TESTOSTERONA E HORMÔNIO DO CRESCIMENTO
Hormônio do Crescimento
NFL faces battle with Wada over transparency of drug-testing

- NFL hopes policy will be more open in future
- Twenty-six players were suspended in 2012

Van Miller, of the Denver Broncos, has been suspended for six games of the NFL season. Photograph: Jack Dempsey/AP
TESTOSTERONE
Accepted Manuscript

History and epidemiology of anabolic androgens in athletes and non-athletes

Gen Kanayama, M.D., PhD, Harrison G. Pope, Jr., M.D

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DOI: 10.1016/j.mce.2017.02.039
Reference: MCE 9866

To appear in: Molecular and Cellular Endocrinology
1935 - Testosterone first isolated by David et al.

1940's - Widespread use of testosterone and other AAS to treat the "male climacteric" and various medical conditions

1962 - Mr. Olympia bodybuilding contest premieres

1970's - Widespread dissemination of AAS throughout elite sports


1930 - Ruszkis and Butenandt - 1939

1940 - Russians use AAS for weightlifting

1950 - Championships in Vienna

1960 - International Olympic Committee first bans AAS and performs drug testing at Munich games

1970 - American College of Sports Medicine publishes position paper stating that AAS are ineffective for muscle gains

1980 - Present - Testing positive for synthetic testosterone

2007 - Operation Raw Deal: DEA seizes 11.4 million dosage units of AAS in largest seizure ever

2008-present - News stories regarding use of AAS by military and by private security contractors in Iraq and Afghanistan

2009-present - News stories regarding use of AAS by law enforcement officers in many U.S. cities

2012 - Lance Armstrong retroactively stripped of his titles

2010 - Mitchell report on AAS use in Major League Baseball generates widespread publicity

WADA Code amended - 2009

Norwegian terrorist Anders Behring Breivik - 2011

Describes use of steroids in preparation and execution of mass murder of 77 people
HIPERTROFIA MUSCULAR

FORÇA, POTÊNCIA

TEMPO DE REAÇÃO

AGRESSIVIDADE

PERFORMANCE

VONTADE E IMPULSIVIDADE
Sist. Endócrino
• ↓ libido
• ↓ Fertilidade
• ↓ LH e FSH
• Metabolismo da glicose
• Atrofia testicular
• Disfunção erétil
• Impotência
• Hipertrofia prostática
• Prejuízo da espermatogênese
• Ginecomastia
• Hirsutismo
• Virilização
• Voz grave
• Irregularidade menstrual
• Hipertrofia clitoriana
• Redução dos seios

Sist. CV
• Dist. Metab. Lipídico
• Hipertensão
• Arritmias
• Hipertrofia de ventricular
• Cardiomiopatia
• Trombose
• IAM
• Morte súbita
Sist. Hepático e renal
- Colestase
- Icterícia
- Hepatite
- Neoplasia
- Cálculo renal
- Alt. da creatinina
- Polaciúria

Injeção
- Hematoma
- Infecção
- Fibrose
- Lesão neuro-vascular
- Hepatite B e C
- Infecção por HIV
Dist. Psiquico-comportamentais
- Alt. do humor
- Agressividade
- Depressão
- Sintomas maníacos
- Alt. do sono
- Dependência
- Psicose

Pele
- Acne
- Urticária
- Estrias
- Alopécia
Sit. Musculoesquelético
- Lesão dos tendões
- Dor óssea
- Fechamento epifisário precoce

Dist. Gastro-intestinais
- Enjôo
- Vômito
- Diarréia
- Sangramento

Gerais
- Edema
- Febre
- Tremores
- Choque anafilático
Substances

- S0 Non-approved substances

Methods

- S1 Anabolic agents
- S2 Peptide hormones, growth factors, related substances and mimetics
- S3 Beta-2 agonists
- S4 Hormone and metabolic modulators
- S5 Diuretics and masking agents

ANABOLIC AGENTS

If a Substance or Method is not defined in this list, please verify with your Anti-Doping Organization.

Anabolic agents are prohibited.

1. ANABOLIC ANDROGENIC STEROIDS (AAS)

A. EXOGENOUS * AAS, INCLUDING:

- 1-androstenediol (5α-androst-1-ene-3β, 17β-diol)
- 1-androstenedione (5α-androst-1-ene-3, 17-dione)
- 1-testosterone (17β-hydroxy-5α-androst-1-en-3-one)
- 4-hydroxytestosterone (4, 17β-dihydroxyandrost-4-en-3-one)
- Bolandiol (estr-4-ene-3β, 17β-diol)
- Bolasterone
- Calusterone
<table>
<thead>
<tr>
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<th>Methods</th>
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<tr>
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<tr>
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<td>S2 Peptide hormones, growth factors, related substances and mimetics</td>
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<td>S5 Diuretics and masking agents</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Clostebol</th>
<th>Danazol (1,2)oxazolo[4',5':2,3]pregna-4-en-20-yn-17α-ol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dehydrochloroesterone (4-chloro-17β-hydroxy-17α-methylandrosta-1,4-dien-3-one)</td>
<td>Desoxymethyltestosterone (17α-methyl-5α-androst-2-en-17β-ol)</td>
</tr>
<tr>
<td>Drostanolone</td>
<td>Ethylestrenol (19-norpregna-4-en-17α-ol)</td>
</tr>
<tr>
<td>Fluoxymesterone</td>
<td>Formebolone</td>
</tr>
<tr>
<td>Furazabol (17α-methyl [1,2,5]oxadiazolo[3',4':2,3]-5α-androstan-17β-ol)</td>
<td>Gestrinone</td>
</tr>
<tr>
<td>Metandienone (17β-hydroxy-17α-methylandrosta-1,4-dien-3-one)</td>
<td>Mesterolone</td>
</tr>
<tr>
<td>Metenolone</td>
<td>Methandriol</td>
</tr>
<tr>
<td>Methasterone (17β-hydroxy-2α,17α-dimethyl-5α-androstan-3-one)</td>
<td>Methyldienolone (17β-hydroxy-17α-methylestra-4,9-dien-3-one)</td>
</tr>
<tr>
<td>Methyl-1-testosterone (17β-hydroxy-17α-methyl-5α-androst-1-en-3-one)</td>
<td>Methyltestosterone</td>
</tr>
<tr>
<td>Methyltestosterone</td>
<td>Metribolone (methyltrienolone, 17β-hydroxy-17α-methylestra-4,9,11-trien-3-one)</td>
</tr>
<tr>
<td>Mibolerone</td>
<td>Norbolethone</td>
</tr>
<tr>
<td>Norclostebol</td>
<td>Norethandrolone</td>
</tr>
<tr>
<td>Norethandrolone</td>
<td>Oxabolone</td>
</tr>
<tr>
<td>Oxandrolone</td>
<td>Oxymesterone</td>
</tr>
<tr>
<td>Oxymetholone</td>
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PROHIBITED AT ALL TIMES

Substances

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- S5 Diuretics and masking agents

Prostanozol (17β-[(10H-thioxanth-4-yl)oxy]-1'H-1,2,3-pyrazolo[3,4-d:2,3-d']-5α-androstan-17-one)
Quinbolone
Stanozolol
Stanozolol
Stenbolone
Stenbolone
tetrahydrogestrinone (17-hydroxy-18a-homo-19-nor-17α-pregn-4,9,11-trien-3-one)
Trenbolone (17β-hydroxyestr-4,9,11-trien-3-one)
and other substances with a similar chemical structure or similar biological effect(s).
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</table>

### B. ENDOGENOUS** AAS WHEN ADMINISTERED EXOGENOUSLY:

- 19-norandrostenediol (estr-4-ene-3,17-diol)
- 19-norandrostenedione (estr-4-ene-3,17-dione)
- Androstenediol (androst-5-ene-3β,17β-diol)
- Androstenedione (androst-5-ene-3,17-dione)
- Boldenone
- Boldione (androsta-1,4-diene-3,17-dione)
- Dihydrotestosterone (17β-hydroxy-5α-androstan-3-one)
- Nandrolone (19-nortestosterone)
- Prasterone (dehydroepiandrosterone, DHEA, 3β-hydroxyandrost-5-en-17-one)
- Testosterone

*Note: metabolites and isomers, including but not limited to:

- 3β-hydroxy-5α-androstan-17-one
- 5α-androst-2-ene-17-one
- 5α-androstane-3α, 17α-diol
- 5α-androstane-3α, 17β-diol
- 5α-androstane-3β, 17α-diol
### PROHIBITED AT ALL TIMES

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#### Substances
- 5α-androstane-3β,17β-diol
- 5β-androstane-3α,17β-diol
- 7α-hydroxy-DHEA
- 7β-hydroxy-DHEA
- 4-androstenediol (androst-4-ene-3β,17β-diol)
- 5-androstenedione (androst-5-ene-3,17-dione)
- 7-keto-DHEA
- 19-norandrosterone
- 19-noretiocholanolone
- Androst-4-ene-3α,17α-diol
- Androst-4-ene-3α,17β-diol
- Androst-4-ene-3β,17α-diol
- Androst-5-ene-3α,17α-diol
- Androst-5-ene-3α,17β-diol
- Androst-5-ene-3β,17α-diol
- Androsterone
- Epi-dihydrotestosterone
- Epitestosterone
- Ethiocholanolone
## PROHIBITED AT ALL TIMES

### Substances
- **S0** Non-approved substances

### Methods
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- **S3** Beta-2 agonists
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## 2. OTHER ANABOLIC AGENTS

Including, but not limited to:
- Clenbuterol
- Selective androgen receptor modulators (SARMs), e.g. andarine and ostarine;
- Tibolone
- Zeranol
- Zilpaterol

For purposes of this section:
- * “exogenous” refers to a substance which is not ordinarily produced by the body naturally.
- ** “endogenous” refers to a substance which is ordinarily produced by the body naturally.
HORMÔNIO DO CRESCIMENTO
GH
Fig. 1 The physiology of anabolic–androgenic steroids and their downstream effects. AAS anabolic–androgenic steroids, DHT dihydrotestosterone, DNA deoxyribonucleic acid, mRNA messenger ribonucleic acid.
Two Emerging Concepts for Elite Athletes
The Short-Term Effects of Testosterone and Cortisol on the Neuromuscular System and the Dose-Response Training Role of these Endogenous Hormones

Blair T. Crewther,1,2,3 Christian Cook,3,4,5 Marco Cardinale,6,7 Robert P. Weatherby2 and Tim Lowe8

1 The New Zealand Institute for Plant & Food Research Limited, Hamilton, New Zealand
2 Department of Exercise Science and Sport Management, Southern Cross University, Lismore, New South Wales, Australia
3 Hamlyn Centre, Institute of Global Health Innovation, Imperial College, London, UK
4 United Kingdom Sport Council, London, UK
5 Sport, Health and Exercise Science, Bath University, Bath, UK
6 British Olympic Medical Institute, London, UK
7 University College London, Division of Surgical and Interventional Science, London, UK
8 School of Applied Sciences, Bay of Plenty Polytechnic, Tauranga, New Zealand
Fig. 1. Summary of the dual effects of testosterone and cortisol on the neuromuscular system and the implications for human performance. PNS = peripheral nervous system.
O uso do hGH proporciona aumento significativo de vários tecidos do organismo, entre eles, o tecido muscular. O uso prolongado de quantidades excessivas do hormônio do crescimento pode produzir efeitos colaterais prejudiciais ao organismo, tais como a acromegalia (crescimento desmedido das mãos, pés, cara e de alguns órgãos), intolerância à glicose, compressão de nervos periféricos, hipertrofia cardíaca e doenças articulares. Outros efeitos a retenção de líquidos e de sódio, originando sobrecarga cardíaca, o aparecimento de diabetes e maior incidência de tumores malignos (ex: leucemias).
Por quatro anos, atleta usou hormônio de crescimento

DA REPORTAGEM LOCAL

O melhor jogador do mundo de 2009 teve muito mais dificuldade que seus antecessores para crescer, literalmente. Messi foi submetido, quando adolescente, a rigoroso tratamento para se desenvolver normalmente. Ele teve que receber por quase quatro anos injeções diárias de hormônio de crescimento -levotiroxina, que funciona no organismo como o hormônio natural da tireoide.

Nascido em Rosario, Messi começou a jogar na base do Newell's Old Boys, e foi o clube que orientou a família do craque a procurar tratamento para o seu problema. O custo do tratamento, porém, era alto: US$ 900 por mês. Quando tinha 11 anos, o River Plate chegou a mostrar interesse por Messi, mas não quis arcar com o custo do tratamento da já revelação.

Em julho de 1998, quando acabara de fazer 11 anos, consta que Messi tinha 1,32 m e 30 kg -idade óssea correspondente à de um garoto de dez anos.

O tratamento se estendeu até 2001, quando Messi já estava em Barcelona. O pai, com dificuldade para custear o pagamento do tratamento, pesou na decisão de ir para a Espanha o fato de o Barcelona auxiliar na saúde do filho. Ele teria começado a jogar no clube catalão com 1,48 m e 39 kg, mas há quem diga que não tinha 1,40 m em 2000, quando começou a sua história no time espanhol.

De todas as formas, o Barcelona recebeu uma promessa que tinha uma defasagem em sua idade óssea de um ano. "É normal pediatras recomendarem hormônio de crescimento para garotos que precisam. A substância é eliminada rapidamente do organismo, em questão nem dias, mas de horas. Por isso é difícil de pegá-la em exames.
Impact of GH administration on athletic performance in healthy young adults: A systematic review and meta-analysis of placebo-controlled trials

Kasper Hermansen\textsuperscript{a,\ast}, Mads Bengtsen\textsuperscript{a}, Michael Kjær\textsuperscript{b}, Peter Vestergaard\textsuperscript{c,d}, Jens Otto Lunde Jørgensen\textsuperscript{a}

\textsuperscript{a} Department of Endocrinology and Internal Medicine, Aarhus University Hospital, Aarhus, Denmark
\textsuperscript{b} Institute of Sports Medicine, Department of Orthopedic Surgery M, Bispebjerg Hospital and Centre for Healthy Aging, Faculty of Health and Medical Science, University of Copenhagen, Denmark
\textsuperscript{c} Department of Clinical Medicine, Aalborg University Hospital, Aalborg, Denmark
\textsuperscript{d} Department of Endocrinology, Aalborg University Hospital, Aalborg, Denmark

\section*{Article Info}

\textbf{Keywords:} GH, Athletic performance, Doping

\section*{Abstract}

\textbf{Objective:} Illicit use of growth hormone (GH) as a performance-enhancing drug among athletes is prevalent, although the evidence of such effects in healthy, young subjects is sparse. We therefore performed a meta-analysis of published studies on the effect of GH administration on body composition, substrate metabolism, and athletic performance in healthy, young subjects.

\textbf{Design:} The English-language based databases PubMed, EMBASE, and Cochrane Central Register of Controlled Trials were searched, and eligible articles were reviewed in accordance with the PRISMA guidelines. Fifty-four potentially relevant articles were retrieved of which 11 were included in this analysis comprising 254 subjects.

\textbf{Results:} Administration of GH significantly increased lean body mass ($p < 0.01$) and decreased fat mass ($p < 0.01$). In addition, GH increased the exercising levels of glycerol ($p = 0.01$) and free fatty acids ($p < 0.01$), but did not alter the respiratory quotient during exercise ($p = 0.30$). GH significantly increased anaerobic exercise capacity ($p < 0.01$) in the only study which investigated this, but did not over weeks to months improve muscle strength ($p = 0.36$) or maximum oxygen uptake ($p = 0.89$).

\textbf{Conclusion:} GH administration elicits significant changes in body composition, but does not increase either muscle strength or aerobic exercise capacity in healthy, young subjects.

\section{1. Introduction}

\section{2. Materials and methods}
Fig. 1. Flowchart of study selection.
Fig. 2. Effects of GH administration on body composition.
Fig. 3. Effects of GH administration on lipolytic markers.

Fig. 4. Effects of GH administration on strength and exercise capacity.
Percentage change in body composition variables. Data are expressed as means (95% CIs).

Percentage change in performance variables. Data are expressed as means (95% CIs).

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- S5 Diuretics and masking agents

GROWTH HORMONE (GH) AND ITS RELEASING FACTORS INCLUDING:

Growth Hormone Releasing Hormone (GHRH), and its analogues, e.g. CJC-1295, sermorelin and tesamorelin;
Growth Hormone Secretagogues (GHS), e.g. ghrelin and ghrelin mimetics, e.g. anamorelin and ipamorelin;
GH-Releasing Peptides (GHRPs), e.g. alexamorelin, GHRP-6, hexarelin, and pralmorelin (GHRP-2);

Additional prohibited growth factors:
- Fibroblast Growth Factors (FGFs)
- Hepatocyte Growth Factor (HGF)
- Insulin-like Growth Factor-1 (IGF-1), and its analogues;
- Mechano Growth Factors (MGFs)
- Platelet-Derived Growth Factor (PDGF)
- Vascular-Endothelial Growth Factor (VEGF)

and any other growth factor affecting muscle, tendon or ligament protein synthesis/degradation, vascularisation, energy utilization, regenerative capacity, or fibre type switching.
26º CONGRESSO PAN-AMERICANO DE MEDICINA DO ESPORTE

29º CONGRESSO BRASILEIRO DE MEDICINA DO ESPORTE

14 à 16 de setembro - Rio de Janeiro - Brasil

RIO. 2017

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