

PERFORMANCE ENHANCING DRUGS

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DISCLOSURES

- I have no financial relationship to the content of this CPE activity
- I will be discussing many off-label uses for prescription, nonprescription, and illicit drugs.

OBJECTIVES

Pharmacists

- Summarize the anti-doping policies and testing of athletes
- Review how performance enhancing drugs affect athletic performance
- Analyze health and safety risks of using performance enhancing drugs
- Describe the effects of testosterone, peptide hormones, growth factors, steroids, beta agonists, diuretics, stimulants and blood doping on the body
- Explain the different laboratory testing and monitoring of performance enhancing drugs

Technicians

- Summarize the anti-doping policies and testing of athletes
- Review common side effects and therapeutic contraindications associated with performance enhancing drugs

PERFORMANCE ENHANCING DRUGS

- Substances taken by an athlete to improve performance
- Used to be used to refer to anabolic steroids but now other substances are involved
 - Human growth hormone
 - Stimulants
 - Diuretics
 - Others

ANTIDOPING POLICIES

- The world anti-doping code
 - Harmonizes anti-doping policies, rules and regulations with sports organizations and world public authorities
- Anti-doping rule violation (ADRV)
 - Certain consequences (or sanctions) apply to the athlete or the athlete support system

ANTI-DOPING RULE VIOLATION

- There are different types of violations
 - Presence of prohibited substance or its metabolites in an athlete's sample
 - Use or attempted use of a prohibited substance or method
 - Refusing or failing without justification to submit sample
 - Whereabouts violation (combo of 3 missed tests or filing failures within 18-month period)
 - Tampering or attempted tampering with any part of doping control
 - Possession of prohibited substances or methods
 - Trafficking or attempted trafficking in any prohibited substances or method
 - Administration or attempted administration of any prohibited method or substance or assisting, encouraging, aiding, abetting, covering up.

TESTING OF ATHLETES

- Urine and blood collection
- Athletes can be tested 365 days per year without advance notice
- Athletes are required to inform USADA of their daily regular schedule and must report changes
- Athletes can be tested at a competition "in competition" or without any advanced notice – "out of competition" testing
- They are informed by a USADA Doping control officer (DCO) or USADA chaperone

TESTING OF ATHLETES

- Urine may not be able to detect all substances
- Blood samples allow for detection of additional substances
- "Biological passport"
- Athlete selection
 - Anytime at any location
- Selection of kits
 - Athletes should inspect the kits and security of kits
- Blood collection
 - 1 tablespoon of blood
 - Seated for 20 minutes
 - Up to 3 attempts for blood draw

REASONS FOR BANNED SUBSTANCES

- World Anti-Doping Agency's Prohibited List
- Drugs that qualify for the "prohibited list"
 1. It has the potential to enhance or enhances sport performance
 2. It represents a potential or actual health risk to the athlete
 3. It violates the spirit of sport
- Therapeutic use exemptions (for surgeries, etc.)
- Not sure: phone line/online

MARIJUANA AND CANNABINOIDS

- Banned substance
 - Why does marijuana or cannabinoids qualify for performance enhancing drugs banned list
 1. Enhance performance
 1. Seemingly would impair physical activity
 2. Muscle relaxation and reduce pain post workout
 2. Health risk
 1. Respiratory, cardiac, mental health risks
 3. Spirit of the sport
 1. Negative values and ethics in sport – illegal in most countries

DIETARY SUBSTANCES

- The use of dietary substances can be risky!
 - Some athletes believe they need dietary supplements for peak athletic performance
 - Athletes need to read the label (or we can help) to determine if the substance is on the banned list
 - Example: oxilofrine = methysynephrine
 - If a company is known to produce a banned substance, any product from that company should be avoided
 - They should avoid muscle building, weight loss, sexual enhancement and energy supplements
 - Athletes need to avoid: proprietary blends, complicated-or tons of ingredient products, all natural herbal (acacia rigidula), any ingredient ending with -ol, -diol, -stene

FDA, NCAA, ANTIDOPING AGENCIES & REGULATIONS OF PERFORMANCE-ENHANCING SUPPLEMENTS

- FDA does not approve dietary supplements or validate claims of PED
- Unlabeled doping substances (i.e. amphetamines and anabolic steroids) found in 19% of vitamin & creatine supplements in voluntary testing of Olympic athletes in 2002
- More recently, compounds found:
 - Erythropoetin
 - Growth hormone
 - Insulin-like growth factor
 - Growth-hormone-releasing protein

NCAA SURVEY

- Surveyed division I, II, III levels
 - 44.5% used energy drink, 13.9% used energy booster in previous 12 months
 - 38.4% protein supplements
 - 13.8% used creatine
 - General vitamin use: 20.3%
 - Amphetamine use: 3.7%, down from 4.5% use in 2005
 - Anabolic steroid use 0.5%, down from 1.7% use in 2005
- Where are they getting them from
 - Friends, teammates, relatives

TEENS AND PROFESSIONAL ATHLETES ROLE MODELS

I cannot speak for the young men who have used steroids to enhance their athletic abilities but it is my belief that our kids did not try steroids simply because of some professional athlete. It is my opinion that they were just trying to get bigger, faster, and stronger, the easiest and fastest way they knew how. I consider their actions selfish and ill advised. In looking at all the circumstances, I believe they never felt w^hat they were doing was anybody's business, and I feel they never worried about the consequences."

-----Bobby Barnes (Head football coach at Buckeye Union High – Buckeye AZ)

TEENS AND PROFESSIONAL ATHLETE ROLE MODELS

- 3248 students grades 8-12 during homeroom or physical education class
- Approximately 20% of high school males and females suggested that professional athletes influence their decision to use steroids
- When they were asked if their friends were influenced that response went up to 50%

Hoffman et al. Medicine & Science in Sports and Exercise Study, 2008)

HIDING THE ILLEGAL SUBSTANCES

- Called it B12 injections
- Used the cream
- "The Clear"
 - Increased lean muscle mass
 - Increased strength
 - Faster recovery
 - Reduced catabolism
- Urine replacement
- Diuretics
- Tattoo needles

BALCO SCANDAL



- Bay Area Laboratory Co-operative
- Initially, Millbrae Holistic vitamin shop in Millbrae, CA
- Rogue chemist, Patrick Arnold created tetrahydrogestrinone, THG, or "The Clear"
- Special concoctions with undetectable drugs
- In 2003, a tipster (sprint coach of Marion Jones) sent a syringe with trace amounts to USADA = THG
- Retested 550 existing samples, 20 were + for THG
- As a result, MLB and NFL made league-wide policies

MILDRONATE (MELDONIUM)

- Added to the WADA (World Anti-Doping Agency) in 2015 – as a metabolic modulator
- Trimethylhydrazinium propionate chemical name
- Not available in the US or in the European Union – it was grandfathered in Latvia, legal in Russia
- Originally created for ischemic heart disease

MILDRONATE (MELDONIUM)

- Increase in endurance in athletic performance
- Improved rehabilitation after exercise, Protection against stress, enhanced activations of CNS
- All published studies except one are in Russian
- Supposedly no side effects reported in most of these studies; however, in 8 healthy volunteer, almost all reported insomnia, 1/2 burping, and 1/4 dreaminess
- No clinical studies on athletic performance

JUST SINCE JANUARY 2016...

name	Country	sports	where	loomequenceseason
Maria Sharapova	Russia	Tennis	2016 Australian Open	Provisionally suspended
Semion Elistratov	Russia	Short track speed skating		Unknown
Pavel Kulzhnikov	Russia	Speed skating	2016 World Sprint Speed Skating Championships -- Men	Unknown
Alexander Markin	Russia	Volleyball		Unknown
Edouard Vagnerov	Russia	Cycling	January 14, 2016	Unknown
Ekaterina Bobrova	Russia	Figure skating	2016 European Figure Skating Championships	Unknown
Edvard Lalygov	Russia	Biathlon		Provisionally suspended
Olya Abramova	Ukraine	Biathlon		Unknown
Artem Tyshchenko	Ukraine	Biathlon		Unknown
Davit Modzhanashvili	Georgia	Wrestling		Unknown
Janaína Konezashvili	Russia	Short track speed skating		Unknown
Abeba Aregawi	Sweden	Athletics		Unknown
Endeshaw Negesse	Ethiopia	Athletics		Unknown
Alexey Mikhaltsov	Russia	Rugby sevens		Unknown
Alena Mihaltsova	Russia	Rugby sevens		Unknown
Natalia Lapi	Ukraine	Athletics		Unknown
Yuliya Votkova	Russia	Swimming		Unknown
Nadezhda Sergeeva	Russia	Bobsleigh	2 out of competition tests - February 15 & 24	Unknown
Nadezhda Kotlyarova	Russia	Athletics		Unknown
Andrey Minschulin	Russia	Athletics		Unknown
Gulshat Fazletdinova	Russia	Athletics		Unknown
Olya Ivok	Russia	Athletics		Unknown
Sergei Semenov	Russia	Wrestling		Unknown
Evgeny Saleev	Russia	Wrestling		Unknown

1. Summary

1.1 This case involves Mr. Reed's second anti-doping violation. His first violation was the result of testing positive for a steroid he obtained from an over the counter product purchased at a vitamin supplement store. The American Arbitration Associated Panel hearing his first case determined that Mr. Reed's positive test was inadvertent and he did not intend to cheat.

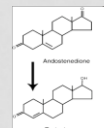
1.2 In this second violation, Mr. Reed tested positive for metabolites of Cannabinoids¹ as a result of a legitimate medical condition. His treatment with Cannabinoids is

¹ Under the WADA Code, Cannabinoids are not prohibited in out-of-competition tests.

legal under California law. Pursuant to the parties' stipulation, Mr. Reed faces the maximum of a two-year period of ineligibility for this second violation.

ANDROSTENEDIONE ("ANDRO")

- Androstenedione converted to testosterone
 - Also gets converted to estrogen
- Banned substance
- Banned in Major League Baseball June 24, 2004
- Purported uses: increase muscle strength and shorten muscle recovery time
- Side effects: acne, headaches, liver disease, kidney disease, enlarged prostate, premature baldness,
- reduced sperm count, infertility



ANDROSTENEDIONE ("ANDRO")

Table 3. Body Composition in Newtons^a

Parameter	Androstenedione Group (n = 9)			Placebo Group (n = 10)		
	Week 0	Week 4	Week 8	Week 0	Week 4	Week 8
Height, cm	176.8 (2.7)	178.0 (1.5)
Body mass, kg††	80.6 (4.1)	81.5 (4.3)	81.2 (4.2)	81.1 (5.2)	83.3 (5.1)	83.2 (4.9)
Lean body mass, kg†	61.2 (2.5)	...	64.1 (2.4)	63.1 (2.6)	...	66.0 (2.5)
Fat mass, kg†	19.3 (2.9)	...	17.1 (3.4)	18.0 (2.9)	...	17.2 (2.9)
Body fat, %†	23.5 (2.4)	...	20.3 (3.0)	21.3 (1.9)	...	19.9 (2.1)
Circumferences, cm						
Biceps*††	31.9 (0.8)	32.2 (0.9)	32.4 (0.8)	32.6 (1.4)	33.2 (1.4)	33.4 (1.3)
Shoulder††	119.3 (1.3)	120.3 (1.6)	121.1 (1.4)	120.3 (3.4)	120.2 (3.5)	120.7 (3.3)
Chest††	99.6 (2.0)	99.1 (1.9)	99.2 (1.9)	98.0 (3.8)	99.9 (3.8)	100.9 (3.4)
Abdomen*††	89.5 (5.2)	88.3 (5.1)	87.7 (5.1)	87.2 (3.8)	86.5 (4.0)	85.9 (3.6)
Waist*†	86.6 (4.2)	84.6 (3.6)	83.7 (3.6)	84.9 (3.9)	83.6 (3.9)	83.7 (3.7)
Hips*††	91.3 (3.5)	89.4 (3.9)	88.1 (3.7)	89.2 (2.5)	87.7 (2.1)	86.7 (2.3)
Gluteal*††	101.7 (3.1)	98.9 (3.4)	98.2 (3.1)	100.4 (2.5)	98.6 (2.5)	97.4 (2.3)
Thigh	54.2 (1.3)	54.7 (1.9)	54.4 (1.8)	54.7 (1.2)	55.1 (1.4)	55.1 (1.5)
Calf	37.8 (0.7)	37.8 (0.9)	37.6 (0.8)	37.4 (1.7)	38.4 (0.9)	38.6 (0.9)

^aValues are mean (SEM). Hipses indicate parameter not measured at this point. Week 4 was significantly different from week 0 (main effect, $P < .05$).
[†]Week 8 was significantly different from week 0 (main effect, $P < .05$).
^{††}Week 8 was significantly different from week 4 (main effect, $P < .05$).

King DS. Effect of Oral Androstenedione on Serum Testosterone and Adaptations to Resistance Training in Young Men JAMA 1999;281:21:2020-2028

TESTOSTERONE

- Used to treat testosterone deficiency in males
 - Sometimes used for osteoporosis, depression/anxiety
- Aids in building muscle, reducing fat, increasing strength, increasing bone density
- Side effects: enlarged prostate, high blood pressure, liver damage, testicular atrophy, sexual dysfunction, acne, mood swings, fluid retention

ERYTHROPOETIN AND BLOOD DOPING

- Erythropoetin is a protein hormone produced by the kidney
- Binds with receptors in the bone marrow and stimulates red blood cells
- Blood doping is artificially increasing the amount of red blood cells in the body to improve athletic performance
- Athletes can donate their blood for their own use later or transfuse with another person's
- Increased risk of heart attack, stroke or blood clot

HCG AND HGH

- Human chorionic gonadotropin (HCG)
 - Used in conjunction with cycles of anabolic steroids to maintain levels of testosterone after steroids cause the body to shut down testosterone production
 - May help restore testicular size after steroid cycles
 - Side effects: soreness, acne, headaches, depression
- Human growth hormone (HGH)
 - Reduce body fat and increase lean muscle mass, speed recovery from injury, resist injury
 - Side effects: joint pain, carpal tunnel syndrome, diabetes, hypertension

BETA AGONISTS

- Banned: all beta-2 agonists except formoterol, salbutamol, terbutaline all via inhalation
- Purported pros
 - Aerobic exercise improvement
 - Fat reduction
 - Muscle growth
- Purported cons
 - Anxiety, arrhythmias, dizziness, headache, insomnia, mood disorders, muscle cramps

DIURETICS

- Used for htn, kidney disease, heart failure
- Used for weight loss
 - Can result in potassium depletion could result in death
- May prevent detection of banned substances
- Produce urine excretion of banned substance
- Adverse effects: blood pressure drops, cramps, dehydration, headaches, nausea

STIMULANTS

- To increase energy and alertness and to lose weight by speeding up metabolism
 - Ephedra
 - Benzoyllecgonine (metabolite of cocaine)
- Adverse effects: nausea, hypertension, dizziness, shortness of breath, insomnia, loss of appetite

SUMMARY/CONCLUSION

- Performance enhancing drugs have effects that have the potential to drastically change the human body
 - This may improve athletic performance
- Performance enhancing drugs may be dangerous or deadly
- Scandals, cheating, cover-ups, agencies to monitor, sudden death of athletes, peak athletic performance, amazing sport achievements