GHboost, a research driven nutritional supplement, is a unique growth hormone stimulating product that optimizes natural growth hormone (GH) secretion more effectively than any other GH boosting product on the market.

GHboost also optimizes serum and tissue levels of the potent anabolic growth factor, insulin-like growth factor I (IGF-I) and its major isoforms as well as working productively and synergistically with other hormones and growth factors, both local and systemically. The result is an increase in protein synthesis, a decrease in muscle breakdown and an increase body fat loss leading to significant anabolic, body composition and performance effects.

GHboost information updated January 6, 2020

**GHboost is manufacture in a GMP and NSF certified pharmaceutical grade facility.**

While it’s mostly known as a hormone that is involved in the growth of children growth hormone is vitally important in adults as well. That’s because it plays a central role in body composition, metabolism, protein synthesis and exercise performance.

Growth hormone deficiency at any age, whatever its cause and whether its acute (as in certain instances of short or long-term overtraining) or chronic (due to aging, stress and other factors) can have significant adverse effects on body composition, performance, mood, cognition, cardiovascular function, bone mineral density, health, aging and quality of life.

GHboost stacks a number of different growth hormone optimizing compounds that maximize natural GH secretion. Many of these compounds optimize GH secretion by different methods (for example the mechanisms by which L-dopa and arginine stimulate GH secretion are different) and in some cases act synergistically (for example, arginine pyroglutamate and lysine have been shown to work
synergistically to release growth hormone), resulting in an increased GH secretion. Stacking a number of these compounds also allows smaller doses to be used with a decrease in any potential side effects.

GHboost effectively suppresses somatostatin, the hormone that inhibits GH secretion, while at the same time increasing GH secretion through various direct and indirect pathways including the stimulation of growth hormone releasing hormone (GHRH).

But that’s not all as GHboost also increases that anabolic hormones IGF-I and insulin sensitivity, decreases the catabolic hormone cortisol, helps maintain thyroid function and increases nutrient delivery to muscle, all of which are necessary to maximize body composition and exercise performance, as well as maintaining energy levels, health and feelings of wellbeing.

The previous version of GHboost was already the leader in GH boosting products. The new GHboost version VI significantly improves the anabolic and fat burning effects of GHboost and creates a new paradigm in boosting endogenous GH and IGF-1 levels. And as you’ll see below it does much more.

For Drug Tested Athletes

The Use of GHboost Absolutely Will Not Result in a Positive Drug Test


GHboost optimizes endogenous growth hormone and IGF-1 levels, correcting anything that may be involved in decreasing natural optimal production.

GHboost does not contain growth hormone or any other hormones, peptides, or any banned substance. It does not result in supraphysiological levels of either growth hormone or IGF-1. What it does is to allow your body to reach its natural and optimal potential for endogenous production.

But it does much more than optimize GH and IGF-1 levels, including improving health, the function and efficacy of other hormones, and providing immune and other effects that improve body composition and physical and mental performance.
## Nutrition Panel GHboost version VI

### Supplement Facts:

<table>
<thead>
<tr>
<th>Serving Size: 6 Tablets</th>
<th>Servings Per Container: 30</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Amount Per Serving</strong></td>
<td><strong>% Daily Value</strong></td>
</tr>
</tbody>
</table>

- **Vitamin A** (as Retinyl Palmitate) | 1000 IU | 33% |
- **Vitamin C** (Ascorbic Acid) | 500 mg | 556% |
- **Vitamin D3** (as Cholecalciferol) | 600 IU | 75% |
- **Vitamin B2** (Riboflavin) | 10 mg | 76% |
- **Vitamin B3** (Nicotinamide) | 15 mg | 94% |
- **Vitamin B6** (as Pyridoxine HCl & Pyridoxal-5-Phosphate) | 10 mg | 588% |
- **Vitamin B12** (as Methylcobalamin) | 100 mcg | 4,167% |
- **Biotin** | 300 mcg | 1,000% |
- **Calcium** (as Calcium Phosphate) | 300 mg | 30% |
- **Magnesium** (as Magnesium Aspartate) | 300 mg | 72% |
- **Potassium** (as Potassium Citrate) | 99 mg | 3% |
- **Zinc** (as Zinc Monomethionine) | 10 mg | 91% |
- **Copper** (as Copper Gluconate) | 200 mcg | 22% |
- **Chromium** (as Amino Acid Chelate) | 25 mcg | 71% |
- **Selenium** (as Selenium Monomethionine) | 25 mcg | 70% |

### GHboost™ Proprietary Complex 3428 mg *

- **Bovine Colostrum** (lg 400 mg) | 1600 mg | * |
- **L-Lysine** | 800 mg | * |
- **L-Citrulline-Malate** | 750 mg | * |
- **L-Glutamine** | 600 mg | * |

**Other Ingredients:** Hypromellose, Hydroxypropyl Cellulose, Silicon Dioxide.

*Daily Value Not Established
The information below on the new GHboost version VI is in a constant draft form as revisions are made as new information becomes available. This latest information will give you the flavor of just what GHboost will do for you in helping you achieve your health, body composition and performance goals.

**What can I expect from the use of GHboost?**

GHboost will naturally:

1. Increase GH and GH-receptor and other receptors number and binding
2. Increase IGF-I and IGF-1 isoforms number and receptors binding
3. Increase insulin function and sensitivity for improved body composition
4. Increase testosterone secretion and effect
5. Decrease cortisol
6. Optimize thyroid health and function
7. Increase nutrient delivery to muscle

As a result you can expect:

1. Increased muscle mass
2. Decreased body fat
3. Increased energy
4. Increased exercise performance including power and endurance (yes even endurance benefits from increased levels of GH¹)
5. Increased recovery
6. Increased well-being
7. Anti-aging effects

No two people will react to GHboost in exactly the same way since phenotypically (a combination of genetics, transgenerational epigenetics, and environmental epigenetics to produce the person we are right now) we’re all different. However, in a limited number of follow-ups, everyone using GHboost increased their serum levels of both GH and IGF-I.

Overall, GHboost version VI resulted in an average increase of about 10% to 25%, depending on the individual, over and above the results seen with the previous version of GHboost.

As well, GHboost resulted in significant changes in body composition. There was a significant decrease in overall body fat, and particularly so in problem areas such as abdominal fat and areas prone to cellulite, and a maintenance of lean body mass in those losing weight. And in those wishing to maximize body composition and/or athletic performance, there was a shifting of body composition to decreased body fat and increased muscle mass.

Since GHboost works naturally in the body, the potential for side effects is dramatically reduced when compared to the use of GH injections. That’s because the exogenous use of GH (usually by injection) decreases the natural production and make the body dependent on the exogenous use for its GH. When the GH is discontinued it can result in a state of GH deficiency at least until the body revs up its own GH production, something that may take some time and in some never goes back to normal.
Having a problem with producing endogenous levels of GH doesn’t happen when you go off GHboost since it works by increasing natural GH production, and thus puts the body’s manufacturing capability in high gear. While GH levels drop when you discontinue its use, they will not drop to below the levels that existed prior to the use of GHboost. In some cases, lab results showed that GH levels remained slightly higher after the use of GHboost than they were prior to its use.

As well, using GHboost only optimizes GH and IGF-1 rather than producing above normal levels for both. As such, even in the elderly, GHboost only increases GH and IGF-1 to appropriate levels for any age group, thus circumventing any adverse effects of using exogenous GH, popularly used to sustain lean muscle mass and vigor in aging, but with consequences beyond optimizing endogenous GH levels appropriate for the age group.²

History of GHboost

I’ve been involved in all aspects of sports medicine, sports performance, body composition, weight loss, nutrition, and nutritional supplements both academically and in the trenches for over five decades. For most of that time, besides being an elite athlete in several sports, especially in Powerlifting, I’ve incorporated my ideas and protocols in my practice, in my Bariatric Medicine clinic and in the world of exercise and sports.

During the last five decades I’ve helped athletes in all sports, from professional bodybuilders to Olympic 100- meter gold medalists, optimize their body weight for maximum performance.

As well I’ve researched and written books and hundreds of magazine and more recently Internet articles (in top fitness, sports and bodybuilding magazines and sites including my own site at www.MetabolicDiet.com) about ways to optimize health, body composition and both physical and mental performance for over five decades.

During this time I was fully aware of the effects of GH and how it is an important hormone for health, weight loss and for maximizing body composition. Unfortunately, I found that the people that needed it most didn’t produce enough physiologically. And even in those that did, optimizing GH, insulin-like growth factor 1 (IGF-1) production, and insulin and their effects, are an important part of the body composition and performance solutions.

I looked into using exogenous GH but because of side effects including shutting down endogenous GH production, expense and the bother of daily injections this wasn’t the solution I was looking for. I was looking for something natural that had minimal side effects, was convenient to use and that worked.

All of my knowledge and research finally came to fruition in GHboost, a supplement that really works and is safe. In fact, not only safe but a supplement that naturally increased health and wellbeing, provided some anti-aging benefits as well as helping people to reach their performance, weight and body composition goals.

My GHboost formulations produced an entirely new level of effectiveness when compared to all of the other GH boosting products on the market. In fact, it is the first product ever to look at all aspects of
optimizing GH levels and contains dozens of ingredients that work additively and synergistically to optimize GH and IGF-1 levels and their effects both systemically and locally.

Systemic elevations are secondary to stimulating the endogenous systemic GH generating system that involves the supra-hypothalamic, hypothalamic and pituitary pathway (SHPP), while the local involves the formation in different tissues including skeletal muscle and nervous system of IGF-1 in various isoforms which include insulin like growth factor-1Ec (mechano growth factor/MGF) IGF-1Ea, and IGF-1Eb) and the various GH and IGF-1, and insulin receptors.345678910

The ingredients in this evidence-based, research-driven formula have been proven to affect your GH and IGF-I levels and result in significant anabolic and fat burning effects without causing any negative health effects.

GHboost is a product of my more than five decades of research and involvement in the medical, sports and weight/fat loss fields. It is a true GH boosting breakthrough that is unequaled in its ability to provide significant performance, anabolic and body composition effects, culminating now in the new GHboost version VI.

It’s so good that GHboost is used by several hundred elite Olympic athletes (many gold medal winners in their respective fields, and top bodybuilders to optimize body composition and performance. With GHboost they’re able to maximize muscle mass while taking body fat levels to the absolute minimum for their needs.

They’re finding that GHboost is the perfect supplement to complement their diet and training efforts. And with the emphasis on drug testing in many of these sports, GHboost offers the advantages optimizing the endogenous production and naturally increasing their effects on body composition and performance without any of the adverse effects of using exogenous peptides and hormones.

There are several ways that I made sure that GHboost version VI is safe for drug tested athletes. The first is that I had GHboost manufactured in a pharmaceutical level facility that is GMP and NSF certified. Each ingredient and the final product were tested to make sure they were safe to use and contained no contaminants that would result in a positive test.

I then had a half dozen athletes use 6 tabs of GHboost twice a day (12 tabs in all) for two weeks and had their urine and blood tested in a laboratory using WADA/IOC standards of detection. All the results showed that GHboost version VI is 100% safe for drug tested athletes.

As an aside I discovered from an acquaintance at WADA that GHboost, along with TestoBoost and the rest of my MD+ nutritional supplement products, have been tested by WADA/IOC in the past few years and their testing found no banned substances thus adding to the fact that all my supplements are completely safe to use for drug tested athletes.
What’s Changed in GHboost version VI?

I first formulate GHboost in 1997 and when it came out it was immediately popular among bodybuilders and other athletes, and those looking to lose weight and maximize body composition. Version VI of GHboost represents the fifth evolution of this supplement. Each formulation is an improvement over the previous one, taking into consideration my experience with the previous version and the most recent research and findings, and applying these to make GHboost even more effective.

Version VI of GHboost is a major upgrade from version V. So much so that instead of 150 tabs per bottle and one dose being 5 tablets, GHboost version V1 contains 180 tablets with one dose being 6 tablets.

I added several ingredients as well as fine tuning some of the ingredients in GHboost version VI. I tried several dozen variations of ingredients and dosages to determine the optimum number and dosages of ingredients necessary to dramatically improve on the already spectacular effects of GHboost its anabolic and body composition effects, and more specifically further boosting GH and IGF-I levels both systemically and locally.

Among other ingredients, I added

1. Pyridoxyl-5-phosphate
2. Alpha GPC
3. L-tyrosine
4. Resveratrol
5. Selenium
7. Biotin
8. Magnesium
9. Potassium
10. Milk Protein Isolate

And I increased the amounts of

1. Velvet bean
2. GABA
3. Acetyl-L-tyrosine
4. L-Carnitine
5. Bovine colostrum
6. Turmeric

All were increased significantly, some more than four-fold over the previous formula.

The result of the additions and fine tuning is a much more effective product. The dose is now 6 tablets and a bottle of GHboost now contains 180 tablets, quite a jump from the original GHboost dose of three tablets and 90 tablets per bottle.

Although much more expensive to manufacture I’ve kept the retail price at a reasonable level given the cost of manufacturing GHboost due to the expensive ingredients used in the formulation, testing for contaminants and WADA banned substances, the and having my products produced in a...
pharmaceutical grade facility. GHboost is by far the best GH booster on the market at a bargain price compared to the other, relatively ineffective, GH boosters on the market.

The Problems with Exogenous Growth Hormone

In my view, increasing your own natural endogenous levels of growth hormone is more effective for maximizing body composition than using exogenous GH. There are two main reasons for this view.

First, the use of recombinant or synthetic GH (the only kind available since 1985 when the possibility of prion infection resulting in Creutzfeldt-Jakob disease, a variant of mad cow disease, halted the use of GH harvested from the pituitaries of cadavers) only provides limited GH exposure. That’s because human GH represents a family of proteins rather than a single hormone. In fact, the circulation contains over a hundred GH forms. And because we have yet to discover enough about the various forms, the net biological activity of this mixture is difficult to predict since the exogenous recombinant GH represents only 20 percent or so of the mix.

Thus far, most of the research has been largely confined to monomeric 22K, the same GH that is available for exogenous use. However, while it is certainly effective for its original intended purpose, namely growth promotion, it’s not known if it’s sufficient for optimal growth. It’s unlikely that it can fulfill all the functions of the GH family that are naturally present in the body. As well, the use of one GH variant likely decreases the production of the other variants in the body thus limiting the normal biological activity of GH.

But there’s more to GHboost in that it also stimulates insulin release and increases insulin sensitivity in the tissues such as skeletal muscle where it produces an anabolic effect. But in adipose tissue it actually causes an increase in fat breakdown and beta-oxidation, and a decrease in lipolysis.

The combination of increased GH, IGF-I and insulin levels results in a synergistic anabolic effect on muscle while at the same time maintaining significant fat burning effects since the action of GH and IGF-I minimize insulin’s effects on body fat.

The anabolic and fat burning effects of GHboost is accomplished by the use of several of the ingredients in GHBoost, including arginine, glutamine, taurine, alpha lipoic acid, and dozens of other ingredients.

The second reason is that the use of exogenous GH shuts down your own growth hormone production. And that’s a bad thing as it takes time for your body to ramp up the GH machinery once you discontinue the GH injections. In some cases the body decreases the natural production of GH permanently, often making it necessary for you to go back on the injections to feel normal.

That doesn’t happen with GHboost since it acts by increasing your natural GH secretion. It acts by ramping up your GH producing machinery rather than shutting it down. So if you go off GHboost you’re still in business, even if your levels go back to what they were before using GHboost. In other words, unlike the use of exogenous GH, you don’t become a “GH Eunuch” when you discontinue taking it.

The bottom line is that the use of GHboost is more natural, more effective, and has no adverse effects, especially when compared to the significant problems secondary to the use of injectable GH.
Effects of GH on Body Composition and Athletic Performance

Growth hormone and IGF-I have various anabolic and ergogenic effects including increasing protein synthesis, decreasing protein catabolism, increasing lipolysis and utilization of fatty acids for energy, increasing skeletal muscle blood flow, and increasing non contractile musculoskeletal tissue. The various mechanisms involved are still being worked out and there are several theories as to their modes of action.

For example, one paper postulated that the ergogenic effects of GH, and the associated levels of IGF-I are due to their effects on connective tissue. In this paper the authors state that “a strengthened connective tissue would give a stronger and more strain-resistant muscle and tendon and this could, in part, fit with the claimed effect of rhGH on athletic performance. Furthermore, an anabolic effect of rhGH in connective tissue could also suggest a potential for rhGH in treatment of muscle and tendon injuries, which are common problems in many sports.”

This is an interesting hypothesis and the authors do make a creditable presentation that’s supported by other studies. However, in light of the many studies showing the anabolic and other metabolic effects of GH and IGF-I there’s much more involved.

A recent study stated that “Molecular and functional studies provide evidence that GH stimulates the anaerobic and suppresses the aerobic energy system, in turn affecting power-based functional measures in a time-dependent manner. GH exerts complex multi-system effects on skeletal muscle function in part mediated by the IGF system.”

Adults with growth hormone deficiency (GHD) who receive GH replacement have been reported to significantly increase total lean body mass and muscle mass. It’s also been shown that long term continuous replacement therapy in patients with GHD results in a sustained increase in total body nitrogen and that even low-dose regimens of GH result in improvements in body composition, fatigue, bone mineral density and lipid profiles.

As well, other studies have shown that the use of GH stimulates amino acid uptake and protein synthesis in skeletal muscle and enhances nitrogen retention.

However, until recently, there has only been a few studies documenting the anabolic effects of GH in normal adults, even though increases in growth hormone production are known to have significant effects on carbohydrate, fat, and protein metabolism, have been shown to enhance recovery after exercise and stimulates IGF-I production in muscle.

Several studies have shown that GH and IGF-I have significant anabolic, anti-catabolic, lipolytic, regenerative and other effects that impact on body composition and athletic performance. It seems that GH and IGF-I can act directly on their own, and also have shared effects, likely due to cross-talk between the GH and IGF-I transduction pathways.

While there is evidence from animal models that the effects of GH may be mediated through circulating and/or local production of IGF-I, there is additional evidence to suggest that the mechanisms by which IGF-I and GH promote protein anabolism are distinct.
As such, although studies have shown that insulin and IGF-I decrease protein degradation and GH results in enhanced protein synthesis, recent work has shown that under certain circumstances they can both enhance protein synthesis and decrease protein degradation.\(^3^4\)

For example, an early study looked at the effects of an acute dose of GH on amino acid metabolism in 15 young healthy males while controlling for the effects of other confounding hormones (i.e. via simultaneous infusion of somatostatin and replacement of insulin, glucagon, and GH).\(^3^5\)

This study demonstrated direct effects of GH in terms of increased anabolic effects via inhibition of amino acid oxidation and stimulation of whole body protein synthesis. The direct effect of GH for this action was supported by the fact that insulin, glucagon, cortisol, IGF-I, catecholamine and glucose concentrations were not different between the control and GH treatment groups.

We know that increases in local IGF-I expression is associated with increased muscle protein and DNA synthesis, and exhibits both GH and insulin like effects.\(^3^6\) Local production of IGF-I also stimulates satellite cells to multiply and fuse with existing muscle fibers to enlarge muscle mass.\(^3^8\)

### GH, IGF-I, Insulin and Amino Acids Synergism

It's been known for decades that insulin, growth hormone, glucocorticoids, insulin-like growth factor 1, thyroid hormones, and other hormones regulate body protein metabolism. It's been known for decades that insulin,\(^3^9\) IGF-I,\(^4^0\) and GH\(^4^1\) each has acute, anabolic actions on skeletal muscle protein while the glucocorticoids (for example cortisol) have a catabolic effect.

Increasing levels of GH, IGF-I and increasing insulin production and sensitivity (by the use of arginine,\(^4^2\) ornithine,\(^4^3\) alpha lipoic acid, chromium and zinc.\(^4^4\)) results in powerful synergistic effects on body composition.\(^4^5\) This is evidenced by the exogenous use of all three hormones and peptides by power athletes and bodybuilders. The substantial decrease in body fat and increase in muscle mass, strength and performance attests to their effectiveness.\(^5^0\)

Unfortunately, their use results in significant and sometimes debilitating side effects both while taking them and after, including permanent dysfunction in the regulating systems.\(^5^7\) Reproducing their synergistic effects by increasing endogenous production and effects with GHboost produces similar results without the side effects.

GHboost not only increases the effectiveness of endogenous GH, IGF-I, insulin and thyroid, but also provides other boosting effects secondary to the interaction of the select amino acids in the formulation.

For example GH levels are increased by specific amino acids\(^5^8\) and other compounds, and in turn the GH acts synergistically with amino acids, such as arginine, ornithine, glutamine, GABA, lysine, glycine, tyrosine and taurine to increase IGF-I levels even further than GH acting alone.\(^5^9\) Also IGF-I levels, which are controlled by growth hormone and insulin, rise even higher because of the increase in insulin sensitivity.

This synergistic effect of several ingredients in GHboost results in an increase in IGF-I levels that is out of proportion to the increase in GH levels, and thus provides a more potent anabolic and fat loss stimulus than either one alone.\(^6^0\)
As well, increasing levels of GH has been shown to decrease the catabolic effects of cortisol by decreasing its formation from inactive cortisone,\textsuperscript{64} to decrease myostatin expression and increase testosterone effects in the body.

**Myostatin**

Myostatin inhibits muscle growth and is a negative regulator of muscle mass. Inhibiting myostatin, either at the genetic level, or by inhibiting its effects in the body, can result in marked increases in muscle hypertrophy.

Information on myostatin was first published in 1997 in a paper describing enhanced muscle hypertrophy in myostatin deficient mice.\textsuperscript{65} Later that same year myostatin was reported as being responsible for double muscled cattle.\textsuperscript{66} I reported on the myostatin story featuring these mighty mice and cattle in my Research Update column in September of 1997 in Muscle Media 2000.

Since then research on myostatin has validated its role in regulating muscle mass, regeneration of muscle tissue, and in regulating body fat, with myostatin promoting increased formation of adipose tissue.\textsuperscript{67} Decreases in myostatin levels and/or effects results in increased skeletal muscle mass and decreased levels of body fat while increases result in decreased muscle and increased body fat.\textsuperscript{68,69,70,71}

As well, some elite bodybuilders have validated the real world results of inhibiting myostatin through various means and have thus achieved massive levels of muscle hypertrophy in part through this inhibition.

Various degrees of natural inhibition of myostatin secondary to genetic polymorphisms likely explains some of the differences naturally seen in muscular hypertrophy and in the ability to attain significant increases in muscle mass.

![Image](7 Months)

An extreme example of this is seen in a child that was born in Berlin with a loss of function mutation that turns off the myostatin gene.\textsuperscript{73} The base-pair alteration in the gene results in the missplicing of myostatin messenger RNA, thereby reducing the production of mature myostatin protein. At 4.5 years, this boy is reported to have the physique of a mini-bodybuilder with markedly increased muscle mass and reduced levels of body fat.

At 7 months of age muscle hypertrophy was pronounced in all muscles as can be seen by the hypertrophy of the thigh and calf muscles in this picture (from Bouley 2005). The arrowheads indicate the protruding muscles of the patient’s thigh and calf.

In one study done on double muscled Belgian blue bulls, muscle biopsies revealed that this deletion in the myostatin gene altered the muscle fiber composition by increasing the fast-twitch glycolytic muscle fiber proportion inducing a higher proportion of fast-twitch glycolytic fibers and, to a lesser extent, a lower proportion of slow-twitch fibers.\textsuperscript{74}

An important function of myostatin is inhibition of satellite cells. Thus one would expect that in the absence of myostatin there would be enhanced muscle regeneration. This appears to be true from
studies of acute and chronic muscle injury. For example, muscle from myostatin null animals that were acutely injured regenerated large-diameter myofibers earlier than injured controls with normal myostatin.

**GH and Myostatin**

Studies have shown a negative correlation between GH and myostatin. It appears that deficits in GH may result in increased myostatin expression and a disassociation in autocrine IGF-I effects on muscle protein synthesis and that myostatin likely represents a potential key target for GH and IGF-I induced anabolism.

Interestingly enough, decreasing myostatin can also result in an increase in the expression of the androgen receptor. This results in an increased anabolic stimulus due to increased binding of testosterone to the androgen receptor.

GH potentially can have multiple effect son body composition due to:

- its direct action, and actions secondary to
- increases in IGF-I
- decreases in myostatin and subsequently
- increased testosterone activity

**GHboost and Testosterone**

Besides increasing testosterone activity, GHboost also may increase testosterone secretion. Part of this ability, besides the interaction of various hormones and systems, is the effects of two of the ingredients in GHboost.

These two ingredients may increase testosterone secretion by decreasing estrogen production secondary to the inhibition of aromatase. Inhibiting aromatase decreases systemic estrogen and thus the inhibiting effects that estrogen has on testosterone production. As such, inhibiting aromatase signals the body to produce more testosterone.

*Melatonin* and *resveratrol* (both in GHboost) have been shown to inhibit aromatase activity, decrease the synthesis of gonadal estrogens, downregulate the expression of the estrogen receptor and inhibit the binding of the estradiol-estrogen receptor complex to the estrogen response element in DNA. The overall result is an increase in testosterone and a decrease in estrogen production and adverse effects.

As well, the effects of GHboost in increasing insulin sensitivity and effects may secondarily increase testosterone levels through one or several mechanisms. For example it may work synergistically with luteinizing hormone (LH), the pituitary hormone that dictates testicular testosterone production. It may do this by stimulating a testes enzyme called 11 beta-hydroxysteroid dehydrogenase which has been shown to relieve steroid-dependent inhibition of Leydig cell function and thus increase testosterone secretion.
Nutrient and Hormone Delivery to Muscle

On top of the direct anabolic, fat burning, performance and body composition effects, GH, insulin and IGF-I also increase nutrient delivery to skeletal muscle. While exercise is known to dramatically increase muscle blood flow, studies have shown that IGF-I, GH and an improvement in insulin sensitivity can also increase muscle blood flow.

The improvement in blood flow by the nutrient route (as against the non-nutritive route) can have anabolic and performance enhancing effects by increasing oxygen, hormonal, and nutrient delivery to exercising muscle.

GHboost, besides achieving increased nutrient delivery by increasing GH, insulin and IGF-I levels, also increases tissue levels of nitric oxide, a gas formed from L-arginine and oxygen. The combination of arginine alpha ketoglutarate and arginine pyroglutamate results in an optimum increase in NO production, which in turn can further increase oxygen and nutrient delivery to muscle, and athletic performance.

GH and Exercise

Both aerobic and anaerobic exercise have a dramatic effect on serum GH and IGF-I levels, and tissue IGF-I levels in both men and women.

This effect is influenced by several variables, including the type of exercise, training state, body composition, age and gender.

For example, all out rowing performance results in dramatic post exercise increases in GH. And studies have shown that a single 30-s sprint elicits a marked GH response.

However, repeated exercise can result in an attenuation of that response. For example, repeated 10-min bout of high-intensity submaximal exercise has been shown to result in a dramatic attenuation of the exercise-induced GH response.

It’s also been shown that although a single both of intense exercise results in a marked increase in serum GH, repeated bouts separated by 60 minutes of recovery results in a lower GH response.
later study found that repeated bouts separated by up to four hours of recovery still resulted in an attenuated GH response whereas there was no adverse effect on serum GH levels in bouts of intense exercise done on consecutive days.\textsuperscript{106}

Another study looked at the GH responses to two consecutive 30-min cycling sessions at 80% of individual maximal oxygen consumption ($\dot{V}O_{2\text{max}}$) in amateur competitive cyclists.\textsuperscript{107} Subjects were tested on three occasions with different time intervals between the two bouts: 120 min, 240 min and 360 min.

The GH response to the second bout was significantly lower at the 120 and 240 minute time intervals between bouts but not with the 6 hour interval.

Other studies have shown that even repeated bouts of aerobic (submaximal) exercise resulted in an increase in serum GH that was greater when the recovery period between bouts increased.\textsuperscript{108}

The reason for the attenuated serum GH and IGF-I responses (likely also tissue levels of IGF-I) seen in these studies are not known but it could be due to several factors, including autoinhibition at the level of the pituitary secondary to increased levels of GH and/or IGF-I,\textsuperscript{109} to an increase in serum free fatty acid levels\textsuperscript{110} secondary to exercise and GH effects on lipolysis.

GHboost, used prior to repeated bouts, will enhance the GH response to exercise and result in anabolic and ergogenic effects for all athletes because it boosts GH and IGF-I levels, as well as boosting endogenous testosterone, enhancing the beneficial effects of insulin and controlling cortisol.

**GH and Endurance Athletes**

Several studies have shown that GH improves body composition and is an effective anabolic and ergogenic aid.\textsuperscript{111}

Although many of the studies center around anaerobic training such as resistance training, GH is also effective in increasing aerobic performance in all sports and activities, including ultra-endurance events. In fact, levels of GH (and cortisol) increase more dramatically in endurance events than with anaerobic events.\textsuperscript{112,113}

Aerobic capacity is increased by GH. It’s been shown that GH treatment displays multiple actions through several components of the oxygen transport system including increasing red cell mass, blood volume, and cardiac function.\textsuperscript{114,115}

Cardiac systolic function, in particular, is well documented to improve with GH treatment of both male and female GH-deficient subjects.\textsuperscript{116}

One study looked at the effects of exogenous GH in male endurance athletes. The use of GH resulted in reduced leucine oxidation by more than 50%, which suggests that the metabolic effects of GH include an anabolic effect in skeletal muscle.\textsuperscript{117}
Another study found that GH use resulted in a lower exercise oxygen consumption without a drop-off in power output.\textsuperscript{118} The authors concluded that the use of GH may improve exercise economy.

As well, GH decreases the perception of fatigue in adults with untreated GHD and therefore may be useful in this regard as well in endurance athletes.

GHboost not only results in an increase in GH and IGF-I levels, but also decreases inappropriate cortisol levels, resulting in significant ergogenic effects for the endurance athlete.

**Effects of GH on Core Temperature and Performance**

Growth Hormone has other effects that can result in an increase in performance in endurance athletes.

An increase in sweat rate is associated with a greater heat loss from evaporation and a lower core temperature. Investigators have shown that growth hormone stimulates sweat production and heat loss from evaporation during exposure to heat in either the absence or presence of exercise.\textsuperscript{119} Growth hormone deficiency, on the other hand, is associated with reduced sweat secretion and an increase in heat storage.\textsuperscript{120}

A study of Ironman triathletes found that those with higher GH expression had lower rectal temperatures which in turn correlated with increased performance.\textsuperscript{121}

**Effects of GH on Intramyocellular Triacylglycerol/Triglyceride Content**

For those following my phase shift diets (the Metabolic Diet, the Anabolic Solution and the Radical Diet) the effect of GH on the lipid content of skeletal muscle has added importance. That’s because a recent study found that GH not only stimulates fat breakdown and the use of fat as a fuel, but it also increases the amount of fat in muscle cells.

In those that follow my phase shift diets, fat is the primary fuel for generating energy, including energy needed for skeletal muscle contraction. Fat is stored in the muscle cells as droplets of triacylglycerols (triglycerides). The implications of their presence in muscle cells is in direct contrast to their presence in non-athletes.\textsuperscript{122}

For example, in athletes intramuscular triglycerides (IMTG) are associated with insulin sensitivity whereas in non-athletes they are associated with insulin resistance, the metabolic syndrome and diabetes.

In athletes, especially those that are fat adapted, IMTG are in direct contact with mitochondria and are a dynamic source of energy that is readily available and used first after ATP and phosphocreatine to provide needed energy. IMTG are used before stored glycogen and extracellular sources of fatty acids and glucose.

Interestingly a study found that GH increased levels of IMTG although their interpretation of this increase was flawed.\textsuperscript{123} However, along with the known effects of GH on increasing lipolysis and fat oxidation, the increase in insulin sensitivity coupled with the presence of IMTG forms a powerful combination for the use of fat as a primary fuel for muscle contraction in athletes.
Regenerative and Cognitive Effects of GH and IGF-I

As we’ve seen the anabolic, anti-catabolic, fat burning effects of GH are well established. However, there is also evidence that the HG/IGF-I axis affect cognition and the biochemistry of the adult brain. The findings of various studies suggest that both GH and IGF-I have cognitive, neuroprotective and regenerating effects on the central nervous system.\textsuperscript{124,125} As well, maintaining proper levels of GH and IGF-1 is paramount for improving cognitive and function in the aging brain \textsuperscript{126}

Effects of GHboost on Aging

As we’ve seen GH levels decline dramatically from age 20 to age 60. This decline leads to a progressive GH deficiency. Since GH has beneficial effects on muscle mass, bone density and body fat it counters some of the age related changes in body composition.

This reduction in GH contributes to physical and psychological changes seen with aging including decreased skeletal muscle, increased body fat, thinning skin and decreased wellbeing and quality of life. Studies have shown that restoring GH levels results in improvements in all these areas as well as boosting the immune system, improving protein, lipid and carbohydrate metabolism, improving recovery, and decreasing inflammation in the body.\textsuperscript{127,128,129,130,131,132}

Some of these effects from increasing GH are secondary to increases in IGF-I and may also be secondary to subsequent changes in other hormones and growth factors. For example, as we’ve seen, GH has a direct effect on decreasing myostatin and an indirect effect of increasing the effects of testosterone in the body.

A recent study found that while exercise has been shown to downregulate myostatin expression in adults, it doesn’t do so in the elderly. The authors concluded that this impaired capacity may play a role in limiting hypertrophy in older females.\textsuperscript{133}

But there’s more to GHboost than just boosting GH. GHboost also contains numerous ingredients that also impact on health, wellbeing and longevity, and have anti-aging effects.

Resveratrol

For example, GHboost contains resveratrol, a potent anti-oxidant with significant anti-aromatase activity.\textsuperscript{134,135} Researchers in Italy have shown that resveratrol may have significant anti-aging effect and extend lifespan.\textsuperscript{136}

The authors of this study conclude that "the observation that its supplementation with food extends vertebrate lifespan and delays motor and cognitive age-related decline could be of high relevance for the prevention of aging-related diseases in the human population."

As well, resveratrol has been shown to decrease fatigue, enhances body composition and both physical and mental performance, and improves testicular function.\textsuperscript{137,138,139,140,141,142,143,144,145,146,147}

Studies have also shown that resveratrol, and the B vitamins in GHboost, can counteract some of the detrimental effects of environmental pollution especially first, second, and third hand cigarette smoke and air pollution.\textsuperscript{148,149,150}
GHboost formulation includes:

- Several individual amino acids. Many studies have shown that specific amino acids, such as arginine, ornithine, lysine, L-dopa and GABA (all in GHboost) taken orally can act alone and synergistically to increase the release of growth hormone.\textsuperscript{151-157}

Studies have also shown that the increase in the body's production of growth hormone depends on the specific amino acids used and the ratios of the amino acids.\textsuperscript{158} For example, one study found that combining relatively small amounts of arginine pyroglutamate with L-lysine resulted in a much greater increase in GH secretion than large doses of either one alone.

A study found that a combination of glycine and glutamine, along with niacin (all three are in GHboost) enhanced growth hormone secretion in middle aged and elderly men.\textsuperscript{159} Glycine has been shown to increase growth hormone secretion on its own.\textsuperscript{160}

GHboost contains an ideal mixture (number and dosage) of the most effective GH boosting amino acids, including L-dopa, arginine pyroglutamate, arginine alpha ketoglutarate(AKG), GABA, glutamine, glycine, lysine and ornithine. These amino acids have a stimulatory effect on GH secretion directly, through stimulating GHRH, and by inhibiting somatostatin.

Since several of these amino acids cause the release of growth hormone by different mechanisms,\textsuperscript{161} they are even more effective when taken together. The amino acids can also stimulate other hormones. For example, arginine, like other dibasic amino acids, stimulates pituitary release of growth hormone and pancreatic release of insulin. Various amino acids, for example arginine, also stimulate IGF-I synthesis, both hepatic and local.

- **Bovine colostrums**, which acts as a bioavailable source of IGF-1. It also contains immunoglobulins, including transferrin to bolster the immune system and promote GH secretion. Note that colostrum is not prohibited by WADA and other drug testing agencies and the levels of IGF-1 in the bovine colostrum that is in GHboost, equivalent to the amount found in a regular glass or two of milk, absolutely cannot influence the outcome of anti-doping tests.

- **Acetyl-L-carnitine**. This compound is part of a technique to increase nighttime growth hormone release, along with the amino acid ornithine.\textsuperscript{162}

  It’s postulated that 500 mg of acetyl-L-carnitine and 25-100 mg of ornithine taken before bed will produce increased nighttime GH release. GHboost contains 500 mg of acetyl-L-carnitine and 200 mg of ornithine. The higher level of ornithine is set for the added synergistic effect that ornithine has with some of the other amino acids, including arginine. There is evidence to show that acetyl-L-carnitine also directly increases IGF-I levels.

  One study found that acetyl-L-carnitine significantly increased levels of free IGF-1 (the bioactive component of total IGF-1). As well, all the treated patients reported, an improved sense of well-being by the second and third week of acetyl-L-carnitine therapy.\textsuperscript{163}
• **L-tyrosine** and acetyl-L-tyrosine. L-tyrosine is a conditionally essential amino acid and is a precursor to epinephrine, norepinephrine and dopamine, three important brain neurotransmitters involved in brain function and GH secretion. Tyrosine is also used by the thyroid gland for the production of thyroid hormone, which is important for maximizing metabolism and body composition.

Acetyl-L-tyrosine is an active metabolite of tyrosine that has some properties outside of L-tyrosine. Both tyrosine and the acetyl metabolite are precursors to the neurotransmitter dopamine, and have been found to increase GH secretion. Both ingredients have also been shown to increase cognitive function.

• **Alpha Glycerylphosphorylcholine (alpha GPC)** is a precursor to acetylcholine. It’s been shown that low acetylcholine levels can result in decreased levels of GH secondary to decreased cholinergic tone. Studies have shown that alpha GPC increases GH production secondary to stimulation via GHRH.

• **CDP choline (cytidine 5'-diphosphocholine)** has been shown in several studies to increase serum levels of GH in man.

• **Melatonin.** Several studies have shown that melatonin increases growth hormone secretion through complimentary pathways for as long as 24 hours. As well it’s been shown that melatonin induces normal sleep patterns which in turn are conducive to maximizing night time growth hormone secretion. Melatonin has also been shown to have significant antioxidant effects.

• **Taurine.** Taurine has been shown to increase GH in animals. As well it is a potent antioxidant, increases insulin sensitivity, increases cell volume and therefore protein synthesis, and acts as a cytoprotective agent in the central nervous system and muscle. Overall, while it isn’t used to make up muscle tissue, it has significant anabolic effects.


• **Turmeric.** The active constituent in turmeric, known as curcumin, is a potent antioxidant with anti-inflammatory properties and has a wide range of therapeutic effects. Turmeric exhibits marked anti-inflammatory action and has been shown to be as effective as some anti-inflammatory drugs. For example, in a double-blinded trial, post-surgical patients receiving curcumin experienced reductions in stiffness and joint swelling comparable to the effects of phenylbutazone, a potent anti-inflammatory drug.

Of all the spices and herbal preparations it seems that only the spice turmeric has any anti-inflammatory effects. This was the conclusion of a study of a variety of Ayurvedic and herbal preparations, which was presented recently at the 9th Asia Pacific League of Associations for Rheumatology Congress.

In this study, a variety of herbal and Ayurvedic preparations were tested in rats. The rats were fed oral doses of the varied herbal and Ayurvedic recipes. Only turmeric showed anti-inflammatory effects when tested on irritated paws of the rats.
It works by inhibiting cyclooxygenase and lipoxygenase enzymes that catalyze the formation of inflammatory prostaglandins.

Several studies have shown the effectiveness of curcumin, especially when coupled with piperine which increases absorption of curcumin (both are in GHboost) on exercise induced muscle damage and soreness, and recovery as well as on improving body composition and exercise performance.  

In one study the combination of curcumin and piperine (both in GHboost) resulted in an improvement of in sprint mean power output 24 hours post-exercise. A recent study found that the combination of curcumin and alpha lipoic acid (both in GHboost) exhibit an additive effect in weight and fat loss.

As well, other studies have shown the value of curcumin in the prevention and treatment of neurological dysfunction such as Alzheimer's disease and other neurological diseases.

Since GH secretion is compromised by acute and chronic inflammation, the anti-inflammatory effects of turmeric, along with the other potent antioxidants in GHboost, such as resveratrol, vitamin C, alpha lipoic acid, taurine, melatonin, relieves the effects of inflammation on GH secretion and thus results in increased GH levels in the body.

- Other potent antioxidants such as vitamin C, glutathione and resveratrol. As mentioned above, these antioxidants suppress oxidant and stress damage to the hypothalamic pituitary axis and minimize the adverse effects of inflammation on GH secretion. Again several studies have shown that chronic systemic inflammation, including arthritis, involving cytokines such as interleukin-1 and tumor necrosis factor-alpha may be associated with a decrease in GH and IGF-I, and concomitant muscle wasting. In one study the authors surmised that the decrease in body weight gain in arthritic rats may be, at least in part, secondary to the decrease in GH and IGF-I secretion.

- Alpha Lipoic Acid. Besides having potent antioxidant properties, likely secondary to increasing levels of intra-cellular glutathione, ALA also increases insulin sensitivity. Alpha lipoic acid (ALA), a potent antioxidant that can recycle other antioxidants such as vitamin C, vitamin E and glutathione. ALA was added to GHboost to increase GH secretion and insulin functioning and sensitivity by its actions on the pro-inflammatory cytokines and because of its effects on decreasing secondary cortisol elevations. Alpha lipoic acid has also been shown effective for weight loss and decreasing hip circumference in conjunction with EPA and on its own. As well, alpha lipoic acid has been shown to decrease inflammation and have a beneficial effect on serum lipids and cardiovascular health.

- Coenzyme Q10 (CoQ10) is a lipid-soluble antioxidant and a key component of the mitochondrial electron transport chain for adenosine triphosphate (ATP) production. As such it is necessary for proper energy metabolism. For example, myocardial CoQ10 content is reduced by cardiac failure and aging. It is also reduced by statins, the popular cholesterol lowering drugs. Studies have suggested preventative supplementation of coenzyme Q10 for cardiac health and for those on statins.
CoQ10 has been shown to decrease oxidative stress and mitochondrial damage in many tissues. As well, CoQ10 has been shown to affect the expression of genes involved in human cell signaling, metabolism and transport. As such since many neurodegenerative disorders, diabetes, cancer, and muscular and cardiovascular diseases have been associated with low CoQ10 levels, supplementation may be useful in many diseases.

For example, CoQ10 supplementation has been shown to have anti-aging and beneficial effects on semen parameters, fertility, testicular damage, and reproductive hormones including testosterone.\textsuperscript{216,217,182,192,202,212,222,232,224} It’s also been shown to have beneficial effects on inflammation, the immune system, and on exercise performance.\textsuperscript{225,226,227}

The combined use of \textbf{CoQ10} and \textbf{selenium} (both in GHboost) dietary supplement ingredients has been shown to have significant effects on cardiovascular health and inflammation.\textsuperscript{229,230,121,32,33}

The combined use has also been shown to increase IGF-1 levels thus adding to the anabolic and body composition effects of GHboost.\textsuperscript{234}

- **Pyridoxine (vitamin B-6) and niacin (vitamin B3)** are water-soluble vitamins that are needed in the body’s production of GH. Niacin also directly increases GH secretion. Niacin, along with the amino acid glycine, also have some relaxing effects and thus are useful before bed to help sleep.

GHboost has both \textbf{pyridoxine} (in the form of HCL) and \textbf{pyridoxal-5-phosphate} (P5P) in it. P5P is the metabolically active form of vitamin B6. Pyridoxine HCL, while as easily absorbed as P5P has to be converted to P5P in the body in order to be used by the enzymes involved in protein metabolism and various hormonal processes. P5P is the preferred form of vitamin B6 as it can be used directly in the body without relying on the liver’s conversion of other forms of vitamin B6 into P5P. As well, less is needed to achieve the same cofactor effects.

Pyridoxal-5-Phosphate (P5P) is an active form of vitamin B6 involved in macronutrient metabolism as well as the production of neurotransmitters including dopamine, noradrenaline and serotonin.

- **Zinc** increases the synthesis of growth hormone and the number of its receptors thus mediating increased GH-receptor binding resulting in increased functional GH and IGF-1.\textsuperscript{235} Supplemental zinc has resulted in an increase the secretion of growth hormone and IGF-1.\textsuperscript{236}

- **Niacin** has been shown to increase GH secretion and to act synergistically with other GH releasing ingredients.\textsuperscript{237}

- **Bioperine** in GHboost significantly enhances the bioavailability of supplemented nutrients through increased absorption and decreased metabolic inactivation.\textsuperscript{238,239,240,241}

\textbf{The Advantages of Bioperine®}

Bioperine® is the only product sourced out of piperine to obtain a patented status for its ability to increase the bioavailability of nutritional compounds. Secondly, it is the only source from piperine to have undergone clinical studies in the U.S. to substantiate its safety and efficacy for nutritional use.
The subtle, yet potent properties of Bioperine® have been measured in several clinical studies with healthy volunteers in the U.S. These studies measured the absorption of three distinct categories of products. The categories evaluated with and without Bioperine® were fat-soluble (beta-carotene), water-soluble (vitamin B6) and a mineral (selenium, in the form of selenomethionine). Gastrointestinal absorption of all the studied nutrients, as measured by amounts present in the blood, increased dramatically when administered with Bioperine® as compared to the control group receiving the nutrient alone. Selenium levels increased by 30%, beta-carotene increased by 60%, and the vitamin B6 increase was slightly higher than beta-carotene.

Bioperine improves bioavailability of ingredients in LipoFlush but it also has several other beneficial properties, including thermogenic effects, reducing cholesterol and protecting against neurodegeneration and cognitive impairment. As well, it has been shown that it may have immunomodulatory, anti-oxidant, anti-asthmatic, anti-carcinogenic, anti-inflammatory, anti-ulcer, and anti-amoebic properties.

For current information on the beneficial effects of piperine as the trademark Bioperine go to https://www.bioperine.com/index.php/aboutbioperine.

How to Use GHboost

Since up to 90 percent of growth hormone is released two hours or so after falling asleep, GHboost is best used before bed as it results in an increase in the GH nighttime peak as well as increased GH levels throughout the day. The nighttime peak of GH also acutely stimulates IGF-I levels for several hours giving elevated levels over a 24 hour period.

GHboost can also be used before exercising to maximize the anabolic and fat burning effects of exercise. As well, GHboost works synergistically with other MD+ nutritional supplements.

For example NitAbol Chocolate and NitAbol Vanilla, the nighttime anabolic, fat burning combos combines TestoBoost with GHboost and Myosin Protein. NitAbol is perfect for those that want to lose weight, but would prefer to maintain the muscle they have and strictly lose bodyfat.

GHboost works synergistically with LipoFlush and with Amino to decrease body fat and maximize muscle mass and performance. This combination is used by competitive bodybuilders and fitness competitors, as well as elite level Olympic athletes to hone their bodies and performance.
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