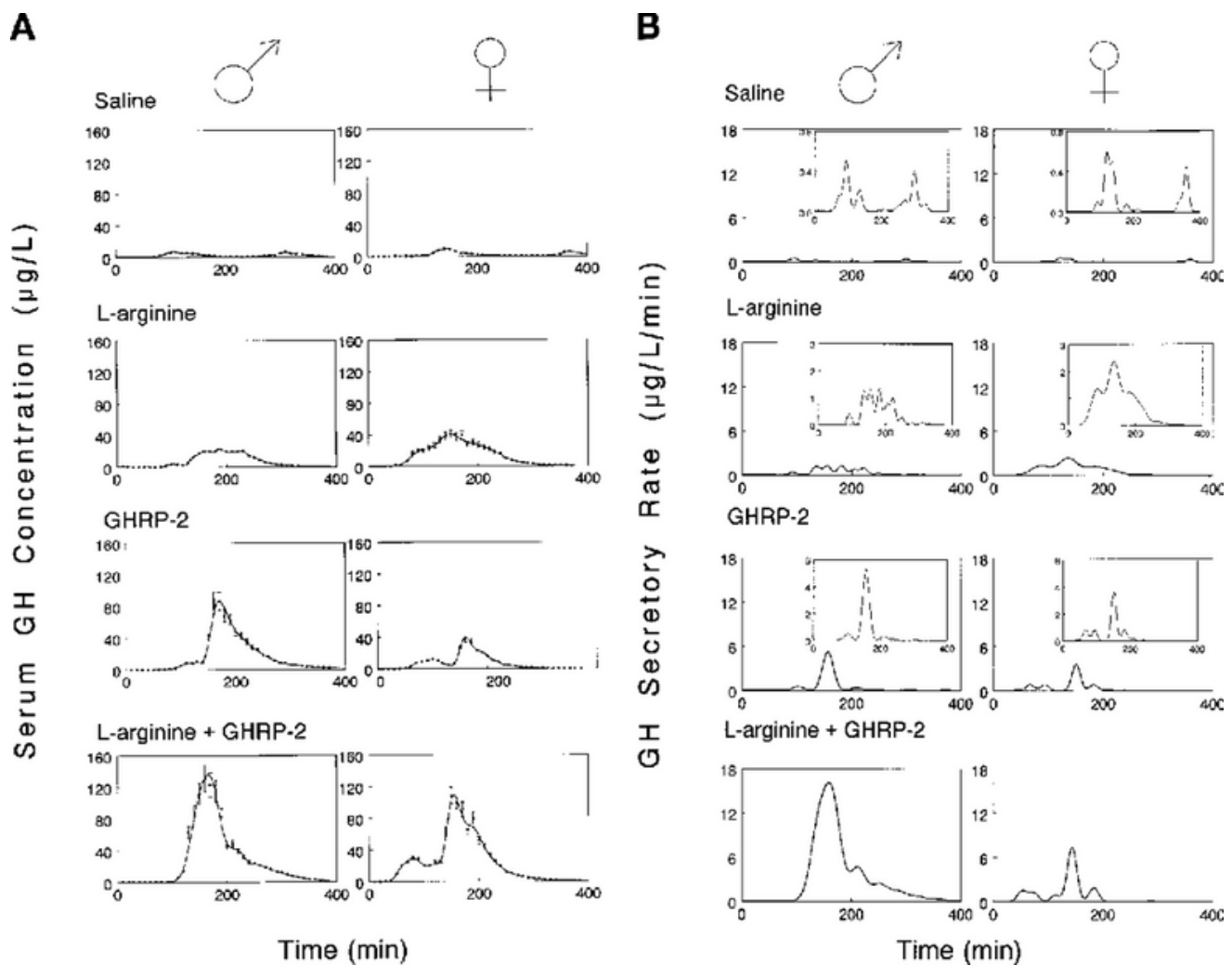
### SUMMARY:

Exercise is a very potent stimulator of growth hormone release and there is considerable research documenting the dramatic growth hormone rise. At rest oral L-arginine ingestion will enhance the growth hormone response and the combination of arginine plus exercise increases growth hormone, but this increase may be less than seen with exercise alone. This diminished response is seen in both younger and older individuals.

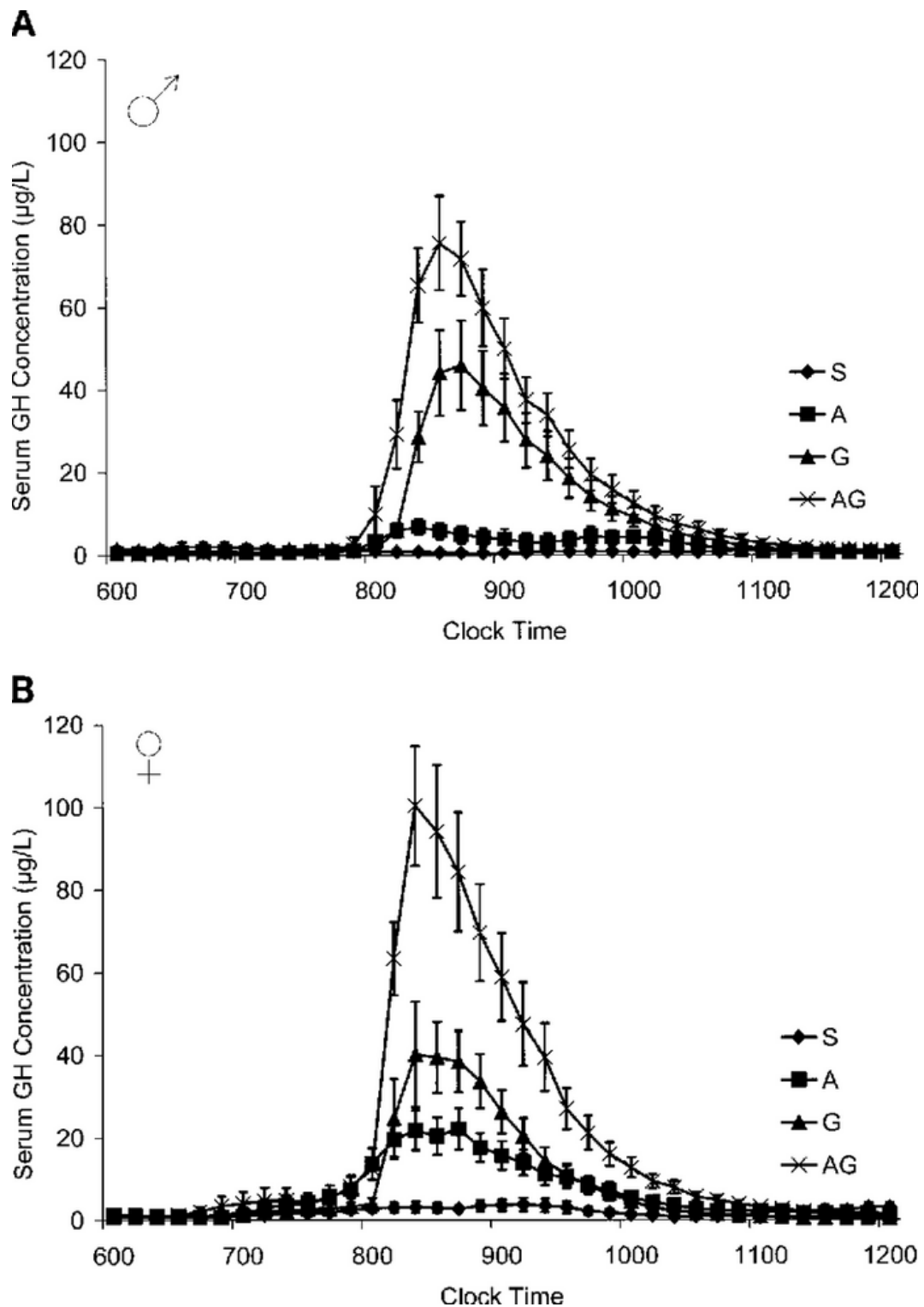
	Basal Secretion Rate, $\mu\text{g}\cdot\text{l}^{-1}\cdot\text{min}^{-1}$		GH Half-Life, min		90-min Mass of GH Secreted, $\mu\text{g/l}$		Production Rate, $\mu\text{g}\cdot\text{l}^{-1}\cdot\text{min}^{-1}$	
	M	F	M	F	M	F	M	F
Saline	$0.006 \pm 0.002$ (0.004)	$0.014 \pm 0.004$ (0.010)	$16.1 \pm 1.5$ (15.4)	$13.9 \pm 1.3$ (13.3)	$2.0 \pm 0.8$ (0.7)	$12.9 \pm 5.8$ (4.5)	$10.5 \pm 3.1$ (7.2)	$34.8 \pm 8.3$ (28.6)
Arginine	$0.004 \pm 0.001$ (0.003)	$0.011 \pm 0.002$ (0.009)	$15.4 \pm 0.6$ (15.3)	$15.8 \pm 1.2$ (15.4)	$22.1 \pm 7.8$ (15.7)	$65.4 \pm 18.7$ (37.9)	$34.0 \pm 10.8$ (25.2)	$101 \pm 20.2$ (87.3)
GHRP-2	$0.005 \pm 0.001$ (0.004)	$0.01 \pm 0.002$ (0.009)	$18.2 \pm 1.9$ (17.4)	$16.4 \pm 1.2$ (16.1)	$115 \pm 24.1$ (88.2)	$117 \pm 32.4$ (93.1)	$128 \pm 21.4$ (109)	$132 \pm 36.2$ (105)
AG	$0.005 \pm 0.001$ (0.004)	$0.011 \pm 0.002$ (0.010)	$19.9 \pm 1.6$ (19.3)	$20.9 \pm 1.6$ (20.4)	$196 \pm 45.8$ (168)	$199 \pm 25.0$ (182)	$212 \pm 53.1$ (179)	$210 \pm 29.1$ (191)

Values are the means  $\pm$  SE (geometric mean). M, males ( $n = 9$ ); F, females ( $n = 9$ ); GH, growth hormone; GHRP, GH-related peptide; AG, combined L-arginine and GH. Time interval for production rate measurement is 0600–1200.

**Table 1. Gender comparisons of calculated GH secretion measures**



**Fig. 2. Representative serum GH concentration profiles (A) and the corresponding GH secretion profiles (B) in an individual healthy young man and woman basally and in response to G and/or A infusions. Time zero corresponds to 0600 clock time in Fig. 1. on April 19, 2017**



**Fig. 1.** Mean serum growth hormone (GH) concentration profiles basally and in response to GH-releasing peptide (GHRP)-2 (G) and/or L-arginine (A) infusions in men (A) and women (B). Data are the means  $\pm$  6 SE. Clock time is shown.

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ETERNO contains natural ingredients specifically designed to support better sleep and optimize the conditions during which growth hormone is released during sleep.

## Sleep and Human Growth Hormone

LAST UPDATED ON FEBRUARY 19, 2018

### DEFINITION

Human growth hormone (often abbreviated HGH or hGH, or simply GH for growth hormone) is a complex protein produced by the pituitary gland in the brain and is an important part of the body's endocrine system. It is especially active in the growing child's maturation (although it is not the only physiological factor that makes kids get taller and grow). HGH is released by the brain into the bloodstream during sleep, and its release is part of the repair and restoration function of sleep.

Sleep and exercise are inextricably linked with each other, thanks to the human growth hormone.

### When is human growth hormone released during sleep?

Both sleep and exercise induce the release of human growth hormone. Experts estimate that as much as 75 percent of human growth hormone is released during sleep.

In normal healthy people, the major period of HGH release occurs during the first period of Stage 3 sleep stage during the night, about an hour after you first fall asleep. Stage 3, also known as deep sleep or slow wave sleep, accounts for about one-quarter of your sleep each night. Deep sleep is the most restorative all stages of sleep. During this stage of sleep, HGH is released and works to restore and rebuild your body and muscles from the stresses of the day.

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## How does the growth hormone change with age?

The production of HGH levels peaks at your youth, and steadily declines with age. Seniors in particular spend less time in deep sleep, which explains the link between lack of HGH and other disorders associated with aging.

The best way to increase your HGH levels is by following good sleep hygiene and getting high-quality sleep on a regular basis. High-quality sleep for most adults means uninterrupted sleep for 7 to 9 hours each night.

In addition to following a consistent sleep schedule, you should also exercise regularly in order to promote HGH secretion. Pulses of HGH are released during the day and can be affected by lack of exercise and an unhealthy diet. Exercise in turn promotes quality sleep.

One of the best ways to promote HGH secretion through exercise is with high-intensity interval training.

As for diet, you should think of HGH and sugar as opposites. The higher your insulin levels (from intake of high-sugar food and beverages), the lower your HGH levels. High blood sugar inhibits your HGH production, so you should avoid foods high in sugar generally, but especially before bed, if you want to avoid inhibiting your natural HGH production during sleep.

## Micro & Macro Nutrients to Support IGF-1 and Healthy Hormone Levels

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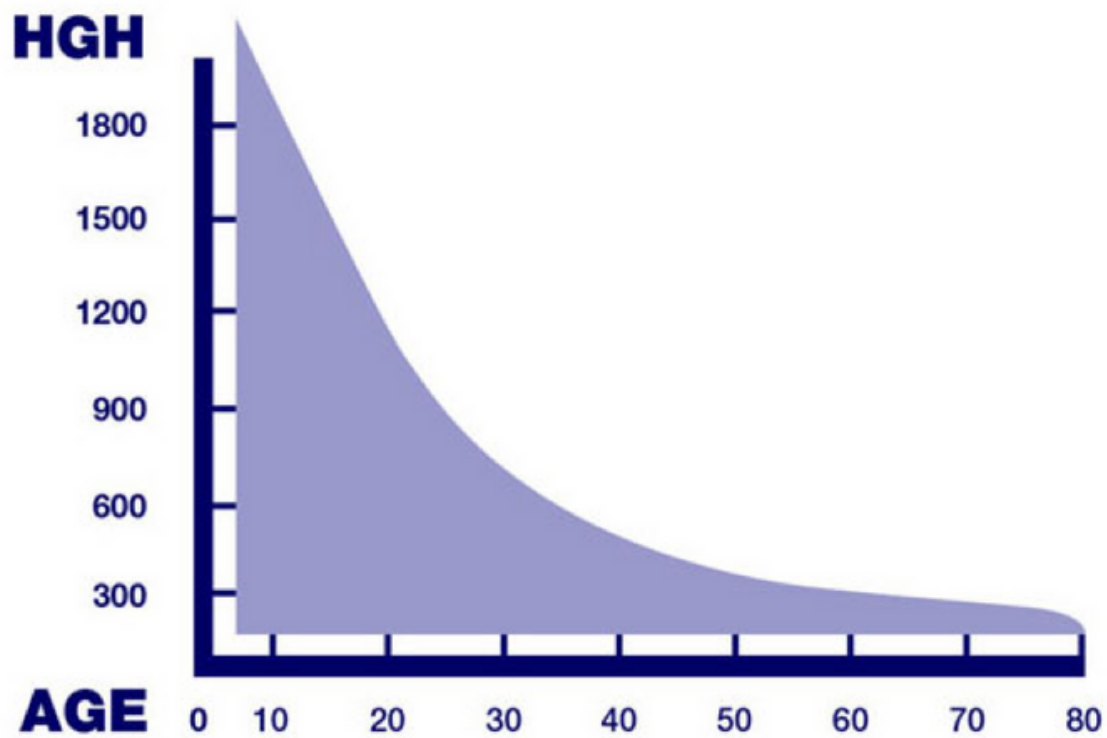
ETERNO contains GABA (γ-Aminobutyric acid) which when taken at night, along with daily exercise and whey protein consumption, produces an increase in resting serum growth hormone.

KYOTO, Japan--(BUSINESS WIRE)--On June 1st, a newly-released study was released at the ACSM Annual Meeting in Boston, proving for the first time that supplementing a post-exercise whey protein regimen with their natural GABA (γ-Aminobutyric acid) produces an increase in resting serum growth hormone, consequently improving the formation of lean muscle mass.

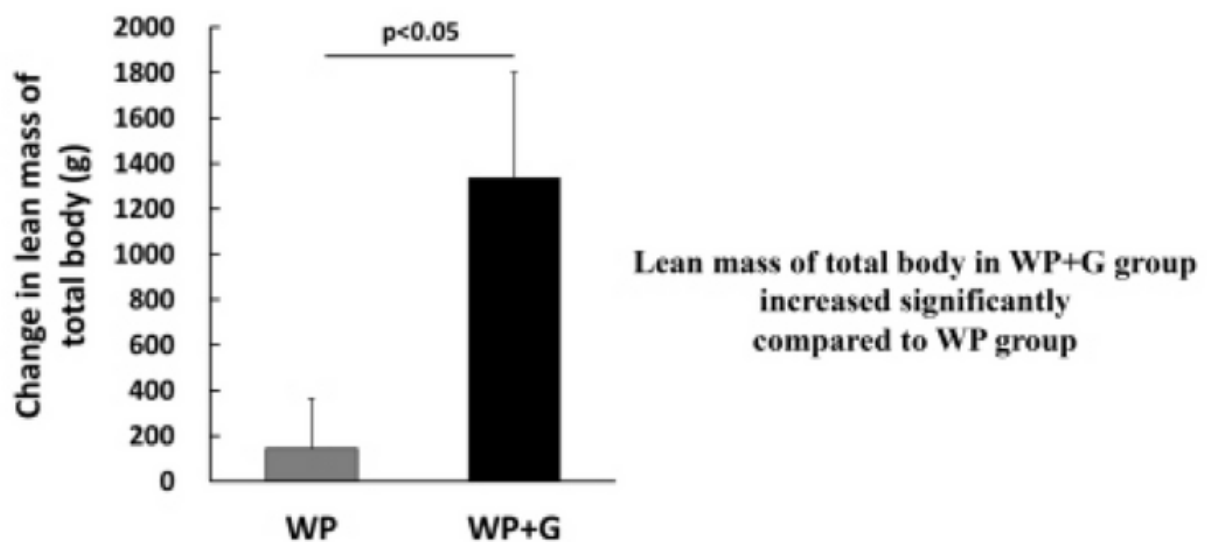
GABA (γ-Aminobutyric acid) is a naturally-occurring amino acid and key inhibitory neurotransmitter found in human cells. Serum growth hormone (GH) regulates various elements of body composition including the synthesis of muscle protein. Although GABA's specific anabolic effect remains undefined, what's been shown, for the first time, is that oral intake of GABA along with whey protein, a known means of stimulating skeletal muscle hypertrophy, enhances the process and produces demonstrably more lean mass than with whey protein alone.

The study looked at 26 males, aged 26 to 48, who practiced progressive-resistance weight training. The group was divided in two – all ingested 10 grams of whey protein daily, half supplemented it with 100 milligrams of GABA. The group trained twice weekly, following a systematized circuit of weight-resistance exercises. Resting serum growth hormone was recorded in blood plasma at baseline, four, eight, and twelve weeks; while change in muscle mass was measured using dual-energy X-ray absorptiometry (DXA) at baseline and twelve weeks. The result was that while GH improved significantly for the group ingesting whey protein, the improvement quickly leveled off, whereas the addition of GABA demonstrated proliferation throughout the period of GH, and at the end of twelve weeks, lean mass was dramatically increased in the group taking both together. In an additional study, GABA produced shortened sleep latency, which is the time it takes for a person to fall asleep and extended Non-Rem sleep time, the deepest stage of sleep.

## Decline of HGH with Age



**Figure. Change in whole body lean mass for 12 wk measured by DXA**



# Growth hormone isoform responses to GABA ingestion at rest and after exercise.

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Author information

## Abstract

### PURPOSE:

To test the hypothesis that GABA ingestion stimulates immunoreactive GH (irGH) and immunofunctional GH (ifGH) release at rest and that GABA augments the resistance exercise-induced irGH/ifGH responses.

### RESULTS:

At rest, GABA ingestion elevated both irGH and ifGH compared with placebo. Specifically, peak concentrations of both hormones were elevated by about 400%, and the area under the curve (AUC) was elevated by about 375% ( $P < 0.05$ ). Resistance exercise (EX-P) elevated time-point (15-60 min) irGH and ifGH concentrations compared with rest ( $P < 0.05$ ). The combination of GABA and resistance exercise (EX-GABA) also elevated the peak, AUC, and the 15- to 60-min time-point irGH and ifGH responses compared with resting conditions ( $P < 0.05$ ).

Additionally, 200% greater irGH ( $P < 0.01$ ) and 175% greater ifGH ( $P < 0.05$ ) concentrations were observed.

### CONCLUSIONS:

Our data indicate that ingested GABA elevates resting and postexercise irGH and ifGH concentrations.

### GABA and Growth Hormone

