Στεροειδή και υπογονιμότητα

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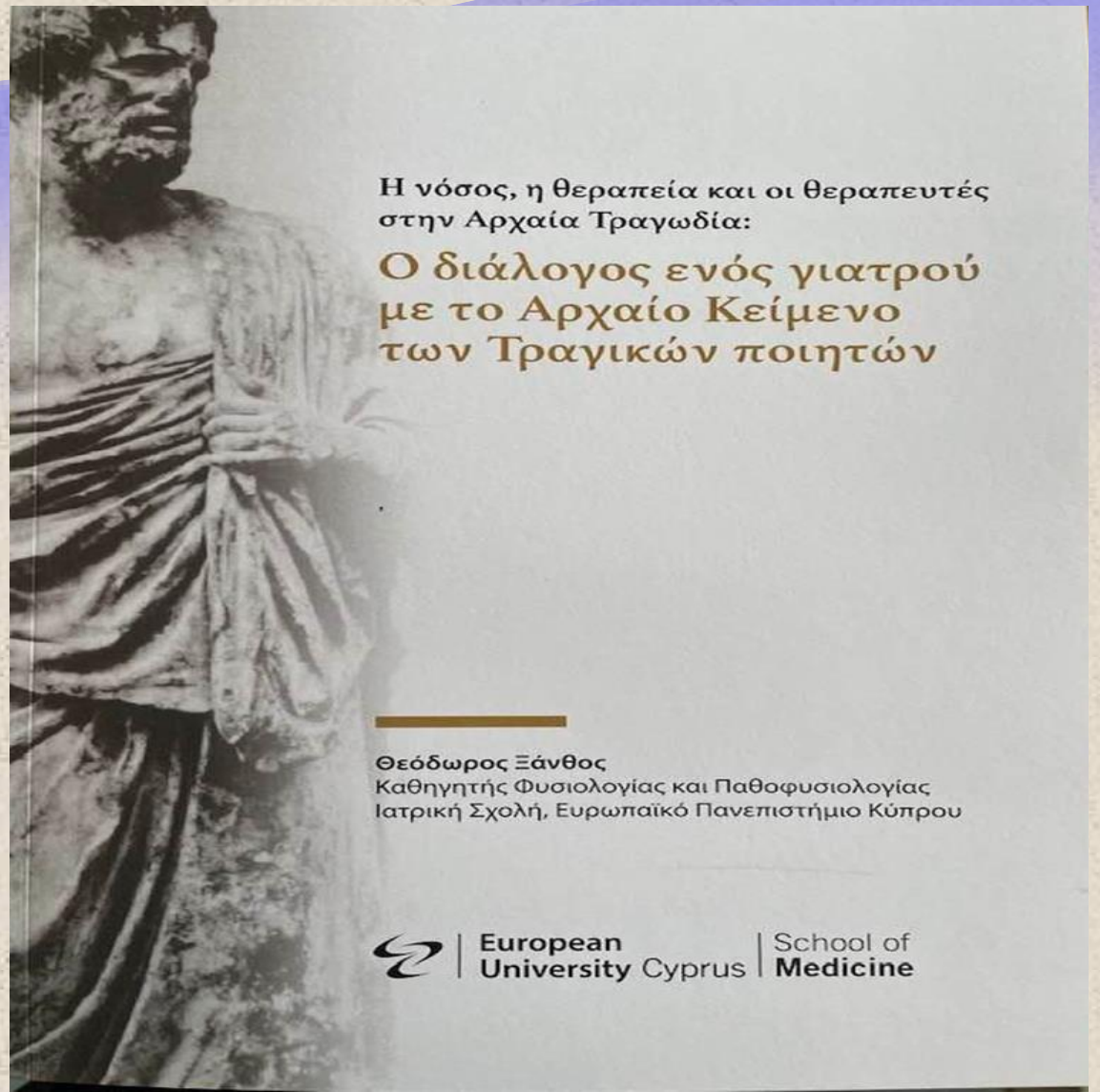
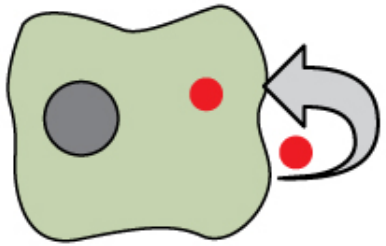
Πρόεδρος Ελληνικής Εταιρείας Καρδιοαναπνευστικής Αναζωογόνησης

Η νόσος και η Υγεία

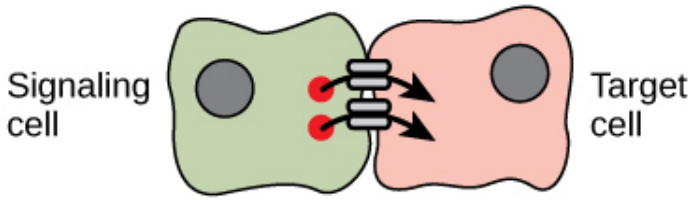


Forms of Chemical Signaling

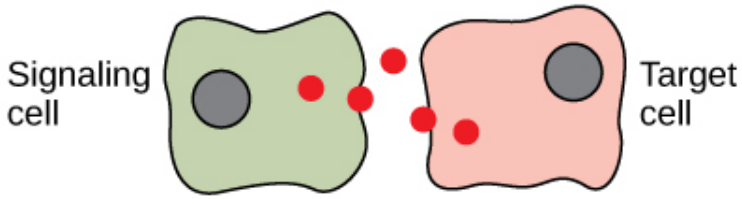
Autocrine	A cell targets itself.



Signaling across gap junctions	A cell targets a cell connected by gap junctions.



Paracrine	A cell targets a nearby cell.



Endocrine	A cell targets a distant cell through the bloodstream.

Η δράση είναι κυρίως θετική

SPECIAL COMMUNICATIONS

Με την προϋπόθεση ότι η άσκηση εκτελείται σωστά

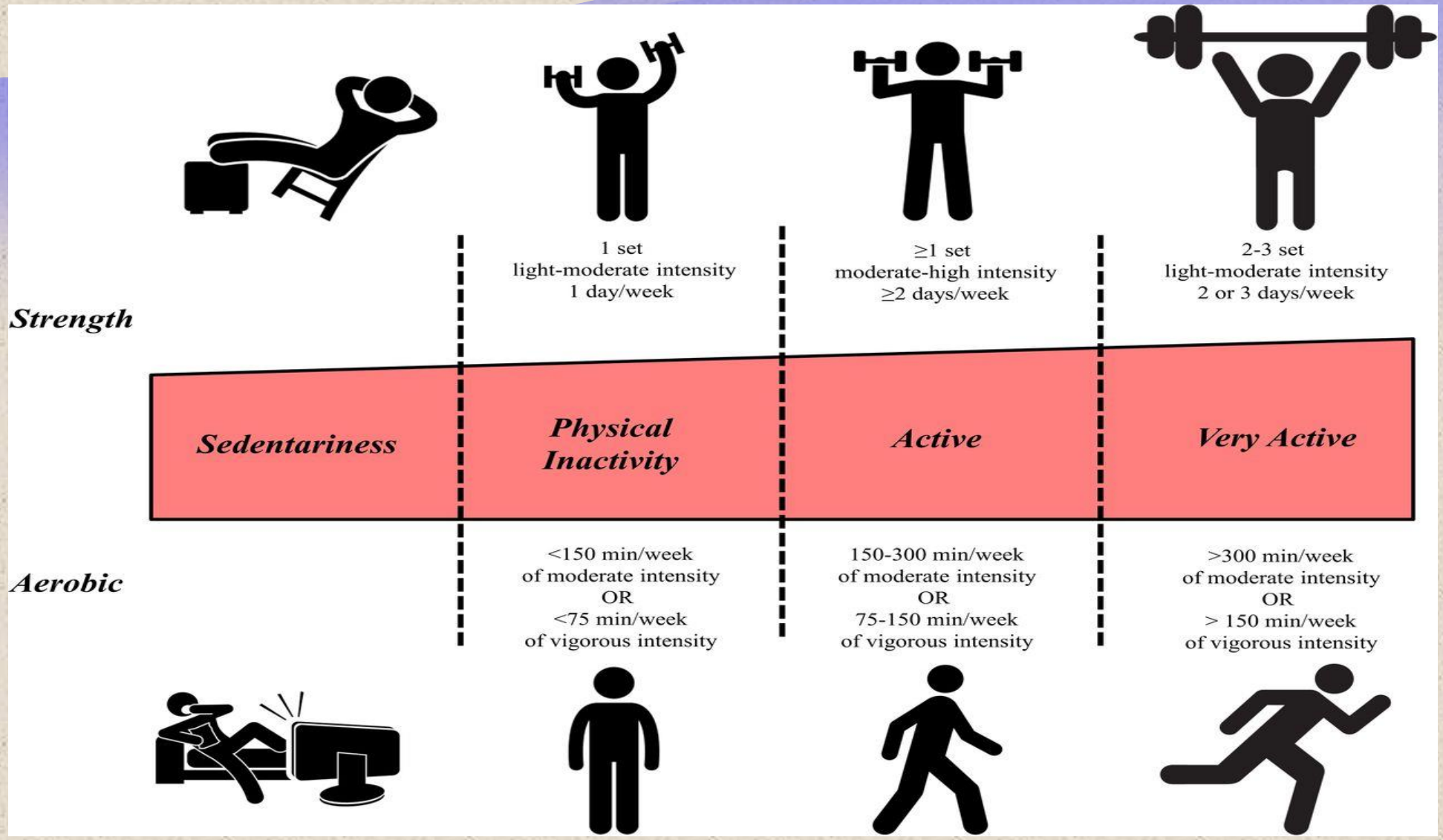
Quantity and Quality of [illegible] and Maintaining Cardiorespiratory, Musculoskeletal, and Neuromotor Fitness in Apparently Healthy Adults: Guidance for Prescribing Exercise

AMERICAN COLLEGE of SPORTS MEDICINE

POSITION STAND

This pronouncement was written for the American College of Sports Medicine by Carol Ewing Garber, Ph.D., FACSM, (Chair); Bryan Blissmer, Ph.D.; Michael R. Deschenes, Ph.D., FACSM; Barry A. Franklin, Ph.D., FACSM; Michael J. Lamonte, Ph.D., FACSM; I-Min Lee, M.D., Sc.D., FACSM; David C. Nieman, Ph.D., FACSM; and David P. Swain, Ph.D., FACSM.

Η συνήθης άσκηση έχει δόσεις



HRmax και VO2max

Zone 1 · 50-60% Max HR
Very light activity, such as warm up/cool down

Zone 2 · 61-70% Max HR
Light activity, such as slow-paced jogging, walking up a flight of stairs, lightweight low resistance

Zone 3 · 71-80% Max HR
Moderate activity that increases aerobic endurance, such as moderate jogging, cycling, or rowing

Zone 4 · 81-90% Max HR
Hard anaerobic activity, such as high rep ball slams, boxing, or heavy weight lifting

Zone 5 · 91-100% Max HR
Extremely hard maximum exertion activity, such as sprinting. All out effort!

1 SEP 1967 // https://doi.org/10.1152/jappl.1967.23.3.353

TOOLS SHARE

JOURNAL OF APPLIED PHYSIOLOGY
Vol. 23, No. 3, September 1967. *Printed in U.S.A.*

Maximal oxygen uptake in athletes[1]

BENGT SALTIN[2] AND PER-OLOF ÅSTRAND
Department of Physiology, Gymnastik-och Idrottshögskolan, Stockholm, Sweden

SALTIN, BENGT, AND PER-OLOF ÅSTRAND. *Maximal oxygen uptake in athletes.* J. Appl. Physiol. 23(3): 353–358. 1967.—During maximal running (treadmill) or bicycling the oxygen uptake was determined in 95 males and 38 female athletes belonging to Swedish National Teams. The mean maximal oxygen uptake for the 15 males with the highest values was 5.75 liters/min with an upper extreme of 6.17 liters/min. The mean maximal pulmonary ventilation was 158.7 (140.0–203.3) liters/min and the mean maximal heart rate 185 (169–200) beats/min. As a team the five cross-country skiers achieved the highest value 83 ml/kg × min (5.6 liters/min) and the highest individual value (*AR*, world champion in cross-country skiing) was 85.1 ml/kg × min (5.7 liters/min). *Subject KK* (3,000 m, 7:39.6) had 82 ml/kg × min (4.9 liters/min). The mean maximal oxygen uptake for the best 10 female athletes was 3.6 liters/min. The maximal pulmonary ventilation was 111.8 (91.6–131.0) liters/min and maximal heart rate 195 (185–204) beats/min. A description of the system for collection of expired air is also given.

maximal aerobic power; physical activity; exercise; pulmonary ventilation; heart rate

tem for collecting expired gas used in this study is therefore also given.

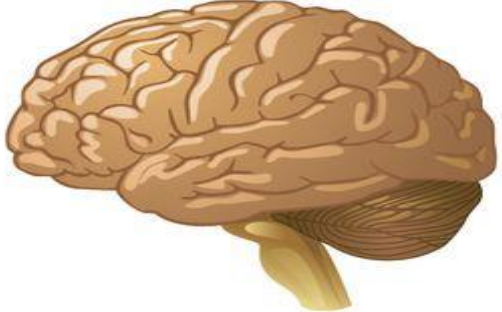
SUBJECTS

Ninety-five males and thirty-eight female subjects, 24 (range 13–47) years of age representing the Swedish National Team in 19 different sports events for the males and 9 different events for the females were studied. Many of them are European, World, or Olympic champions. Two foreign champions who have visited Stockholm for competition during the last year were also included.

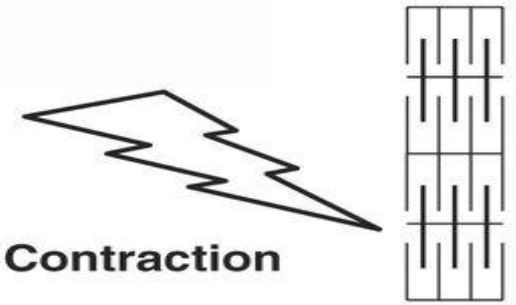
METHODS AND PROCEDURES

Oxygen uptake was determined by collection of expired air in Douglas bags and the volume measured in a spirometer. The inner area of the mouth piece was 400 mm², the inner diameters of tubes in valve, stop cock, and bag are 28 mm, and of the connecting tube (smooth, not corrugated), 35 mm. The resistance in this system with a

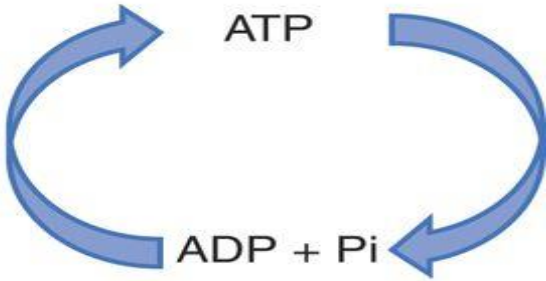
Central motor drive results in muscle contraction and feed-forward mechanism to co-ordinate endocrine response to exercise



Muscle contraction increases energy turnover



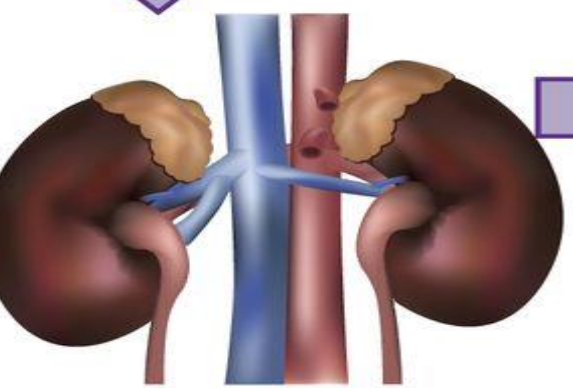
Contraction

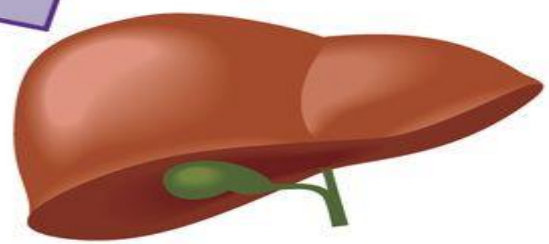


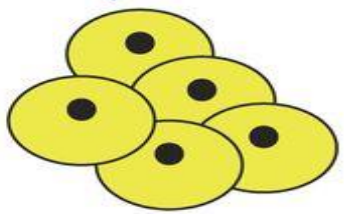
Feed-forward activation of sympathoadrenal system

Increased muscle glucose uptake utilises enhanced hepatic glucose production

Muscle contraction augments uptake of non-esterified fatty acids (NEFAs)

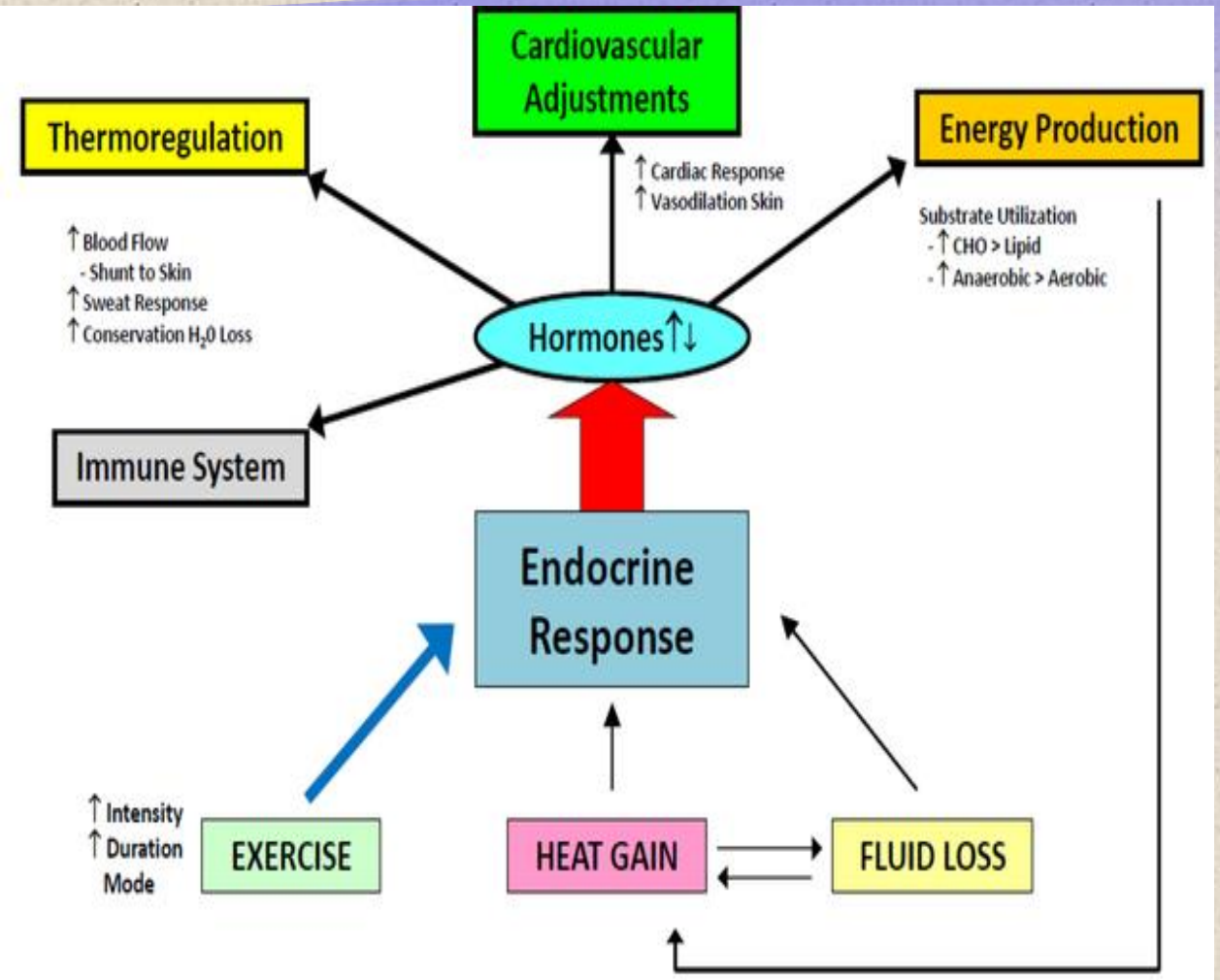






Adrenergic stimulation to mobilise hepatic glucose and adipose tissue NEFA

Το μοντέλο HERM



1. Φάση Α: Συμπαθητική διέγερση (συμβαίνει σε δευτερόλεπτα από την έναρξη της άσκησης)- Flight or Fight, έκκριση αδρεναλίνης, αναστολή έκκρισης ινσουλίνης και έκκριση γλυκαγόνου
2. Φάση Β: Συμβαίνει μετά το 1° λεπτό της άσκησης και ενεργοποιεί το σύστημα υποθάλαμος-υπόφυση και όλες τις «τροφικές» ορμόνες που δρουν σε κάθε ενδοκρινικό όργανο. Υπερέκκριση κορτιζόλης.
3. Φάση Γ: Αντιδιουρητική, αυξητική και προλακτίνη, οι «τροφικές» ορμόνες έχουν οδηγήσει σε έκκριση των ορμονών από τα όργανα στόχους, ενεργοποίηση του RAAS, και οι σκελετικοί μύες εκκρίνουν κυτταροκίνες

Table 1 Endurance and Resistance-Based Exercises Classified by Different Levels of Intensity

Category Term	Effort Perception	Relative Intensity	Energy Pathway Predominating	Representative Duration (min)	Other Terminology
Endurance exercise activities					
Light exercise	Easy	<35% VO_{2max}	Aerobic	>30	Short-term, submaximal
Moderate exercise	Modest difficulty	<70>35% VO_{2max}	Aerobic	30–180	Submaximal, prolonged
Heavy exercise	Difficult	<100>70% VO_{2max}	Aerobic–anaerobic	≤120	Submaximal, prolonged, high intensity
Maximal exercise	Strenuous	100% VO_{2max}	Aerobic–anaerobic	<15	Maximal or max, high intensity
Supramaximal exercise	Extremely strenuous	>100% VO_{2max}	Anaerobic	<1	All-out, power
Resistance exercise activities					
Submaximal exercise	Modest difficulty	<70>35% 1RM	Aerobic–anaerobic	<1	Submaximal
Maximal exercise	Extremely strenuous	~100% 1RM	Anaerobic	<0.1	All-out, power
Supramaximal exercise	Extremely strenuous	>100% 1RM	Anaerobic	≤0.1	Negatives

VO_{2max}—maximal oxygen uptake; 1RM—one repetition maximum.

Exercise and the Regulation of Endocrine Hormones

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†Department of Nutrition, Gillings School of Public Health, University of North Carolina, Chapel Hill, North Carolina, USA

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[1]Corresponding author e-mail address: ach@email.unc.edu

Table 2 Physiological Responses to an Acute Exercise Session Based upon Whether the Activity Is Predominately Endurance or Resistance Exercise

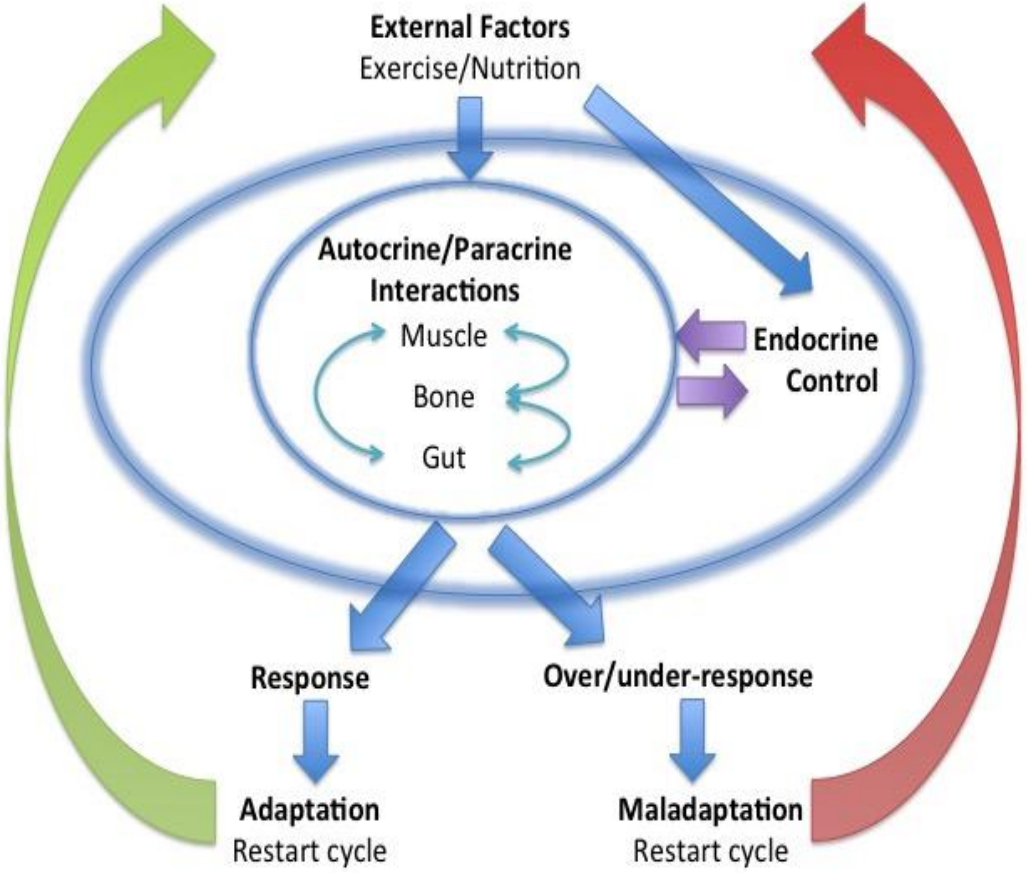
Hormone	Exercise–Activity Predominating Training Component		Mechanism of Cellular Actions (Direct Gene Activation or 2nd Messenger)
	Endurance	Resistance	
Adrenocorticotrophic hormone (ACTH)	↑	↑	2nd messenger
Aldosterone	↑	↑	Direct gene activation
Angiotensin	↑	↑	2nd messenger
Antidiuretic hormone (ADH)	↑	↑↓	2nd messenger
Cortisol	↑	↑	Direct gene activation
Dehydroepiandrosterone (DHEA)	↑	↑	Direct gene activation
β-Endorphin	↑	↑	2nd messenger
Epinephrine (adrenaline)	↑↑	↑↑	2nd messenger
Estrogens	↑	↑	Direct gene activation
Follicle-stimulating hormone (FSH)	↑↓, nc	↑↓, nc	2nd messenger
Glucagon	↑	↑	2nd messenger
Growth hormone (GH)	↑	↑	2nd messenger
Insulin	↓	↑↓, nc	2nd messenger
Insulin-like growth factor-1 (IGF-1)	↑, nc	↑, nc	2nd messenger
Leptin	↑↓, nc	↑↓, nc	2nd messenger
Luteinizing hormone (LH)	↑↓, nc	↑↓, nc	2nd Messenger
Norepinephrine (noradrenaline)	↑↑	↑↑	2nd messenger
Progesterone	↑	↑	Direct gene activation
Prolactin (PRL)	↑	↑	2nd messenger
Testosterone	↑	↑	Direct gene activation
Thyroxine (T4)	↑	↑	Direct gene activation
Triiodothyronine (T3)	↑	↑	Direct gene activation
Vitamin D	↑	?	Direct gene activation

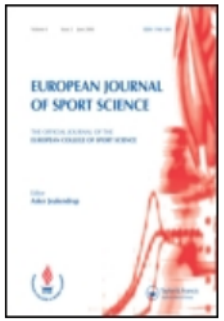
The hormone change denoted here are relative to before versus immediately after the activity.[11–14]
↑, increase; ↑↑, large increase; ↓, decrease; ↑↓, possible increase or decrease; nc, no change; ?, unresolved.

Οι ορμόνες στην άσκηση

- Αυξητική: οστά και μύες, εκκρίνεται κατά τη φάση του REM ύπνου
- Κορτιζόλη: αυξάνει τον μεταβολισμό των υδατανθράκων και των λιπών
- Ντοπαμίνη: Μειώνει τις πιθανότητες κατάθλιψης
- Σεροτονίνη: Βελτιώνει τη διάθεση, την κοινωνική συμπεριφορά, την όρεξη και την πέψη
- Τεστοστερόνη αυξάνει την μυϊκή μάζα και λίμπιντο
- Οιστρογόνα: Μειώνουν τα συμπτώματα της εμμηνόπαυσης

Προσαρμοστικοί μηχανισμοί στην άσκηση





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European Journal of Sport Science

ISSN: 1746-1391 (Print) 1536-7290 (Online) Journal homepage: http://www.tandfonline.com/loi/tejs20

Prevention, diagnosis and treatment of the Overtraining Syndrome

Romain Meeusen , Martine Duclos , Michael Gleeson , Gerard Rietjens , Jürgen Steinacker & Axel Urhausen

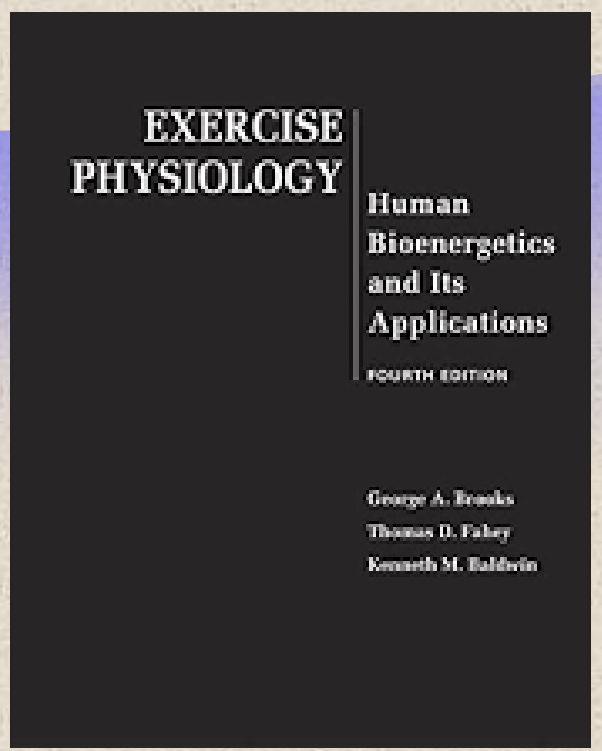
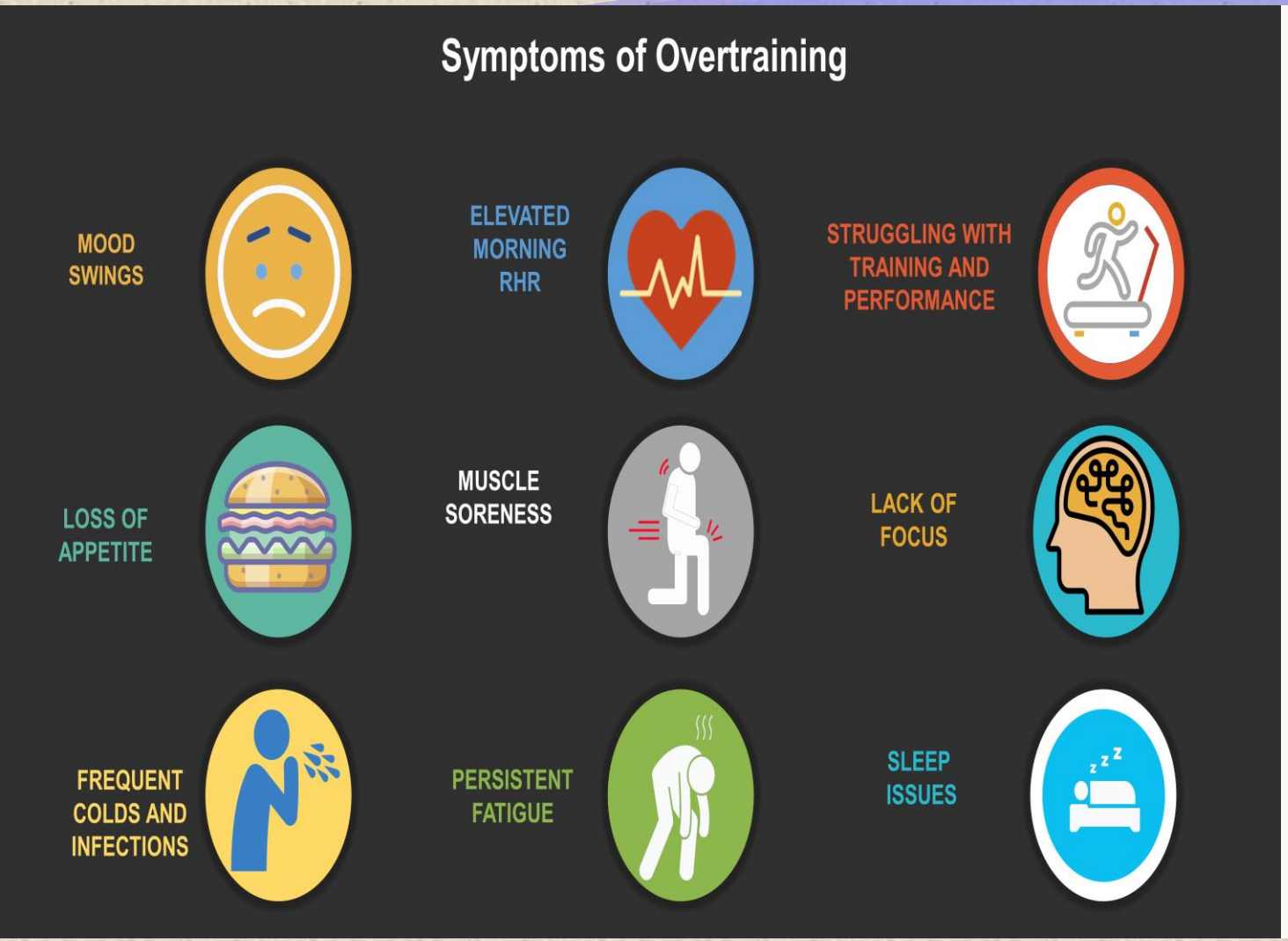
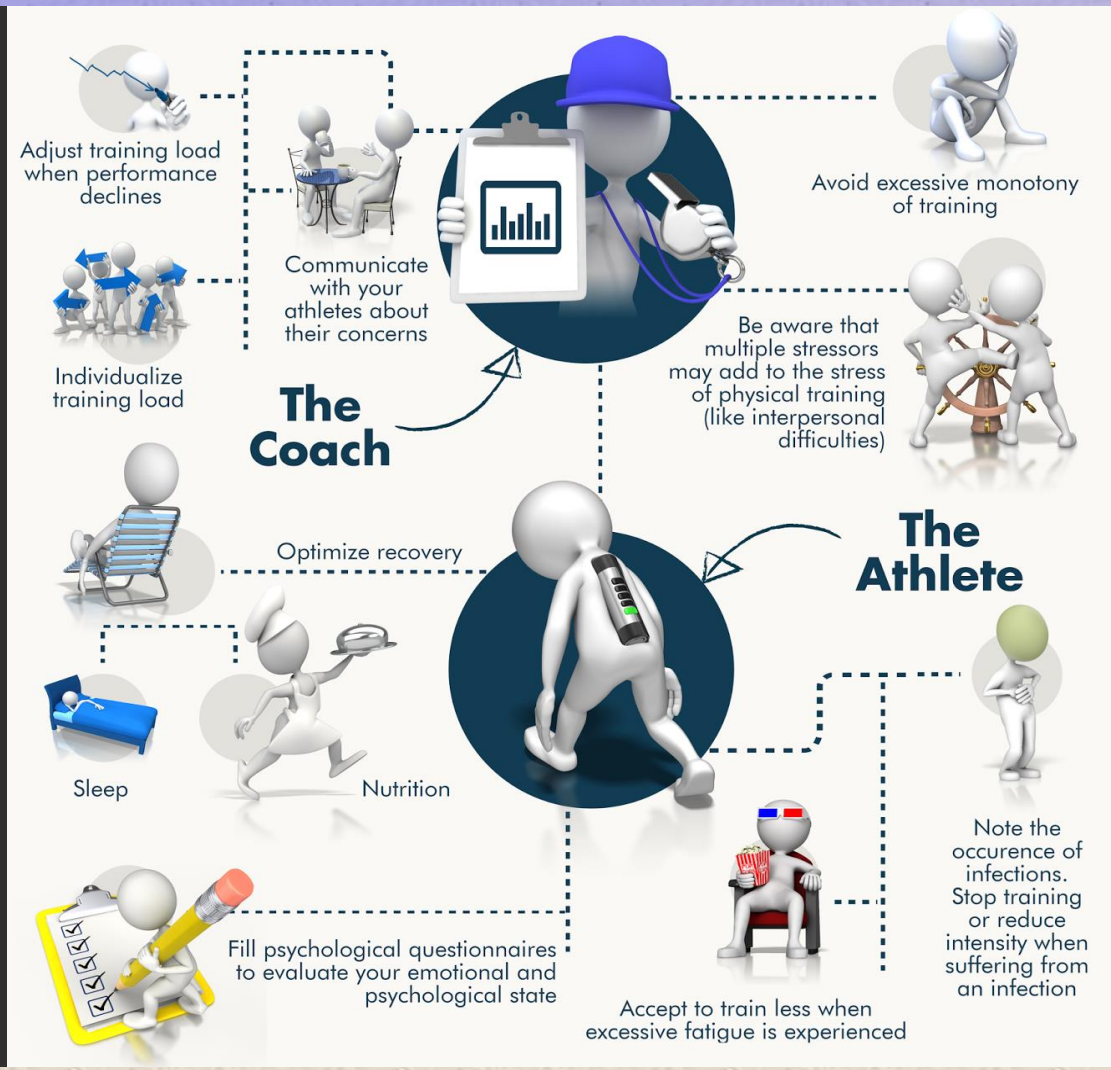


Table 3 The Major Symptoms of Overtraining Separated into Four Major Categories[2,4,25]

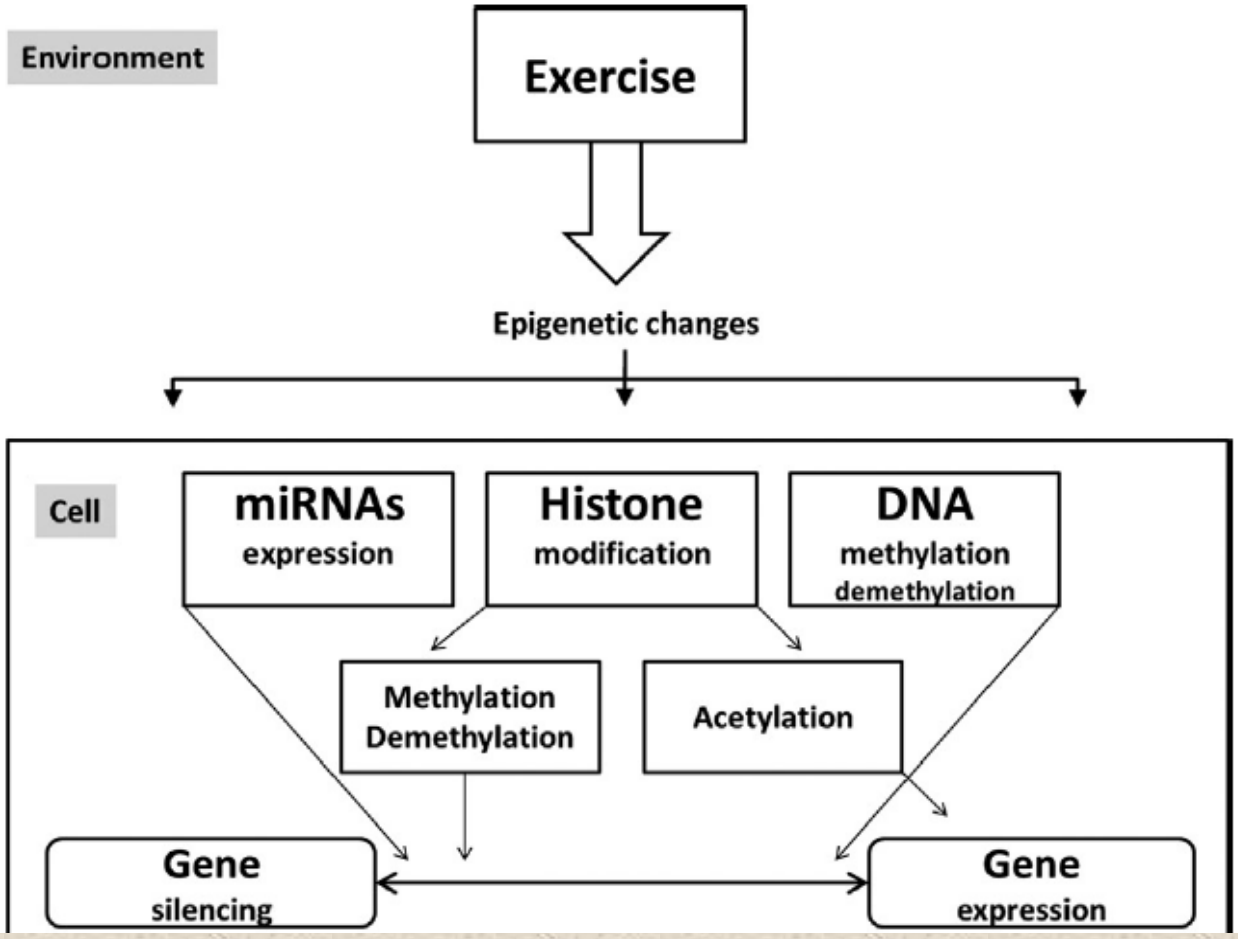
Physiological—performance	
Decreased performance	Decreased body fat
Decreased muscular strength	Increased $\dot{V}O_2$ at submaximal loads
Increased muscle soreness	Changes in heart rate (rest, exercise)
Prolonged recovery periods	Loss of appetite
Chronic fatigue	Gastrointestinal disturbances
Psychological	
Feelings of depression	General apathy
Difficulty concentrating	Emotional instability
Fear of competition	Excitation—irritability
Restlessness—loss of sleep	Anorexic behavior
Immunological dysfunction	
Increased susceptibility to infection	Increased severity of minor infections
Decreased functional activity of neutrophils	Decreased total lymphocyte counts
Reduced response to mitogens	Decreased production of immunoglobulin
Biochemical alterations	
Decreased hemoglobin	Negative nitrogen balance
Increased urea levels	Decreased free testosterone levels
Decreased ratio of free testosterone to cortisol ratio of more than 30%	Elevated cortisol levels

Το σύνδρομο της υπερβολικής άσκησης





Επιγενετική και άσκηση



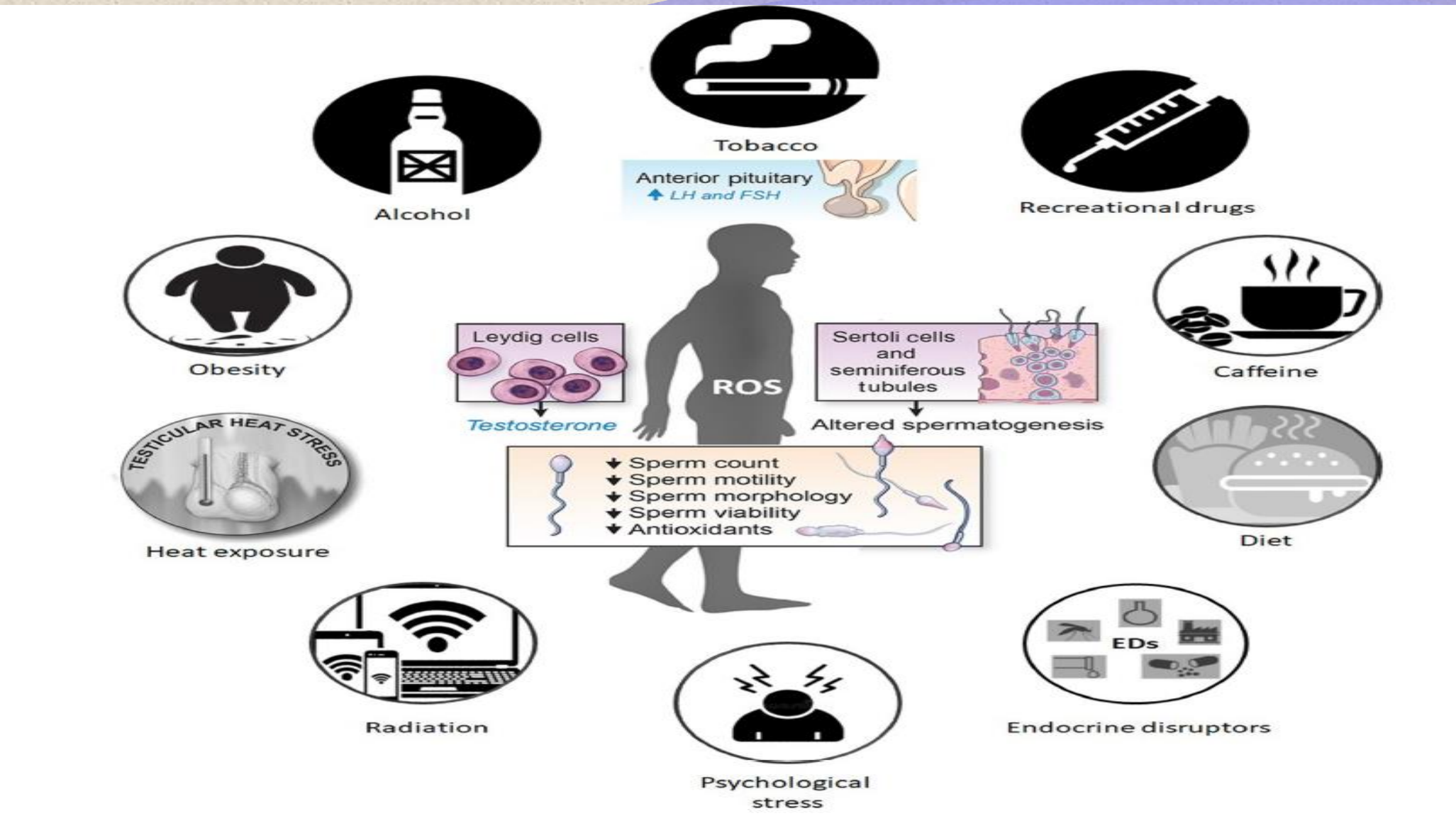
Received: 21 February 2020 | Revised: 21 March 2020 | Accepted: 24 March 2020
DOI: 10.1111/and.13595

INVITED REVIEW
Special Edition: An Update on Male Infertility: Factors, Mechanisms and Interventions

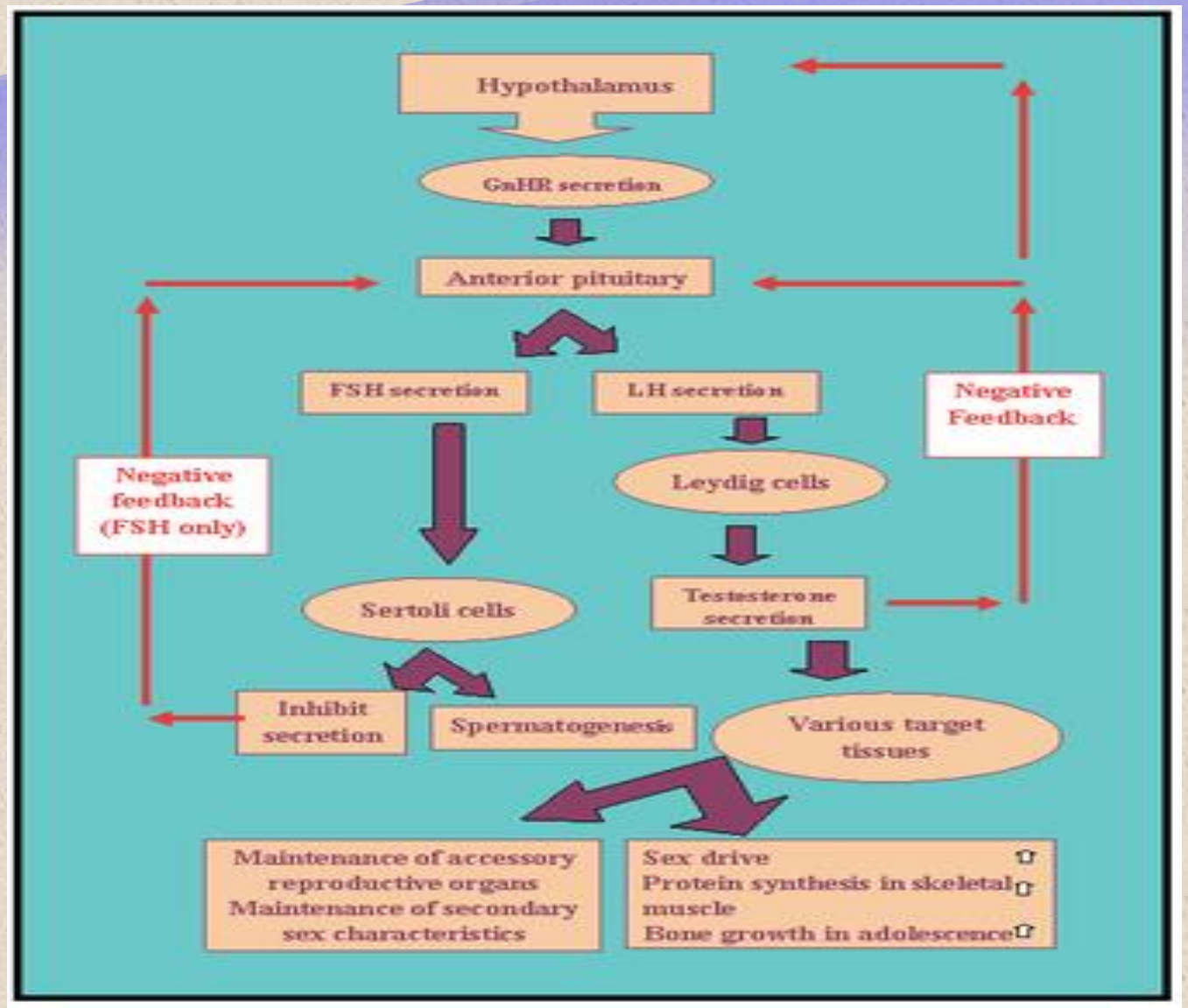
ANDROLOGIA WILEY

Do lifestyle practices impede male fertility?

Kristian Leisegang[1] | Sulagna Dutta[2]



Η ρύθμιση του ανδρικού συστήματος



Ας θυμηθούμε λίγη φυσιολογία

International Journal of *Molecular Sciences*

MDPI

Review

The Roles of Androgens in Humans: Biology, Metabolic Regulation and Health

Marià Alemany [1,2]

[1] Facultat de Biologia, Universitat de Barcelona, Av. Diagonal, 635, 08028 Barcelona, Catalonia, Spain; malemany@ub.edu

[2] Institut de Biomedicina, Universitat de Barcelona, 08028 Barcelona, Catalonia, Spain

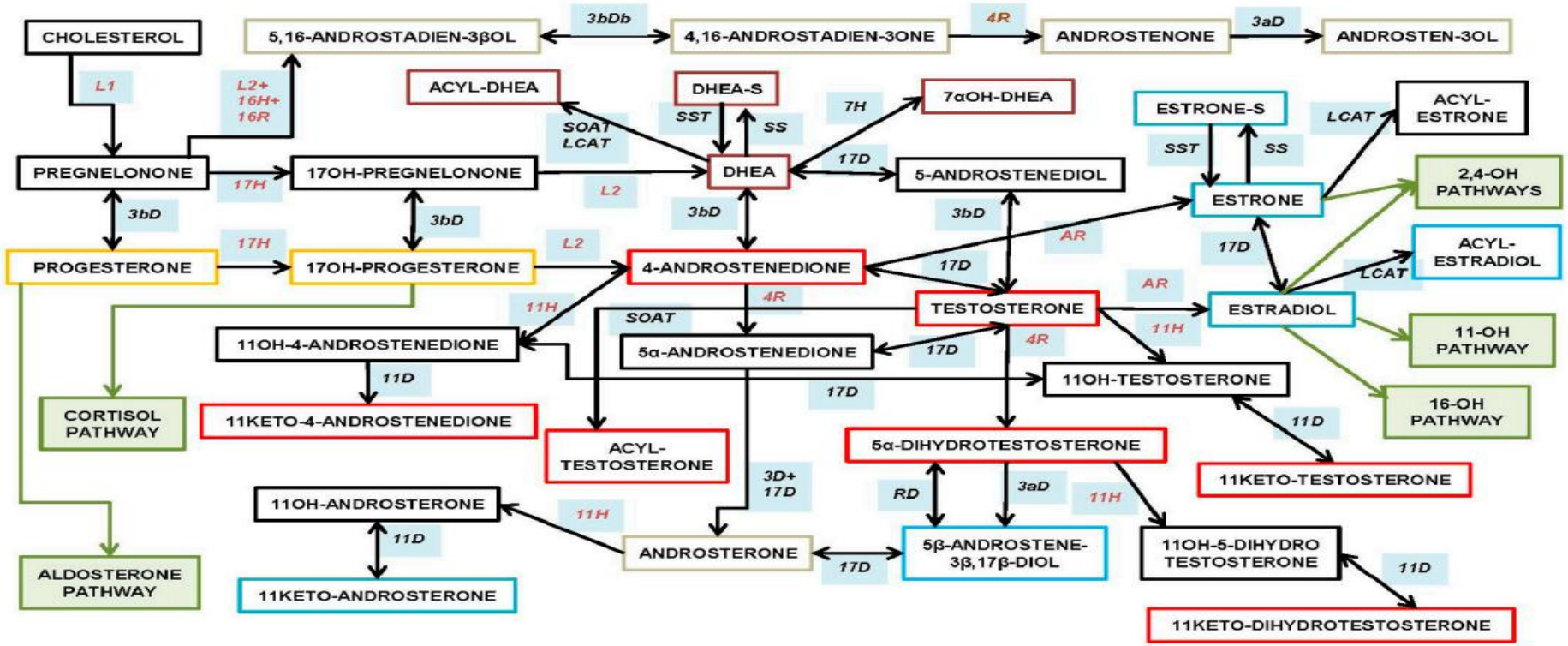
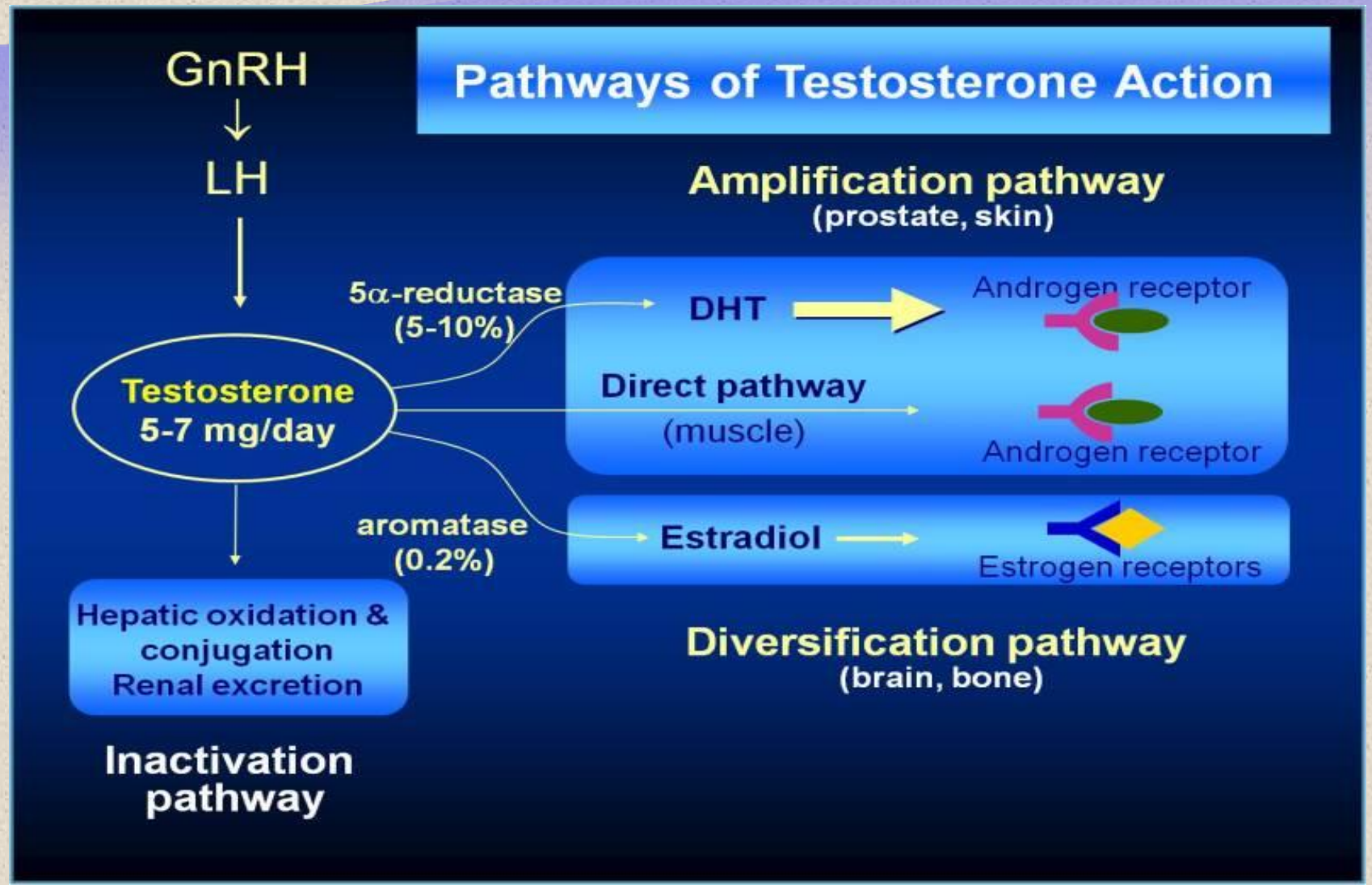
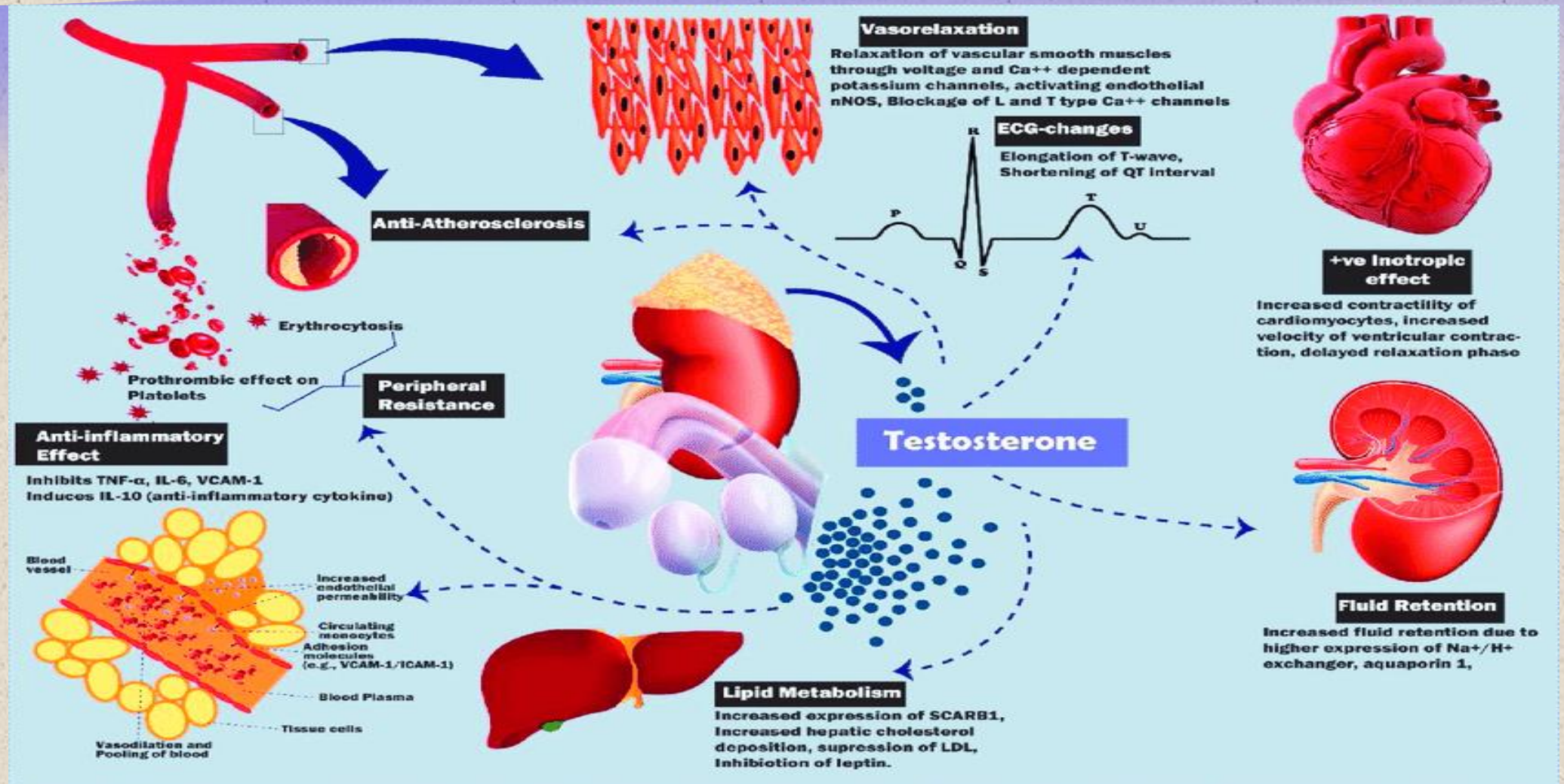


Figure 1. *Cont.*

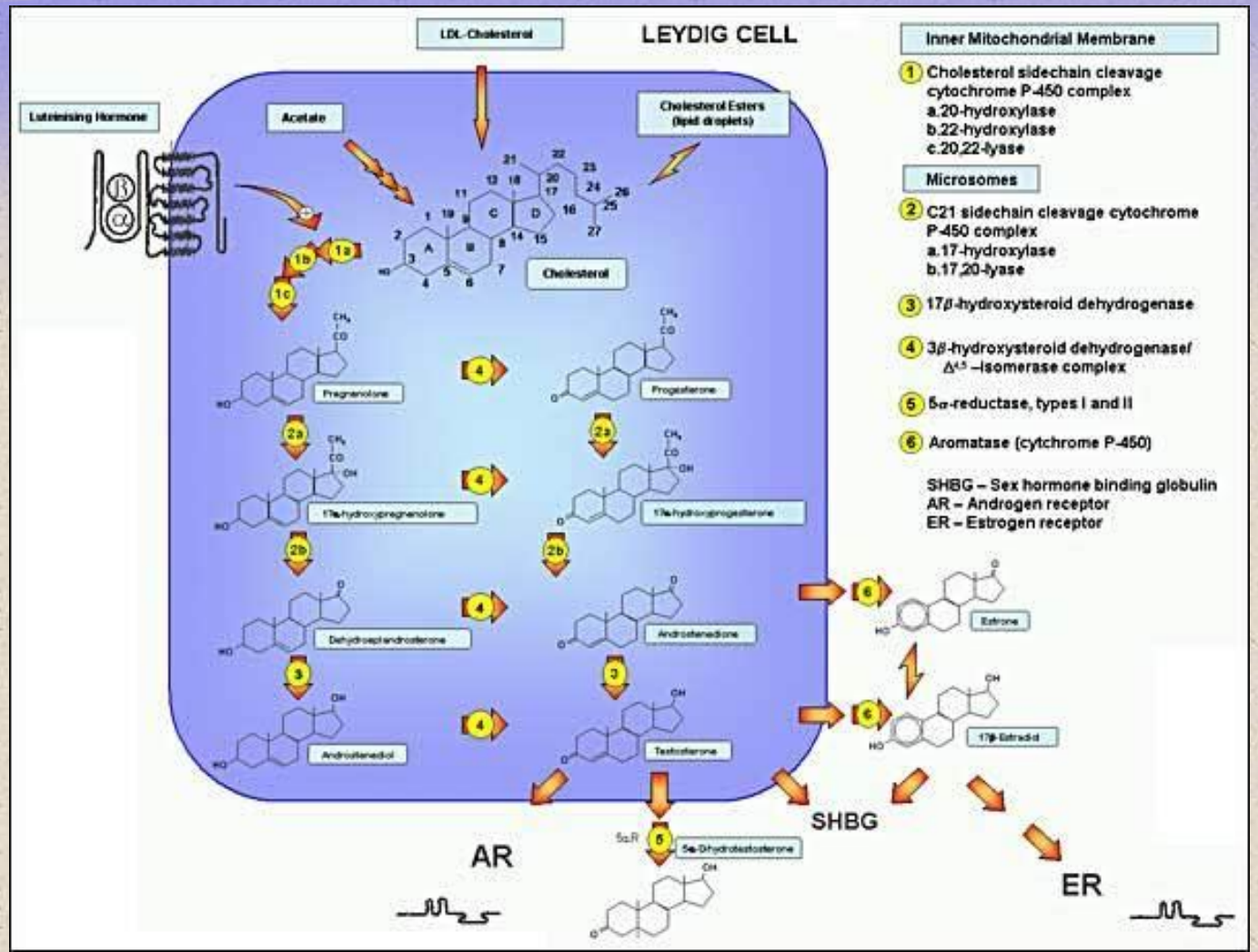
Ή πιο απλά


GnRH
LH
Pathways of Testosterone Action
Amplification pathway
(prostate, skin)
5α-reductase
(5-10%)
DHT
Androgen receptor
Testosterone
5-7 mg/day
Direct pathway
(muscle)
Androgen receptor
aromatase
(0.2%)
Estradiol
Estrogen receptors
Hepatic oxidation &
conjugation
Renal excretion
Diversification pathway
(brain, bone)
Inactivation
pathway

Δράσεις τεστοστερόνης

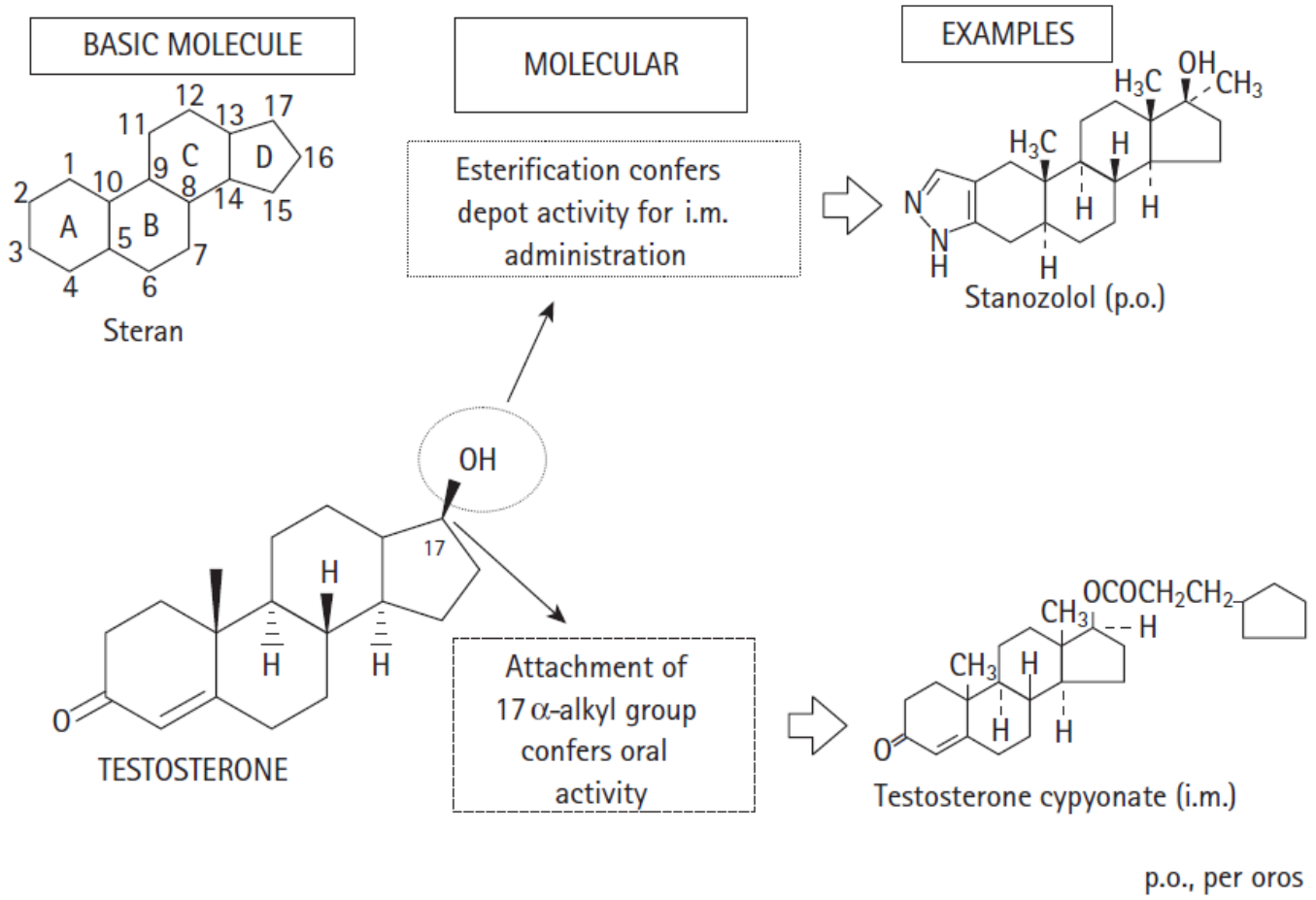


Και πιο συγκεκριμένα



Χημεία Αναβολικών

FIG. 1. The basic 'steran nucleus', typical structural modifications and examples of modified molecules.



Journal of Andrology, Vol. 33, No. 4, July/August 2012

The Insults of Illicit Drug Use on Male Fertility

CAROLYN M. FRONCZAK,* EDWARD D. KIM,† AND AL B. BARQAWI*

Επιδημιολογία: Στεροειδή Αναβολικά

- Από την απομόνωση και τον χαρακτηρισμό της τεστοστερόνης το 1935, έχουν συντεθεί πολλά παράγωγα, οι ιδιότητες των οποίων διαφέρουν από αυτές της τεστοστερόνης.
- Αυτά τα παράγωγα ονομάζονται αναβολικά-ανδρογόνα στεροειδή (AAS), ή πιο συχνά, αναβολικά στεροειδή.
- Αρχικά, αυτές οι ουσίες χρησιμοποιούνταν από επαγγελματίες αθλητές και bodybuilders. Στις μέρες μας, το «κοινό» τους έχει επεκταθεί.
- Πρόσφατες διεθνείς μελέτες αναφέρουν επιπολασμό για άνδρες 3–4 % και 1,6 %για γυναίκες

Contents lists available at ScienceDirect

Annals of Epidemiology

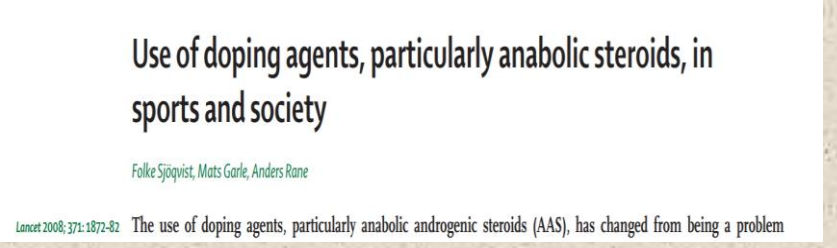
journal homepage: www.annalsofepidemiology.org

ELSEVIER

Review article

The global epidemiology of anabolic-androgenic steroid use: a meta-analysis and meta-regression analysis

Dominic Sagoe MPhil, PhD Cand [a,*], Helge Molde PhD [b], Cecilie S. Andreassen PhD [a,c], Torbjørn Torsheim PhD [a], Ståle Pallesen PhD [a]



Use of doping agents, particularly anabolic steroids, in sports and society

Folke Sjöqvist, Mats Garle, Anders Rane

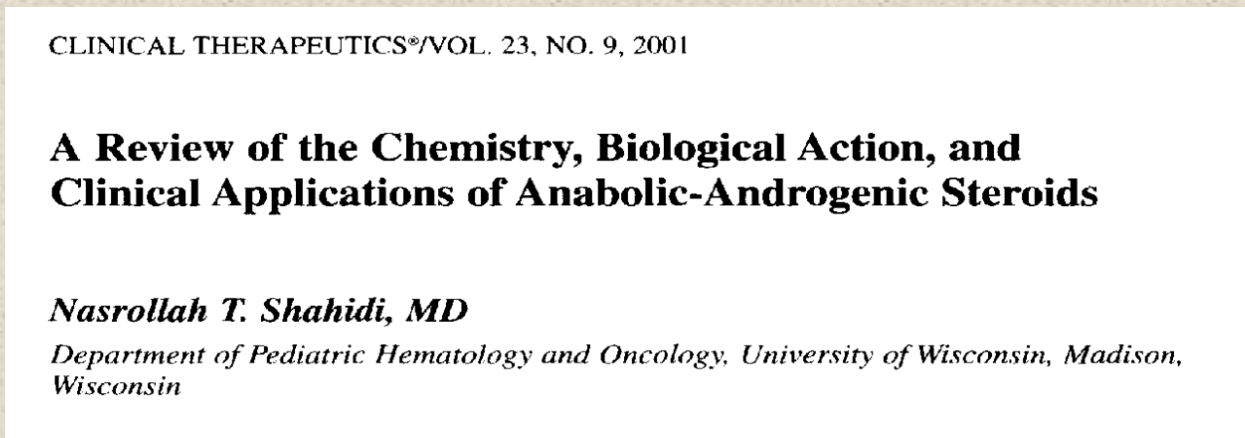
Lancet 2008; 371: 1872-82 The use of doping agents, particularly anabolic androgenic steroids (AAS), has changed from being a problem

Αναβολισμός/ Ανδρογονισμός

- **Αναβολισμός: Προώθηση της ανάπτυξης, σύνθεση πρωτεϊνών και κολλαγόνου και αύξηση των μυών και αύξηση του μεταβολισμού των οστών.**
- **Ο ανδρογονισμός είναι οι φυσιολογικές αλλαγές στο ανδρικό σώμα που οδηγούν στα δευτερογενή χαρακτηριστικά του φύλου. Τα αναβολικά στεροειδή εμφανίζουν ασθενέστερη δέσμευση στους ανδρογενείς υποδοχείς (αναβολική δράση)**
- **Τα ανδρογόνα στεροειδή συνδέονται ισχυρά στους ανδρογενείς υποδοχείς (ανδρογενή δράση).**

Τα αναβολικά

- Έχουν γίνει δομικές αλλαγές στο μόριο της τεστοστερόνης προκειμένου να μεγιστοποιηθούν τα αναβολικά αποτελέσματα και να ελαχιστοποιηθούν τα ανδρογόνα. Ωστόσο, όλα τα AAS έχουν ανδρογόνος εάν χορηγηθούν για αρκετό χρόνο, σε υψηλά επίπεδα και αρκετές δόσεις



CLINICAL THERAPEUTICS®/VOL. 23, NO. 9, 2001

A Review of the Chemistry, Biological Action, and Clinical Applications of Anabolic-Androgenic Steroids

Nasrollah T. Shahidi, MD

Department of Pediatric Hematology and Oncology, University of Wisconsin, Madison, Wisconsin

Παραδοσιακά σε 2 κατηγορίες

ANDROLOGY

ISSN: 2047-2919

ANDROLOGY

REVIEW ARTICLE

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E-mail: ekim@utmck.edu

Keywords:
anabolic steroid-induced hypogonadism, designer steroids, dietary supplements, dimethazine, mentabolan, methylstenbolone

Received: 3-May-2014

Designer steroids – over-the-counter supplements and their androgenic component: review of an increasing problem

C. D. Rahnema, L. E. Crosnoe and E. D. Kim

Division of Urology, Department of Surgery, University of Tennessee Graduate School of Medicine, Knoxville, TN, USA

- Από του στόματος αναβολικά (17 α-εστεροποιημένα στεροειδή): Τροποποίηση για να αποφεύγεται το φαινόμενο πρώτης διέλευσης, άρα έλεγχος ηπατικής λειτουργίας. Μικρός χρόνος μισής ζωής, επομένως καθημερινές δόσεις (στανοζολόλη, οξανδρολόνη, μεθυλεταστοστερόνη)
- Παρεντερικά σε ελαιώδες διάλυμα, μεγαλύτερος χρόνος μισής ζωή, μικρότερη ανάγκη για καθημερινές δόσεις, δεν επηρεάζουν το ήπαρ.

Ταξινόμηση ως προς το αποτέλεσμα

- «Όμοια με τεστοστερόνη»: αναβολική/ανδρογόνο 1:1, παρόμοια με την τεστοστερόνη. Σημαντική αύξηση της μυϊκής μάζας (εστέρες τεστοστερόνης και μεθυλτεστοστερόνη)
- «Όμοια με τη διυδροτεστοστερόνη»: Ισχυρά ανδρογόνο δράση, δεν μεταβολίζεται σε οιστρογόνα, δεν οδηγούν σε κατακράτηση Νατρίου και ύδατος (στανοζόλη και οξαλανδρόνη).
- «Όμοια με τη ναδρολόνη, δράση παρόμοια με προγεστερόνη και αναβολική δράση, αναστέλλουν το άξονα στον υποθάλαμο, χρήση σε κλινικό χώρο

Table 1 Common oral and injection steroids available through the Internet

Type of product	Administration mode	Trade name	Composition	Active agent (Formula)
Anabolic Androgenic Steroids (AAS)	Injection	Boldenone 300	Boldenone Undecylinate	Boldenone ($C_{19}H_{26}O_2$)
		Masteron 100	Drostanolone propionate	Drostanolone ($C_{23}H_{36}O_3$)
		Winstrol 50 mg	Stanozolol	Stanozolol ($C_{21}H_{32}N_2O$)
		Trenbolone A100	Trenbolone Acetate	Trembolone ($C_{18}H_{22}O_2$)
		Trenbolone E200	Trenbolone Enanthate	
		Tri-Trenbo	Mixture of trenbolones: Trenbolone Enanthate Trenbolone Acetate Trenbolone Hexahydro-benzylcarbonate	
		MixDeca	Mixture of nandrolone: Nandrolone propionate Nandrone phenylpropionate Nandrolone decanoate Nandrolone laurat	Nandrolone ($C_{18}H_{26}O_2$)
		Deca Rapide	Nandrolone Phenypropionate	
		Deca durabolin 300	Nandrolone decanoate	
		Sustanon 300	Mixture of testosterones: Testosterone propionate Testosterone phenylpropionate Testosterone isocaproate Testosterone decanoate	Testosterone ($C_{19}H_{28}O_2$)
		Testosterone P100	Testosterone phenypropionate	
		Testosterone C250	Testosterone Cypionate	
		Testosterone E300	Testosterone Enanthate	
		PharmaMix-1	Mixture of: Testosterone Cypionate Boldenone Undecylenate Testosterone Phenylpropionate	-
		PharmaMix-2	Mixture of: Trenbolone Acetate Drostanolone Propionate Testosterone Phenylpropionate	-
		PharmaMix-3	Mixture of: Trenbolone Enanthate Nandrolone Decanoate Testosterone Enanthate	-
		Primobolan 100	Metenolone enanthate	Metenolone ($C_{27}H_{42}O_3$)
	Oral	Anavar 10 mg	Oxandrolone	Oxandrolone ($C_{27}H_{42}O_3$)
		Dianabol 10 mg	Methandienone	Methandienone ($C_{20}H_{28}O_2$)
		Winstrol tabs 10 mg	Stanozolol	Stanozolol ($C_{21}H_{32}N_2O$)
		Turanabol 10 mg	Turanabol	Turanabol ($C_{20}H_{27}ClO_2$)
		Anapolon 50 mg	Oxymetholone	Oxymetholone ($C_{21}H_{32}O_3$)
Burners		Clenbuterol – Meditech	Clenbuterol hydrochlorid	Clenbuterol ($C_{12}H_{18}Cl_2N_2O$)
		T3 Cytomel	T3 cytomel	Cytomel ($C_{15}H_{11}I_3NaO_4$) Triiodothyronine ($C_{15}H_{12}I_3NO_4$)
Post-cycle therapy		Clomid 50 mg	Clomifene citrate	Clomifene ($C_{26}H_{28}ClNO$)
		Nolvadex 20 mg	Tamoxifen citrate	Tamoxifen ($C_{26}H_{29}NO$)
		Provironos 50 mg	Mesterolone	Mesterolone ($C_{20}H_{32}O_2$)
		Proviron 25 mg	Mesterolone	
		Anastrazolas 1 mg	Anastrazol	Anastrazol ($C_{17}H_{19}N_5$)
	Injection	HCG 5000 UI	Pregnyl	Polypeptide
		HCG 1500 UI	Pregnyl	
Other substances		IGF1 Lr3 - Getropin	Insulin-like Growth Factor 1	
		HGH	HGH 100 UI - Getropin	Getropin ($C_{990}H_{1513}N_{263}O_{300}S_7$)
		Eporex 300 (EPO)	Erythropoietin	Erythropoietin ($C_{809}H_{1301}N_{229}O_{240}S_5$)
Side Effects Medications	Oral	Finasteride - Prostacare	Finasteride	Finasteride ($C_{23}H_{36}N_2O_2$)
		Viagra	Sildenafil citrate	Sildenafil ($C_{22}H_{30}N_6O_4S$)
		Cialis	Tadalafil	Tadalafil ($C_{22}H_{19}N_3O_4$)

Current Concepts in Anabolic-Androgenic Steroids

Nick A. Evans,* MD
From the UCLA-Orthopaedic Hospital, Los Angeles, California

Table 2 Accessory Drugs and Dietary Supplements [17]

Drug/Supplement	Reason for use
Ephedrine	Stimulant, fat loss
Clenbutarol	Stimulant, fat loss
Amphetamine	Stimulant, fat loss
Thyroxine	Thyroid hormone, fat loss
Growth hormone	Anabolic, increase muscle mass and strength
Insulin	Anabolic, increase muscle mass
Insulin-like growth factor	Anabolic, increase muscle mass
Diuretics	Reduce edema
Human chorionic gonadotrophin	Restore endogenous testosterone
Tamoxifen	Prevent gynecomastia
Gamma-hydroxybutyrate	Sedative, aids sleep/releases growth hormone
Opioids	Pain relief
Androstenedione	Over-the-counter testosterone precursor
Creatine	Over-the-counter ergogenic supplement
Dihydroepiandosterone	Over-the-counter steroid precursor

BJUI
BJU INTERNATIONAL

Anabolic steroids and male infertility: a comprehensive review

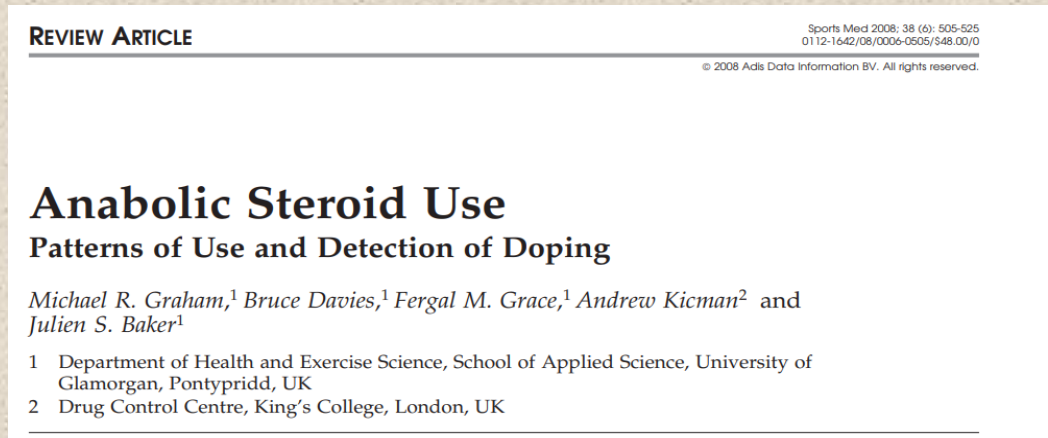
Guilherme Leme de Souza* and Jorge Hallak†

TABLE 1 Commonest AASs in use worldwide, according to main effect

Compound name	Brand name
Testosterone-like effect	
Testosterone esters: cypionate	Deposteron®, Testex Leo®
Testosterone esters: undecanoate	Nebido®, Androxon®
Testosterone esters: blends	Durateston®, Testoviron®, Sustanon®, Omnadren®
Methyltestosterone	Methyltestosterone®, Metandren®
Methandrostenolone	Dianabol®, Anabol®, Naposim®
Chlorodehydromethyltestosterone	Turinabol®
Fluoxymesterone	Halotestin®
Boldenone	Equipoise®, Equilon®
DHT-like effect	
Stanozolol	Winstrol®, Stromba®
Oxandrolone	Anavar®
Oxymetholone	Anadrol®, Hemogenin®, Anapolon®
Mesterolone	Proviron®
Methenolone	Primobolan®
Nandrolone-like effect	
Nandrolone decanoate	Decadurabolin®
Nandrolone phenylpropionate	Durabolin®
Trenbolone	Finaplix®, Parabolan®
Nandrolone undecanoate	Dynabolon®

Λίγη Φαρμακολογία αναβολικών

- Έκκριση ερυθροποιητίνης άρα αιμαποίηση, λιπόλυση, πρωτεϊνοσύνθεση, σμηγματογόνα έκκριση, τριχοφυΐα και αύξηση της λίμπιντο
- Αντιγλυκοκορτικοειδείς δράσεις, (οι οποίες διαμεσολαβούνται από την κατάληψη των υποδοχέων κορτιζόλης με τεστοστερόνη) και οδηγούν σε αντι-καταβολικό αποτέλεσμα



REVIEW ARTICLE

Sports Med 2008; 38 (6): 505-525
0112-1642/08/0006-0505/$48.00/0

Anabolic Steroid Use

Patterns of Use and Detection of Doping

Michael R. Graham,[1] *Bruce Davies*,[1] *Fergal M. Grace*,[1] *Andrew Kicman*[2] and *Julien S. Baker*[1]

1 Department of Health and Exercise Science, School of Applied Science, University of Glamorgan, Pontypridd, UK
2 Drug Control Centre, King's College, London, UK

Ανεπιθύμητες ενέργειες

430 *Mini-Reviews in Medicinal Chemistry*, 2011, *11*, 430-437

Anabolic Androgenic Steroids Abuse and Liver Toxicity

M. Neri*[,1], S. Bello[1], A. Bonsignore[2], S. Cantatore[1], I. Riezzo[1], E. Turillazzi[1] and V. Fineschi[1]

[1]*Department of Forensic Pathology, University of Foggia, Ospedale "Colonnello D'Avanzo", Viale degli Aviatori 1, 71100, Foggia, Italy*

[2]*Department of Legal and Forensic Medicine, University of Genova, Via Antonio de Toni, Genova, Italy*

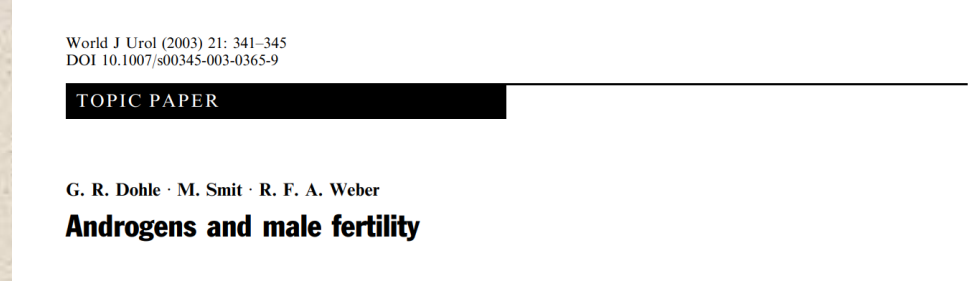
- Ακμή, αλωπεκία και Συμπτώματα από το κατώτερο ουροποιητικό σύστημα αποδίδονται στη διεύρυνση του προστάτη και σχετίζονται συνήθως με το ισχυρό ανδρογόνο αποτέλεσμα 5-DHT
- Στυτική δυσλειτουργία και απώλεια λίμπιντο, ιδιαίτερα μετά τη διακοπή του σχήματος, όταν τα επίπεδα της ενδογενούς τεστοστερόνης είναι συνήθως χαμηλά
- Γυναικομαστία από αρωματοποίηση σε οιστρογόνα
- Ηπατική βλάβη: χολοστατικός ίκτερος, καρκίνος

Ανεπιθύμητες ενέργειες ΙΙ

- Παραδόξως δεν υπάρχει συσχέτιση με καρκίνο του προστάτη και αύξηση του PSA
- Καρδιαγγειακό σύστημα: υπέρταση, αρρυθμίες, ερυθροκυττάρωση και δυσλειτουργία των κοιλιών. Κίνδυνο θνητότητας 4,6 φορές υψηλότερος από του μη χρήστες
- Δευτεροπαθής Νεφρική ανεπάρκεια σε ραβδομυόλυση και διάχυτη μεμβρανοπολλαπλασιαστική σπειραματονεφρίτιδα
- Επιθετική συμπεριφορά, κατάθλιψη, εναλλαγές διάθεσης, αλλοιωμένη λίμπιντο, ευφορία και ακόμη και ψύχωση

Υπογοναδοτροφικός υπογοναδισμός

- Εξωγενής χορήγηση συνθετικών παραγώγων τεστοστερόνης προκαλεί αρνητική ανάδραση στον άξονα υποθαλαμο-υπόφυση και επομένως αναστέλλοντας την έκκριση των FSH και LH.
- Η υπογονιμότητα μετά από κατάχρηση AAS εμφανίζεται συνήθως ως ολιγοζωοσπερμία ή αζωοσπερμία, που σχετίζεται με ανωμαλίες στην κινητικότητα και τη μορφολογία του σπέρματος


World J Urol (2003) 21: 341–345
DOI 10.1007/s00345-003-0365-9

TOPIC PAPER

G. R. Dohle · M. Smit · R. F. A. Weber

Androgens and male fertility

Νεότερα πειραματικά δεδομένα Ι

Physiology & Behavior, Vol. 62, No. 1, pp. 23–30, 1997

0031-9384/97 $17.00 + .00

ELSEVIER

PII S0031-9384(97)00105-4

The Effect of Anabolic-Androgenic Steroids on Sexual Behavior and Reproductive Tissues in Male Rats

MICHELE J. FEINBERG,* AUGUSTUS R. LUMIA,*† AND MARILYN Y. McGINNIS*

- Πειράματα σε ζωικά μοντέλα αναφέρουν κυρίως αλλοιώσεις κυττάρων Leydig και άλλες κυτταρικές ανωμαλίες

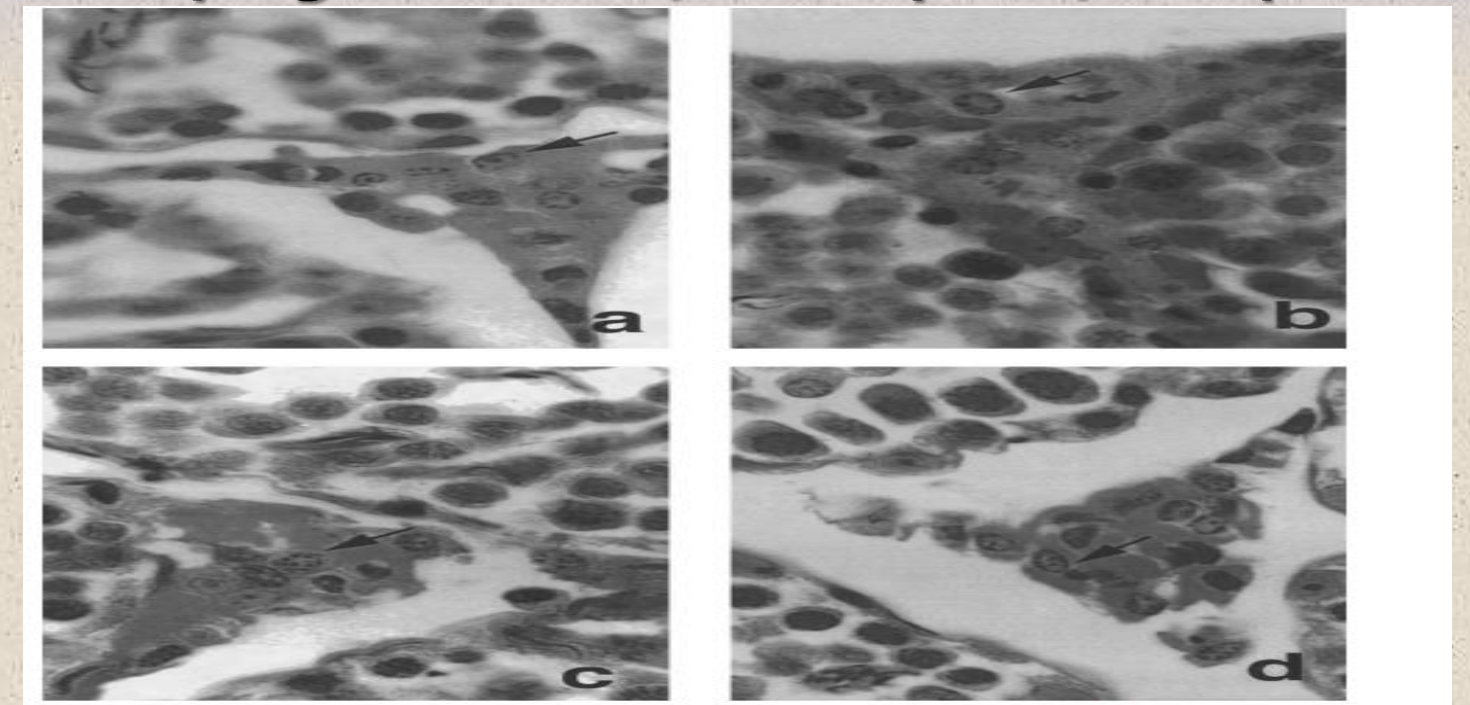


FIG. 3. Representative interstitial areas from the testes of adult male rats treated with a) TP for 16 weeks b) Control-PG injected rats c) TP for 3 weeks and withdrawal for 13 weeks (TPWL) d) TP treated for 16 weeks withdrawal for 3 weeks (TPWS). Leydig cells (arrows) are scarce and irregularly shaped in the TP (a) treated rats and more abundant and rounder in the PG control (b). The Leydig cell number of the TPWL (c) and TPWS (d) treated rats was intermediate between the TP and PG groups. Hematoxylin and eosin stain × 100.

Νεότερα πειραματικά δεδομένα ΙΙ

© Acta Endocrinologica 1992, 126: 173–8

The effects of an anabolic steroid (oxandrolone) on reproductive development in the male rat

Bernard H Grokett[1], Nazir Ahmad[2] and Dwight W Warren[3]

Departments of Exercise Science[1], Anatomy and Cell Biology[2], and Physiology and Biophysics[3], University of Southern California, Los Angeles, California 90033

- Έχει περιγραφεί ειδική διαταραχή σπερματογένεσης τελικού σταδίου, με έλλειψη προηγμένων μορφών σπερμάτιδες
- Μετά τη διακοπή των AAS, τα κύτταρα Leydig τείνουν να πολλαπλασιάζονται αλλά παραμένουν κάτω από τις κανονικές μετρήσεις, ακόμη και μετά μεγαλύτερες περιόδους

Απόπτωση

 Basic & Clinical Pharmacology & Toxicology, 106, 324–330
Doi: 10.1111/j.1742-7843.2009.00495.x

Exercise and Supraphysiological Dose of Nandrolone Deconoate Increase Apoptosis in Spermatogenic Cells

Saeed Shokri[1], Robert John Aitken[2], Mirabbas Abdolvahhabi[3], Farid Abolhasani[3], Fahimeh Mohammad Ghasemi[4], Iraj Kashani[3], Shahram Ejtemaeimehr[5], Shahin Ahmadian[6], Bagher Minaei[3], Mohammad Ali Naraghi[3] and Mohammad Barbarestani[3]

- Η απόπτωση έχει αναφερθεί ότι παίζει σημαντικό ρόλο στη ρύθμιση πληθυσμών γεννητικών κυττάρων στον όρχι του ενήλικα.
- Πρόσφατα, η συσχέτιση μεταξύ της απόπτωσης και υψηλές δόσεις AAS έχουν αξιολογηθεί πειραματικά σε ζωικά μοντέλα.
- Αναφέρεται σημαντική αύξηση του ρυθμού απόπτωσης των σπερματογόνων κύτταρων μετά τη χορήγηση νανδρολόνης

Ανευπλοειδίες και υπερδομικές αλλαγές σε σπερματοζωάρια

J Assist Reprod Genet (2007) 24:195–198
DOI 10.1007/s10815-005-9002-4

CASE REPORT

Structural sperm and aneuploidies studies in a case of spermatogenesis recovery after the use of androgenic anabolic steroids

E. Moretti · G. Collodel · A. La Marca · P. Piomboni · G. Scapigliati · B. Baccetti

- XY δισωμία στο σπέρμα
- Σχέση μεταξύ του αλλοιωμένης μείωσης και της κατάχρησης από ανδρογόνα αναβολικά στεροειδή

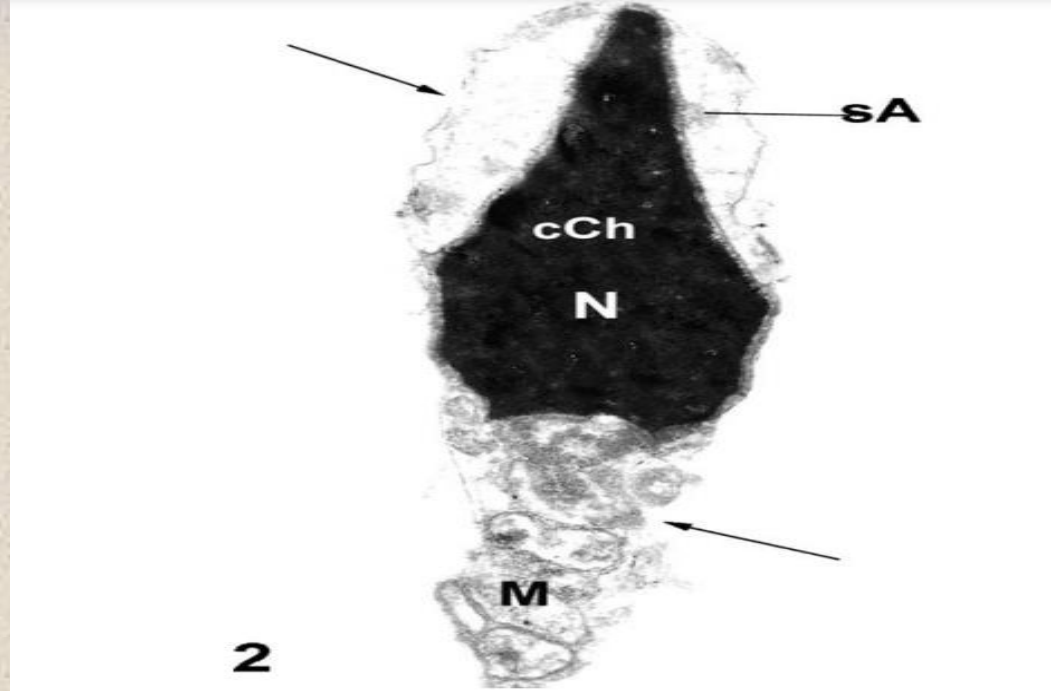


Fig. 2 TEM micrograph of a longitudinal section of sperm with normal nucleus (nN) and swollen acrosome (sA), mitochondria (M) are swollen and disassembled, the plasma membrane is broken (arrows). ×20,000

Παράμετροι στο σπέρμα

- Η χρήση συνδυασμού hCG και στεροειδών είναι κοινή πρακτική
- Για αποφυγή της επίδρασης της αρνητικής ανάδρασης στην LH μετά μακροχρόνια χορήγηση AAS η οποία μπορεί να οδηγήσει σε μόνιμη κατάσταση υπογοναδισμού και κακής ποιότητας σπέρματος.
- Ανάλογα με τη διάρκεια χρήσης των αναβολικών και την περίοδο από την τελευταία χορήγηση φαρμάκου, τα ποσοστά κινητικότητας του σπέρματος (με φυσιολογική μορφή) μειώθηκαν σημαντικά μεταξύ των bodybuilders σε σύγκριση με τους υγιείς εθελοντές
- Ακόμη και μετά από παρατεταμένη χρήση εξαιρετικά υψηλών δόσεων αναβολικών, η παραγωγή σπέρματος μπορεί να ομαλοποιηθεί μετά από διακοπή 4 μηνών

Review Article
Male sexual health and dysfunction

pISSN: 2287-4208 / eISSN: 2287-4690
World J Mens Health 2022 Apr 40(2): 165-178
https://doi.org/10.5534/wjmh.210021

The World Journal of MEN's HEALTH

Consequences of Anabolic-Androgenic Steroid Abuse in Males; Sexual and Reproductive Perspective

Giovanni Corona[1], Giulia Rastrelli[2], Sara Marchiani[2], Sandra Filippi[2], Annamaria Morelli[3], Erica Sarchielli[3], Alessandra Sforza[1], Linda Vignozzi[2], Mario Maggi[4]

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The real epidemiology and the possible consequences of anabolic-androgenic steroids (AAS) use still represent a very tricky task due to the difficulties in the quantification and detection of these drugs. Chronic use of AAS, frequently combined with other illicit substances, can induce tremendous negative effects on the reproductive system, but it is also associated with an increased overall and cardiovascular mortality risk. In the present review we summarize and discuss the available evidence regarding the negative impact of AAS on the male reproductive system, providing practical suggestions to manage these problems. For this purpose a meta-analysis evaluating the effects of AAS abusers *vs*. controls on several hormonal, reproductive and metabolic parameters was performed. In addition, in order to overcome possible limitations related to the combined use of different AAS preparations, we also retrospectively re-analyzed data on animal models treated with supraphysiological dosage of testosterone (T), performed in our laboratory. Available data clearly indicated that AAS negatively affect endogenous T production. In addition, increased T and estradiol circulating levels were also observed according to the type of preparations used. The latter leads to an impairment of sperm production and to the development of side effects such as acne, hair loss and gynecomastia. Furthermore, a worse metabolic profile, characterized by reduced high density lipoprotein and increased low density lipoprotein cholesterol levels along with an increased risk of hypertension has been also detected. Finally sexual dysfunctions, often observed upon doping, represent one the most probable unfavorable effects of AAS abuse.

Keywords: Cardiovascular risk; Doping in sports; Hypogonadism; Infertility, gynecomastia; Sperm; Testosterone congeners

EXPERT REVIEW OF ENDOCRINOLOGY & METABOLISM
https://doi.org/10.1080/17446651.2021.1921574

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REVIEW

Anabolic steroid misuse and male infertility: management and strategies to improve patient awareness

Dustin L Whitaker, Gabriella Geyer-Kim and Edward D Kim

Department of Urology, University of Tennessee Graduate School of Medicine, Knoxville, Tennessee, United States

ABSTRACT

Introduction: Anabolic androgenic steroid use is an uncommon but important cause of male infertility. As paternal age and anabolic steroid use increases, providers are more likely than ever to encounter men with infertility and prior or concurrent anabolic steroid use. In this review, we outline the background, epidemiology and pathophysiology of anabolic steroid induced male infertility and provide recommendations regarding the diagnosis, management, and future prevention of this condition.

Areas covered: Male reproductive physiology is a tightly regulated process that can be influenced by exogenous sources such as anabolic steroids and selective androgen receptor modulators (SARMs). Data suggest that a combination of selective estrogen receptor modulators (SERMs), human chorionic gonadotropin (hCG), aromatase inhibitors (AIs), and recombinant follicle-stimulating hormone (rFSH) may lead to spermatogenesis recovery.

Expert opinion: Anabolic steroid and SARM users continue to exhibit lack of understanding regarding the potential side effects of their use on male fertility. Current literature suggests that spermatogenesis can be safely recovered using a combination of SERMs, hCG, AIs and rFSH although additional studies are necessary. While anabolic steroid prevention strategies have largely been focused on the individual level, further investigation is necessary and should be approached in a socioecological manner.

ARTICLE HISTORY
Received 14 February 2021
Accepted 21 April 2021

KEYWORDS
Anabolic androgenic steroids; clomiphene citrate; human chorionic gonadotropin; hypogonadism; male infertility; selective androgen receptor modulators; selective estrogen receptor modulators; spermatogenesis; testosterone; testosterone replacement therapy

Anabolic Androgenic Steroids

Positive effects

- Increased muscle mass
- Anabolic effects (osteoporosis, anemia, chronic kidney disease)
- Androgenic effects (increased libido)

Supraphysiological doses

Negative effects

Organs and tissues damage

Brain and Behavior

- addiction;
- aggressive behavior;
- depression;
- mood swings;
- psychosis.

Hematologic consequences

- decreased HDL cholesterol;
- increased cholesterol;
- pro-atherogenic effects.

Liver

- cholestatis peliosis
- hepatis hepatoadenoma
- hepatocarcinoma;
- hepatocellular damage.

Muscoloskeletal system

- increased rate of muscle strains/ruptures;
- increased risk of musculotendinous

Cardiovascular system

- hypertension;
- left ventricular hypertrophy;
- pro-atherogenic effects.
- thrombosis.

Urinary system

- acute renai failure;
- ↑ blood urea nitrogen;
- focal segmental glomerulosclerosis;
- membranoproliferative glomerulonephritis;
- Wilm's tumor.

Reproductive system

Male

- decreased reproductive hormones;
- Gynecomastia;
- impotence;
- oligo spermia/azoo spermia;
- prostatic hypertrophy/carcinoma;
- testicular atrophy.

Female:

- breast atrophy/teratogenicity;
- clitoral hypertrophy;
- menstrual irregolarities;
- uterine atrophy.

REVIEWS

Harm Reduction in Male Patients Actively Using Anabolic Androgenic Steroids (AAS) and Performance-Enhancing Drugs (PEDs): a Review

Alex K. Bonnecaze, MD[1], Thomas O'Connor, MD[2], and Cynthia A. Burns, MD[1]

Table 1 Proposed Methods for Transitioning Off AAS

Author	Proposed methods
Anawalt 2019[2]	• Method 1: "Immediate discontinuation of AAS with no medical therapy" • Method 2: "Discontinuation of AAS and initiation of a limited course of clomiphene therapy" • Method 3: "Discontinuation of AAS and initiation of a limited course of hCG therapy" • Method 4: "Conversion of nonprescription AAS to prescription testosterone" The author additionally notes "For these patients, the author has prescribed intramuscular dosages of up to twice the typical replacement dosage with a taper to physiologic dosage over several months"
Rahnema et al. 2014[23]	• 4-week testosterone taper with SERM (Clomiphene 25 mg every other day), followed by rechecking testosterone and gonadotrophs. After 4 weeks, the author suggested ending testosterone therapy and continuing SERM use, also adding hCG 1000–3000 IU SQ 3 times weekly if labs suggested a poor response. • After 8 weeks, the authors recommend rechecking testosterone and gonadotrophs. At week 10, SERM dose should be reduced to 50% of starting dosage and continued until the target testosterone level is achieved. • Also mentioned is that some men using chronic high doses of AAS may have direct testicular damage-thus not responding to agents other than testosterone.

Table 4 Initial Treatment of Diagnosed Adverse Effects of AAS/PED Use

Diagnosed AAS/PED adverse effect	Potential treatment if unwilling to discontinue use
Mood disorders, depression, polysubstance abuse	Intensive behavior therapy
Hypertension	ACE inhibitors / ARBs as first line
Sexual dysfunction	Cessation of oral AAS prioritized rather than immediate treatment with PDE-5 inhibitors
Hepatic dysfunction	Cessation of oral AAS, referral to hepatologist
Dyslipidemia	Statins (caution if current oral AAS use)*
Left ventricular hypertrophy	ACE inhibitors or ARBs, referral to cardiologist
Accelerated atherosclerosis	Statins (caution if current oral AAS use)*
Exogenous hyperthyroidism	Education on risk of lethal arrhythmia, EKG if symptomatic palpitation/ tachycardia.
Decreased BMD	Bisphosphonates+ or denosumab+ if osteoporosis present
Hypoglycemia	Provide with glucose testing supplies, education on hypoglycemic symptoms and management.
Diabetes mellitus	Dietary control, metformin
Polycythemia	Phlebotomy

**Contraindicated in severe liver disease and unexplained transaminitis. We suggest these agents be avoided in men actively using hepatotoxic oral AAS*

+ = Off label for the purpose of treated AI-induced bone loss in men


It's mine, you understand?!