Doping in Sports

What is Doping ?

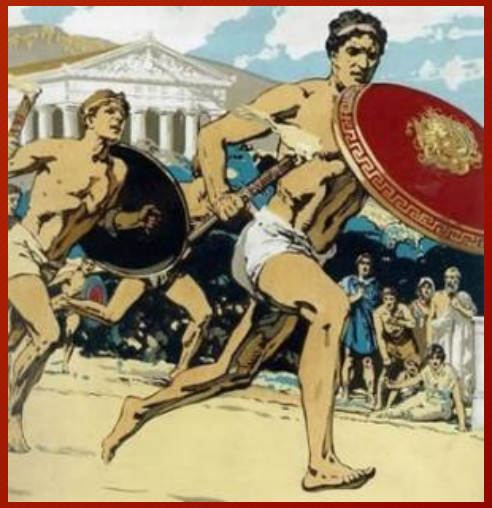
- Doping is the use of prohibited substances or prohibited methods to enhance an athlete's performance, and concealing or attempting to conceal such use. These substances and methods are prohibited under world anti-doping regulations.
- Doping causes immeasurable damage to the values, integrity and attraction of sport. In addition, taking substances and utilizing methods that have been originally developed for entirely different purposes can pose major health risks.

TUE – Therapeutic use exemption

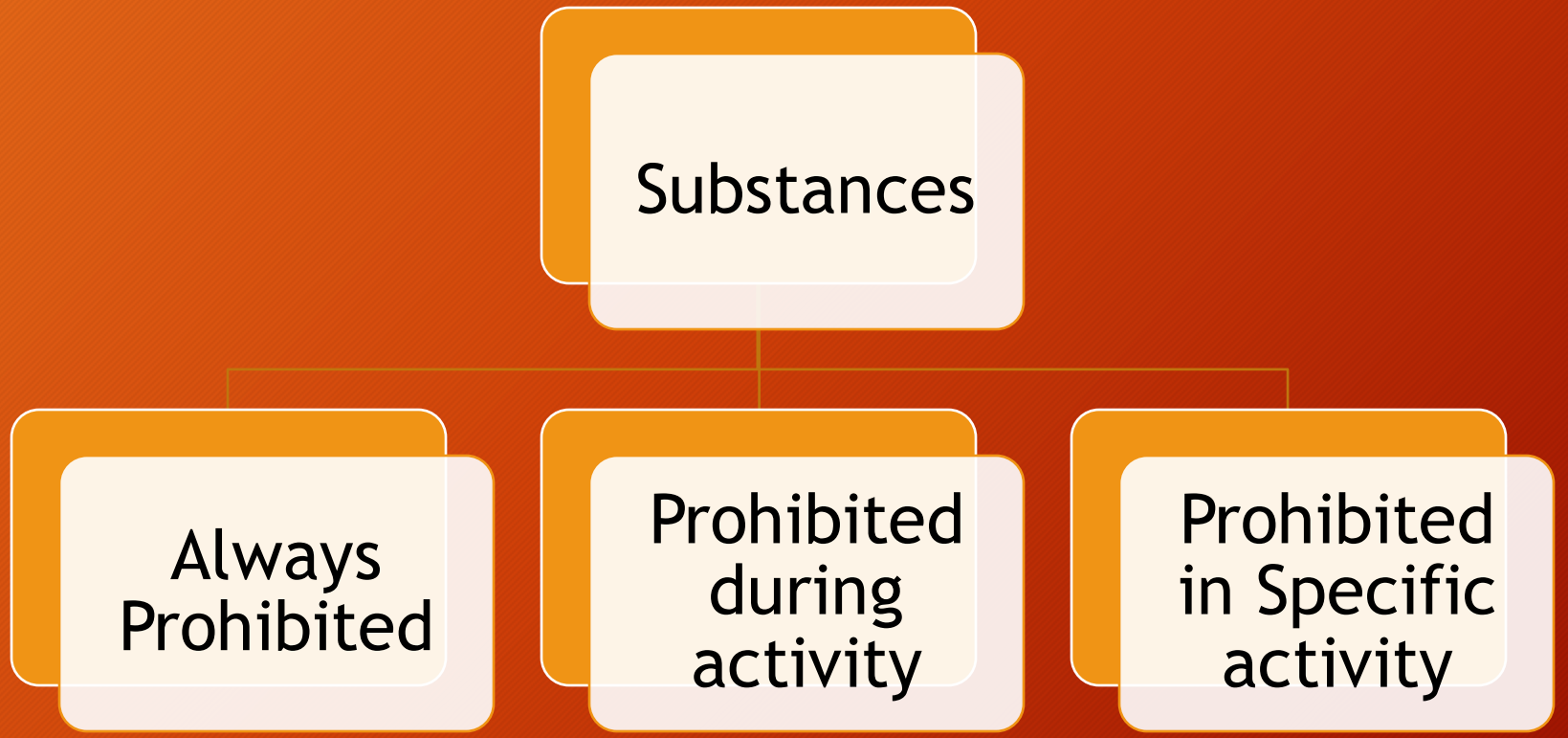
- If the medication an athlete is required to take to treat an illness or condition happens to fall under the prohibited list, a TUE may give that athlete the authorization to take the needed medication.

History of Doping

- Ancient Greeks ingested certain plants before races believing it would give them an edge in competition.
- In 1976 International Olympic Committee started widespread drug testing and penalized athletes for positive testing.
- Even with the present of more rigorous testing drug use has continued to grow among both the world's best and less elite athletes.



Classification of Substances in Doping



Why do they take them ??

- To improve performance
- Increase alertness
- Improve appearance

Methods of Doping

- Pharmacological
  - Hormonal (androgens)
  - Non-hormonal
- Non-pharmacological
  - Blood transfusion
  - Hypoxia induction
  - Gene doping

Performance enhancing drugs

- Anabolic Steroids
- Human Growth Hormone
- Narcotics
- Stimulants
- Beta Blockers
- Erythropoietin

Anabolic Steroid

- Class of steroid hormones related to the male hormone – testosterone.
- It's anabolic effect is to increase protein synthesis within cells which results in growth of muscle and this effect is dose dependent.
- Also have androgenic properties which include the development and maintenance of males characteristics.
- Have both medical and sport performance uses.
- AS have been modified many times to maximize the anabolic effects and minimize the androgenic affects.

Anabolic effects

- Promote cell growth
- Improve protein synthesis mechanism
- Bone growth and remodeling
- Increase in muscle mass
- Decreases the amount of fat

Androgenic effect

- Androgenic (virilizing) - development and maintenance of male characteristics:
- Increased growth of pubic, beard, chest and limb hair
- Enlargement of vocal cords
- Increased libido
- Enlargement of clitoris
- Suppression of natural sex hormones

Medical uses

- Bone marrow stimulation – aplastic anemia
- Growth stimulation – use GH now
- Appetite stimulation – AIDS, cancer
- Induction of male puberty – extreme delay

Administration

- Oral preparations – 17 methyl alkylated to survive acidic gastric secretions, short half life (e.g. dianabol, winstrol)
- Injectable solutions – prepared in water or oil. Longer release times for oil. (e.g. Nandrolone Decanoate)
- Patch and gel – provides steady and constant testosterone delivery (e.g. Trenbolone)
- Aerosol propellant – rapid effects, very hard to detect in drug tests.
- Sublingual preparations – absorbed directly into blood stream so avoid digestive system, rapid effects.

Common practice of use

- Cycle – period of time ranging from 1 to 4 months in which AAS user takes steroids.
- Stacking – combining 2 or more steroids.
- Pyramiding – a gradual buildup in dosage, and then tapering off at the end.

Adverse effect

- Most side effects are dose dependent;
  - Elevated blood pressure (most common)
  - Increase risk of CV disease and coronary artery disease, arrhythmias, and heart attacks (chronic use)
  - Accelerate the rate of premature baldness
  - Acne
  - Liver damage
  - Tendon rupture
  - If taken during adolescence or before, AAS may halt growth

- Mood swings
- Aggression
- Mania
- Depression
- Withdrawal
- Dependence
- Risk of mortality among chronic AS users reported to be 4.6 times higher than non-AS users.
- Rule: The bigger the dose, the bigger the muscle, the bigger the problem.

Gender Specific effects

Male

- Gynecomastia
- Testicular atrophy
- Temporary infertility

Female

- Increase in body hair
- Male-pattern baldness
- Deepening of voice (permanent)
- Enlarged clitoris (permanent)
- Temporary decrease in menstrual cycle
- Affect fetal development during pregnancy

AAS & the Gateway Phenomenon

- After AAS, over 50% used drugs such as:
  - 31% estrogen receptor inhibitors
  - 22% HCG
  - 17% diuretics and/or “uppers”
  - 15% pain killers

Testing

- Uses the testosterone / epitestosterone ratio.
- Epitestosterone is an inactive stereoisomer of testosterone, produced independently of testosterone through a different bio-synthetic pathway and it does not enhance athletic performance in any way.
- Normal value is 4:1
- Positive test result 6:1

Legal status of Anabolic Steroids

- Varies from country to country.
- IN SPOTRS:
  - National Hockey Association.
  - FIFA.
  - National basketball Association.
  - National Football League.
  - International Olympic committee.
  - The World Anti-Doping Agency (WADA) .

Human Growth Hormone

- A naturally occurring hormone in the body.
- Produced in the anterior lobe of the pituitary gland.
- Has been created through DNA technology.
- Accelerates linear growth in the skeletally immature.
- Increases body weight and muscle mass in both the mature and the skeletally immature.
- It increases lean body mass but with no increase in strength or performance.
- Mixed evidence on performance enhancement.

Administration

- IM injections.
- Dosage - A weekly dosage of 0.30 mg/kg of body weight.
- Very expensive!
  - Can be over $20,000 for an annual supply of Growth Hormone.

Side effects

- Acromegaly (abnormal enlargement of appendages)/(one of the most common effects)
- Insulin resistance (diabetes)
- Increased serum cholesterol and triglycerides
- Cardiac enlargement
- Hypogonadism (testicular shrinkage)
- Muscles may be myopathic with long term use

Narcotics

- Used by athletes during soreness to reduce fever or swelling - anti-inflammatory effect.
- Can also slow performance due to a sedative effect.
- Examples: codeine, heroin, opium, morphine.
- Produce dependence very commonly.

Stimulants

- Amphetamines
- Stimulants are known to be have both physical and cognitive performance enhancement.

Effects of stimulants

- Decrease appetite
- Increase energy
- Improve endurance
- Increase anaerobic performance
- Decrease feelings of fatigue
- Improve reaction time
- Increase concentration
- Improve working memory
- Increase alertness
- Weight loss

Adverse effects

- Headache, nausea, insomnia, anxiety, tremor, agitation, panic attacks, hypertension, tachycardia, and in some instances myocardial infarction and stroke.
- Higher doses may lead to aggressive behavior and psychosis .

Amphetamines

- Most potent ergogenic drugs in the stimulant category.
- Increase cardiac output and metabolism of free fatty acids.
- CNS stimulation: increased aggression, increased mental alertness, decreased perception of fatigue.

Adverse effects

- Heat stroke
- Addiction
- Withdrawal syndrome
- Depression
- Marked reduction of athletic performance

Beta Blockers

- Propanolol
- Physical effects of beta blockers on performance include a decrease in heart rate, a reduction of hand tremor, and temporary relief of anxiety.
- Little ergonomic potential except in sports such as shooting, archery, a where fine motor control is critical (steady hand).
- They are prohibited in these sports.
- Adverse effects: bronchospasms, CNS disturbances, hypotension, impotence.

Diuretics

- Increase the amount of urine formation and the rate at which it is excreted.
- Used in sports that require reduced weight such as:
  - Wrestling
  - Horse racing
  - Bodybuilding
  - Boxing
- Also used to mask the use of other performance enhancing drugs.

Adverse effects

- Dehydration
- Decreased circulation of blood volume
- Muscle cramps
- Renal disorders
- Dizziness
- Disrupted Heart rhythm

Erythropoietin and Blood Doping

- Use of exogenous erythropoietin (EPO) and/or blood transfusions to increase blood count (hemoglobin/hematocrit).
- This improves the availability of oxygen to the exercising muscle.
- Improves aerobic capacity and muscle endurance.
- Popular in the cyclists and other aerobic athletes.
- Not legal in any sport.
- Detection is difficult and expensive.

Adverse effect

- Bacterial infection
- Induce shock
- Hypertension
- Stroke
- May receive the wrong blood type
- Increased blood viscosity

How widespread is drug abuse in sports?

- Studies with specific sport populations (strength or endurance) report higher drug use.
- Users believed steroid used in moderation were safe.
- Likely causes of drug abuse in sports:
  - ❑Enhance sport performance
  - ❑Cope with pain and injury rehabilitation
  - ❑Weight control
  - ❑Psychological causes
  - ❑Peer pressure and acceptance

Thank You