RECOMBINANT GROWTH HORMONE

HGH (Human Growth Hormone / Somatropin)

Somatropin; Recombinant Human Growth Hormone; rhGH

CAS Number	12629-01-5
Molecular Weight	22,125 Da
Sequence / Structure	191 amino acid protein identical to natural human GH; synthesized via recombinant DNA technology
Category	Recombinant Growth Hormone
Available Specifications	10 IU, 15 IU, 24 IU, 36 IU, 40 IU

1. OVERVIEW

Human growth hormone (hGH or somatropin) is a 191-amino-acid protein hormone produced by the anterior pituitary somatotroph cells. Recombinant somatropin (rhGH), produced via recombinant DNA technology, is chemically identical to natural GH. Clinically, hGH is FDA-approved for treatment of adult GH deficiency, childhood growth disorders, and specific conditions (AIDS wasting, Turner syndrome, etc.). Off-label anti-aging use at doses of 1–4 IU daily has become widespread in clinical anti-aging practice. hGH exerts broad metabolic effects including stimulation of protein synthesis, lipolysis, and insulin resistance; effects are mediated both directly (via GH receptor signaling) and indirectly (via IGF-1 elevation).

2. MECHANISM OF ACTION

hGH binds to growth hormone receptors (GHRs) on target tissues, directly activating JAK2/STAT5 and MAPK signaling pathways, leading to altered gene expression affecting metabolism and growth. Indirectly, hGH stimulates hepatic IGF-1 production and local IGF-1 generation in peripheral tissues; IGF-1 mediates many anabolic effects. Direct hGH effects include lipolysis (via beta-adrenergic signaling in adipose tissue), protein synthesis stimulation, and metabolic substrate shifts. hGH antagonizes insulin signaling, promoting lipolysis and potentially inducing insulin resistance—a key side effect concern. The broad organ distribution of GHRs explains hGH's pleiotropic effects on metabolism, growth, and quality-of-life parameters.

3. CLINICAL EVIDENCE & RESEARCH

Extensive clinical research demonstrates hGH efficacy in GH-deficient patients, with improvements in body composition, strength, exercise capacity, and quality of life. The landmark 1990 Rudman study in healthy older men showed improved body composition and strength with physiological GH replacement. Subsequent research in aging populations confirms improvements in lean mass, bone density, skin thickness, and cardiovascular parameters, though effects on mortality and longevity remain unproven. hGH also improves cognitive function in some studies. However, long-term safety concerns—particularly regarding cancer risk, diabetes acceleration, and carpal tunnel syndrome—necessitate careful patient selection and monitoring.

4. THERAPEUTIC BENEFITS

- Direct stimulation of protein synthesis and lean muscle mass
- Enhanced body composition and reduction in visceral adiposity
- Improved bone density and fracture risk reduction
- Increased strength and exercise capacity
- Enhanced skin elasticity and cosmetic improvements
- Improved mood, cognition, and quality-of-life measures

- Accelerated recovery from injury or illness
- Improved lipid profiles in some individuals

5. INDICATIONS

- Adult growth hormone deficiency (FDA-approved)
- Childhood growth disorders and growth hormone deficiency (FDA-approved)
- AIDS-associated wasting (FDA-approved)
- Turner syndrome (FDA-approved)
- Off-label: Age-related GH insufficiency and anti-aging protocols
- Off-label: Recovery optimization in post-operative or post-illness states

6. DOSING & ADMINISTRATION PROTOCOL

Indication	Dose	Route	Frequency	Duration
Population	Dose Range	Frequency	Route	Typical Protocol
Anti-aging (standard)	1–2 IU	Once daily	SubQ	Bedtime (fasted state)
Anti-aging (enhanced)	2–4 IU	Once daily	SubQ	Adjust per IGF-1 monitoring
GH Deficiency (clinical)	0.15–0.3 mg/kg/week	Daily or 3× weekly	SubQ	FDA-approved dosing guidelines
Research/Athletic	2–4 IU	Once daily	SubQ	Titrate to IGF-1 target (200–350 ng/mL)

Reconstitution

Most hGH products are supplied as pre-filled pens or vials with pre-made diluent. Vial-based products: Reconstitute lyophilized powder vial by injecting supplied bacteriostatic water (usually 1–2 mL) into the vial. Roll gently to dissolve; do not shake vigorously. Concentration typically 2–10 IU/mL depending on product. Reconstituted solution stable 14–28 days refrigerated (varies by product). Some products use pre-filled liquid pens requiring no reconstitution.

Administration

Administer via subcutaneous injection using provided pen device or standard syringe/needle (29–30 gauge insulin syringe for SubQ). Optimal timing: bedtime (fasted state) to align with natural nocturnal GH secretion and enhance anabolic effects during sleep. Inject into abdomen, thigh, or upper arm; rotate sites to prevent lipohypertrophy or lipodystrophy. Standard starting dose: 1–2 IU once daily SubQ at bedtime. Dose titration guided by IGF-1 monitoring (target 200–350 ng/mL for anti-aging).

Protocol Notes

Anti-aging hGH protocols typically employ 1–4 IU daily, with most practitioners using 2 IU as a standard starting dose, titrating based on IGF-1 response. Higher doses (3–4 IU) may be used in enhanced protocols or therapeutic settings. Bedtime administration (fasted) is preferred for anti-aging protocols. Many clinicians employ 5–6 days on with 1–2 days off weekly, or 12-week on with 4-week off cycles, to minimize side effects and potential tolerance. Baseline and periodic monitoring of IGF-1 (target 200–350 ng/mL), fasting glucose, lipids, and anti-cancer screening recommended.

7. SIDE EFFECTS & SAFETY PROFILE

- Peripheral edema and water retention (early, often transient)
- Carpal tunnel syndrome (dose and duration dependent)
- Joint pain and arthralgia (particularly knees, shoulders)

- Muscle pain or myalgia
- Hyperglycemia and increased diabetes risk
- Thyroid dysfunction (may require increased levothyroxine)
- Increased intracranial pressure (benign intracranial hypertension)
- Breast tenderness or enlargement
- Fatigue or malaise
- Potential cancer risk with chronically elevated IGF-1 (epidemiological and mechanistic concerns)

8. CONTRAINDICATIONS & PRECAUTIONS

- Active malignancy or cancer history (absolute contraindication without oncologic clearance)
- Severe uncontrolled diabetes mellitus
- Diabetic retinopathy
- Severe untreated sleep apnea
- Critical illness or acute medical conditions
- Hypersensitivity to hGH or components
- Pregnancy or breast-feeding
- Closed epiphyses expected to remain closed (in pediatric setting)
- Severe liver or renal disease

Drug Interactions

hGH antagonizes insulin action; insulin requirements may increase significantly in diabetics. Concurrent anabolic steroids have additive anabolic effects on lean mass but amplify IGF-1 elevation and metabolic risk. Thyroid hormone (levothyroxine) requirements often increase due to hGH-induced increased thyroid hormone clearance. Glucocorticoids (cortisol, synthetic corticosteroids) antagonize anabolic effects of hGH. Sex hormones (estrogen, testosterone) interact with hGH signaling.

9. STORAGE & HANDLING

Store lyophilized powder at 2–8°C (refrigerated), protected from light. Do not freeze lyophilized product. After reconstitution, hGH solution remains stable 14–28 days refrigerated (product-dependent); check product-specific guidelines. Pre-filled liquid pens: refrigerate until use; do not freeze. Do not use if solution appears cloudy or discolored. Mark reconstitution date on vial.

10. KEY REFERENCES

1. Rudman, D., et al. (1990). "Effects of Human Growth Hormone in Men Over 60 Years Old." New England Journal of Medicine, 323(1), 1–6.

2. Sattler, F.R., et al. (2002). "Growth Hormone in the Aging Male." Best Practice & Research Clinical Endocrinology & Metabolism, 13(1), 133–157.

3. Blackman, M.R., et al. (2002). "Growth Hormone and Aging." New England Journal of Medicine, 346(12), 926–934.

4. Pollak, M. (2008). "Insulin and Insulin-Like Growth Factor Signalling in Neoplasia." Nature Reviews Cancer, 8(12), 915–928.

5. Colao, A., et al. (2018). "Acromegaly and Cancer: An Updated Review." Journal of Clinical Endocrinology & Metabolism, 103(7), 2651–2665.