



## WHAT ARE PIEDS?

Performance and Image Enhancing Drugs (PIEDs) are a range of substances often used in association with anabolic-androgenic steroids (AAS). People may choose to use PIEDs for a variety of reasons including water loss, strength gain, endurance and muscle mass. They may also be used to counteract the adverse effects of AAS use. Although there appears to be an increasing number of AAS users using these substances, there is little scientific evidence to support their use to enhance performance or image.

This booklet aims to give information on what are believed to be the most commonly used PIEDs in Australia, their perceived benefits and associated harms. These include:

- **Insulin**
- **Human Growth Hormone (hGH)**
- **Insulin-Like Growth Factor (IGF-1)**
- **Clenbuterol**
- **Creatine Monohydrate**
- **Human Chorionic Gonadotrophin (hCG)**
- **Erythropoietin (EPO)**





## **INSULIN**

Insulin is a naturally occurring hormone that is secreted by the cells of the pancreas in response to high blood sugar levels. When blood sugar is high, insulin is released to reduce glucose levels in the body and prevent the liver from releasing more glucose. Insulin plays a role in the metabolism of carbohydrates, fats and proteins.

Insulin is normally prescribed for the treatment of diabetes, and is administered to assist in the regulation of blood sugar.

Insulin is banned for non-medical purposes under the Olympic Movement's World Anti-Doping Code Prohibited Classes of Substances and Prohibited Methods. The legitimate use of insulin in sport to treat insulin dependent diabetes requires a therapeutic use exemption from a recognised therapeutic use exemption committee.

### **What are the perceived benefits?**

Insulin may be illegally used in conjunction with anabolic steroids in an attempt to increase muscle growth and definition. Body builders use it in the belief it will enhance the storage of greater amounts of carbohydrates and amino acids inside muscle cells.

### **What are the side effects and potential harms?**

It is debatable whether the perceived benefits can be achieved. The chances of harmful side effects are great and possibly fatal. Insulin is a potentially dangerous drug. Its use can cause low blood sugar (hypoglycaemia) which may cause shaking, nausea, weakness, shortness of breath, drowsiness, coma, brain damage and death.



## **HUMAN GROWTH HORMONE (hGH)**

hGH is a naturally occurring hormone produced by the pituitary gland and is one of the most important hormones influencing growth and development in humans.

hGH plays a major role in normal growth from birth to adulthood. It stimulates the liver and other tissues to secrete insulin-like growth factor (IGF-1). IGF-1 stimulates production of cartilage cells, resulting in bone growth and also plays a key role in muscle growth.

Low hGH levels in children and teenagers can result in dwarfism. Excessive hGH secretion in children (which is extremely rare and usually resulting from a tumour of the pituitary gland) can result in gigantism. In adults, some conditions (such as tumours) may cause excess secretion of hGH after puberty, and while this has little effect on skeletal growth, it can result in a condition known as acromegaly (abnormal growth of bones of the hands, feet and face).

It is illegal to use hGH without a prescription in all parts of Australia. hGH is banned under the Olympic Movement's World Anti-Doping Code Prohibited Classes of Substances and Prohibited Methods.

### **What are the perceived benefits?**

The reported benefits of hGH include: the reversal of common diseases associated with ageing, improved brain activity and function, strengthening connective tissue which reduces the probability of injury, weight loss without any loss in lean mass, reduction of wrinkles by rejuvenating the skin, increasing energy levels and brightening mood, promotion of muscle growth, improved libido, improved lung function, immune system support and thymus function, and the ability to produce more individual muscle cells.

## What are the side effects and potential harms?

One of the most common side effects of hGH misuse is acromegaly. The onset of this disorder begins with an overgrowth of bone and connective tissue that leads to a change in facial appearance, such as a protruding jaw and eyebrow bones. Acromegaly can also lead to abnormal growth of the hands and feet, and a shortened life expectancy.

Other reported side effects include:

- **Hypoglycaemia (low blood sugar, risk of diabetic coma)**
- **Glucose intolerance/diabetes mellitus (high blood sugar)**
- **Inadequate thyroid function**
- **Acromegaly (irreversible)**
- **Heart enlargement (may be irreversible)**
- **Heart damage**
- **High blood pressure**
- **Premature ageing and death (especially in the case of acromegaly)**
- **Water retention**
- **Thickening of the skin**
- **Abnormal hair growth (hirsutism)**
- **Liver damage**
- **Impotence**

Many of the effects from long-term administration of this drug are irreversible. Some of the effects can induce life-threatening conditions or shorten life expectancy.



# IGF-1

## **INSULIN-LIKE GROWTH FACTOR (IGF-1)**

IGF-1 is a naturally occurring growth factor or hormone that stimulates many processes in the body. It is the hormone through which human growth hormone (hGH) exerts most of its growth promoting effects.

IGF-1's chemical structure is similar to that of insulin, so in very high quantities it can produce the same effects as insulin (such as low blood sugar, or 'hypoglycaemia').

IGF-1 is legitimately produced for research purposes and is used by pharmaceutical companies to stimulate cell growth in cell cultures. Some overseas pharmaceutical companies have also been trialing the use of IGF-1 for human therapeutic purposes, however some clinical trials have been discontinued because of significant side effects.

It is illegal to use IGF-1 without a prescription in Australia. IGF-1 is banned under the Olympic Movement's World Anti-Doping Code Prohibited Classes of Substances and Prohibited Methods.

### **What are the perceived benefits?**

It has been reported that some athletes use IGF-1 in an attempt to increase muscle bulk, reduce muscle cell breakdown and reduce body fat in the belief it will have the same effects as insulin in insulin-dependent diabetics.

IGF-1 is being used alone and in conjunction with other substances to promote the growth of skeletal muscle ('anabolic effects') and to reduce body fat ('catabolic effects').



# Clenbuterol

## **CLENBUTEROL**

Clenbuterol is classed as a 'beta-2 agonist' and its short-term effects are similar to stimulant drugs like amphetamine or ephedrine (i.e. increases heart rate, temperature, perspiration and blood pressure).

The main therapeutic use of clenbuterol is in the treatment of asthma to relax the smooth muscle in the airways. Clenbuterol is also used as a bronchiodilator in veterinary medicine.

Clenbuterol produced for human consumption is generally in tablet form. The most common veterinary preparation is a syrup.

Clenbuterol is not approved for human use in Australia and is also banned under the Olympic Movement's World Anti-Doping Code Prohibited Classes of Substances and Prohibited Methods.

### **What are the perceived benefits?**

Clenbuterol is being used alone and in conjunction with other substances to promote the growth of skeletal muscle ('anabolic effects') and to reduce body fat ('catabolic effects').

Body builders and athletes most often utilise clenbuterol as a 'fat burner' to 'define' muscles (i.e. for its 'catabolic effect'). Clenbuterol has the ability to slightly increase the body's core temperature and metabolism, which users believe assists in the burning of calories. The body will fight this effect however, so clenbuterol may only have an effect over a limited time period.





# Creatine

## CREATINE MONOHYDRATE

Creatine is a naturally occurring compound synthesised from amino acids by the kidneys and liver. Creatine is also contained in foods such as meat, fish and poultry.

Creatine monohydrate is the most commonly used salt form of synthetic creatine. Creatine monohydrate is simply a molecule of creatine accompanied by a molecule of water for added stability and it is available commercially, but is classified as a nutritional supplement, not a pharmaceutical grade drug.

Creatine in its pure form is permitted in sport. It is not listed under the Olympic Movement's World Anti-Doping Code Prohibited Classes of Substances and Prohibited Methods (2004).

### What are the perceived benefits?

Using supplements such as creatine monohydrate may replenish and increase the stores to delay fatigue during intense, brief exercise, as well as reduce recovery time between bouts of exercise. Research in this area seems to support the theory that creatine may benefit certain athletes in certain situations.

Apart from this main benefit of 'supplying energy to the muscles', some believe that creatine can have additional effects:

- **Increasing the volume of muscles (by pulling water molecules into muscle cells)**
- **Neutralisation of lactic acid build-up (acting as a 'buffer')**
- **Protein-synthesis (increasing muscle mass)**

There is less evidence to support these three benefits - they are the subject of much debate at present.

## What are the side effects and potential harms?

People using creatine usually experience an immediate weight gain of 1-2 kgs, most likely due to the increase of fluid stores.

Other short-term effects of use that have been reported include:

- **Muscle cramps**
- **Tightness in muscles and muscle tears**
- **Nausea and upset stomach**
- **Diarrhoea**
- **Dehydration**

Another risk is the potential contamination of some preparations with substances other than pure creatine. As is the case with all supplements, creatine supplements are not subject to the same stringent testing as pharmaceuticals. Therefore they may contain impurities that are not listed on the label.

To date, there is no evidence that pure creatine poses immediate problems in healthy people. However, it is recommended that creatine is not used by diabetics or people with impaired kidney function.

The effects of creatine on teenagers and growing bodies are not known. The majority of studies have been on university-aged students and adult athletes. It is recommended teenagers avoid creatine supplements and stick to a healthy diet and exercise plan.





## **HUMAN CHORIONIC GONADOTROPHIN (hCG)**

hCG is a naturally occurring hormone produced in the placenta of women during pregnancy. It is important in triggering hormonal changes in women during pregnancy, embryo development and it can increase the production of natural male and female steroids (sex hormones).

Legitimate medical uses of prescribed hCG include the treatment of delayed puberty in boys (where boys do not develop secondary sexual characteristics at the normal age of 12 - 14 years old), female infertility (hCG stimulates ovulation), low sperm count (oligospermia) and undescended testes. When taken by males, hCG can stimulate the testes to produce testosterone rapidly. hCG is typically administered via an intramuscular injection.

It is illegal to use hCG without a prescription in all parts of Australia. hCG is banned for men under the Olympic Movement's World Anti-Doping Code Prohibited Classes of Substances and Prohibited Methods, but is allowed for women. hCG is not banned in female athletes because it would not lead to muscle development and might occur naturally in high levels if the athlete is pregnant.

### **What are the perceived benefits?**

Taken for non-medical purposes, hCG is generally used to complement a cycle of anabolic-androgenic steroids (AAS). Many AAS users find that using high doses of these drugs over sustained periods can actually switch off the body's natural production of testosterone.

The primary use of hCG among body builders and others is as part of post-cycle recovery, to 'kickstart' natural testosterone production following a long cycle of AAS. During long duration AAS cycles, the natural testosterone levels stay suppressed for a considerable time causing atrophy of the testes. By administering hCG, AAS users believe they can bring back the size of the testes and natural testosterone production. This is perceived as the main benefit of hCG.

## **What are the side effects and potential harms?**

Reported side effects include:

- **Abnormal enlargement of breasts in men (gynaecomastia)**
- **Over stimulation of the ovaries causing production of many ova (eggs) in women**
- **Multiple pregnancy**
- **Acne**
- **Tiredness**
- **Changes in mood**
- **Irritation in area of use**
- **Excessive fluid retention in the body tissues, resulting in swelling (oedema)**
- **Hair loss**
- **Prostate hypertrophy**





## **ERYTHROPOIETIN (EPO)**

EPO is a naturally occurring hormone produced by cells in the kidneys that regulate the production of red blood cells in bone marrow. These kidney cells are sensitive to low blood oxygen content and will release EPO when oxygen is low. EPO stimulates the bone marrow to produce more red blood cells (to increase the oxygen carrying capacity of the blood).

It is illegal to use EPO without a prescription in all parts of Australia. Use of EPO for non-medical purposes is banned under the Olympic Movement's World Anti-Doping Code Prohibited Classes of Substances and Prohibited Methods.

Unlike other PIEDs, EPO has limited or no application to enhancing body image. People are believed to be using EPO illicitly to enhance performance in elite endurance sports.

### **What are the perceived benefits?**

The use of EPO is believed to increase oxygen absorption, reduce fatigue and improve endurance by increasing the rate of red cell production. It is also believed that EPO increases the metabolism and the healing process of muscles because the extra red cells carry more oxygen and nutrients.

### **What are the side effects and potential harms?**

It is now well recognised that the uncontrolled use of EPO can be dangerous. When a doctor is considering prescribing EPO for the treatment of severe anaemia, there is a specific evaluation of the benefits and dangers of this type of treatment.

# GENERAL RISKS ASSOCIATED WITH PIEDS

## Injecting risks

While not all PIEDs are injected, for those that are there are specific risks. Injecting drugs can be a hazardous procedure with serious risk of injury and disease. Where needles, vials or other equipment are shared, there may be traces of blood, increasing the risk of transmission of blood-borne viruses (such as hepatitis or HIV).

Where the skin has not been properly cleaned, dirt or bacteria may inadvertently enter the bloodstream, carrying risk of infection, inflammation and damage to blood vessels. Injecting an unsterile substance also carries risks of infection or poisoning. In severe cases, infections from injecting can cause thrombosis, ulcers and gangrene.

Injecting into small muscle groups increases the risks of injecting into veins and nerves.

## Risks of counterfeit products

Due to the limited availability of genuine pharmaceutical products many AAS users have grown to accept the fact that many of the products available to them will be either fake or counterfeit. There also appears to be an active blackmarket in many PIEDs products. In addition to the genuine preparations available, there are counterfeits which may have few, if any, active ingredients and carry the risk of contamination. Some unsterile and dangerous counterfeits have also been reported.

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