

Growth Hormone Abuse And Detection In Athletes

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Recombinant human growth hormone (rhGH) is a popular hormone of abuse for performance enhancement with athletes. It is developed through recombinant technology, using E. coli bacteria and human DNA to generate the hormone, reducing the immunogenicity of the hormone. It is difficult to differentiate endogenous and exogenous hormone in toxicology testing because the hormone that is generated in vitro is cloned from human DNA. Growth hormone is a powerful anabolic hormone that affects all body systems and stimulates muscle growth by promoting muscle protein synthesis and inhibiting protein breakdown. Natural (endogenous) growth hormone is secreted by the pituitary gland and has anabolic growth promoting activity. Growth hormone concentrations have been correlated to exercise volume and intensity. Growth hormone aids in recovery, allowing the athlete to have more frequent intense workouts. Blood levels are variable and dependent on factors such as age, sex, and body composition in level of fitness. Growth hormone is released cyclically throughout the day from the anterior pituitary in response to a variety of stimuli including exercise, sleep, stress, and the administration of a variety of drugs and amino acids. There has been an increased availability of rhGH for the medically necessary treatment of growth hormone deficient patients. Due to the potential performance enhancing effects of growth hormone and the difficulties in detecting its use, rhGH has become a become an abused drug in sports and continues to be a problem.



Studies have evaluated the reported claims of growth hormone, they have concluded that there is no evidence of benefit from rhGH use in people that are not deficient in growth hormone.

Administration of rhGH to normal animals does lead to muscle hypertrophy, but this muscular growth is not accompanied by increased strength. Although there is no scientific evidence documenting an improvement in athletic performance following growth hormone supplement, it is reported that this practice is becoming more widespread among athletes wishing to avoid detection with current developing control measures. There are anecdotal reports that athletes are injecting cadaveric or biosynthetic forms of growth hormone, both of which are associated with potentially serious complications. In addition, some athletes are ingesting drugs and amino acids in the belief that their endogenous growth hormone secretions will be increased. There have been no scientific studies to the fact of growth hormone supplementation, while others report no change. Despite the lack of valid evidence for its efficacy, and its potentially serious side effects, it has been predicted that growth hormone use may continue to increase. Growth hormone use and abuse has the potential to dramatically change the future conduct of athletics and may prove to be of threat to the concept of fair competition.

Growth hormone isoform and biomarker tests are currently available for the detection of growth hormone abuse in sports, however both methods suffer from shortcomings. Analyzing for plasma biomarker proteins is an approach to detect any rhGH use. With the use of rhGH there is an increase in plasma proteins that can be directly attributed to the use of rhGH. Immunoassays are used for presumptive testing. If cutoffs are reached with immunoassays, then liquid chromatography and mass-spectrometry/mass-spectrometry (LC-MS/MS) analysis can be used to detect and validate the concentration of these biomarkers. Insulin-like growth factor 1 (IGF-1) increases with the use of rhGH. When IGF-1 increases, there is an increase in detectable biomarkers fibronectin 1 (FN1) and RAB31 genes and proteins. Testing for an increase in these gene expressions and proteins has been determined to be a reliable indicator of rhGH use.

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