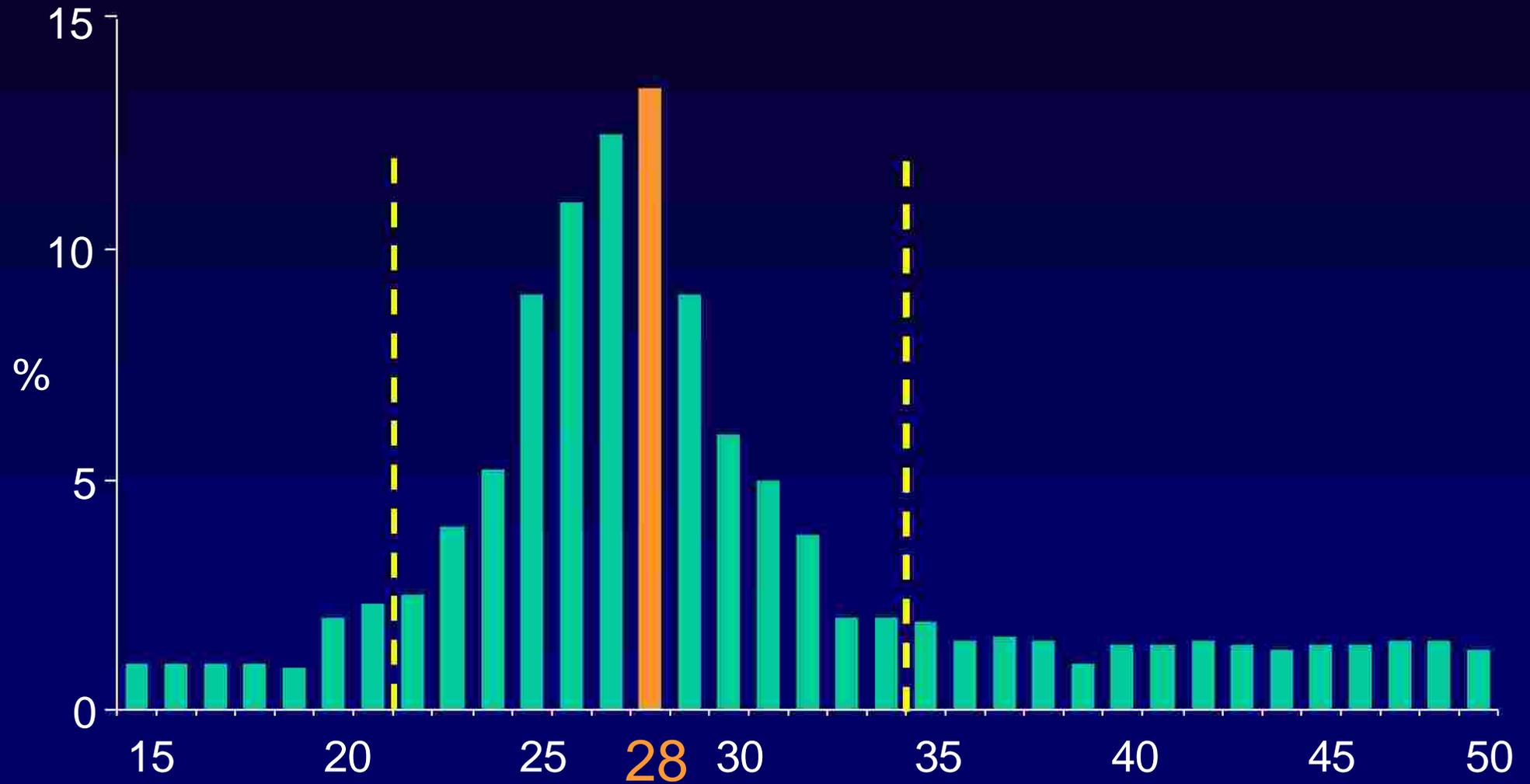


# DISTRIBUZIONE DI FREQUENZA NELLA LUNGHEZZA DEL CICLO MESTRUALE



De Cree 1998

# PREVALENZA DI IRREGOLARITA' MESTRUALI IN DIFFERENTI DISCIPLINE SPORTIVE

Popolazione generale	2-5%
Ginnastica/danza	30-80%
Corsa	25%
Ciclismo, nuoto	10-15%

# DEFINIZIONI

**Amenorrea:** assenza di cicli mestruali per almeno 3 mesi

**Oligomenorrea:** ridotta frequenza dei cicli mestruali (<10/anno, lunghezza dei cicli 35-90 gg)

**Polimenorrea:** aumentata frequenza dei cicli mestruali (lunghezza cicli <21 gg)

# ALTERAZIONI MESTRUALI DELL'ATLETA

- **Amenorrea primaria** (assenza di mestruazione spontanea a 16 anni in presenza di sviluppo sessuale oppure a 14 anni in assenza di caratteri sessuali secondari )
- **Amenorrea secondaria** (interruzione dei cicli)
- **Accorciamento del ciclo mestruale** (inadeguata fase luteale)

ormoni  
ambiente

stress

alimentazione

ipotalamo

GnRH

ipofisi

LH FSH

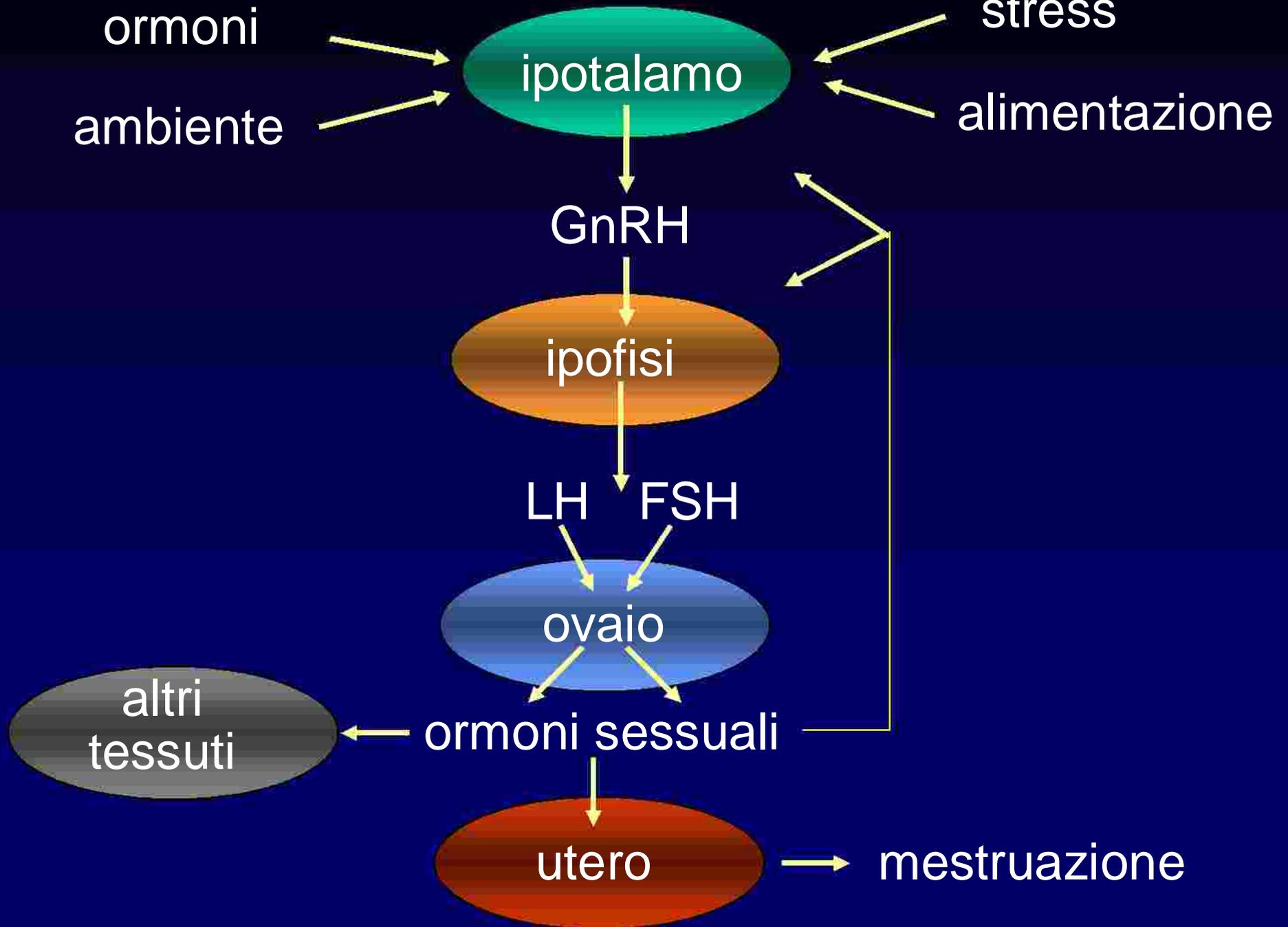
ovaio

altri  
tessuti

ormoni sessuali

utero

mestruazione



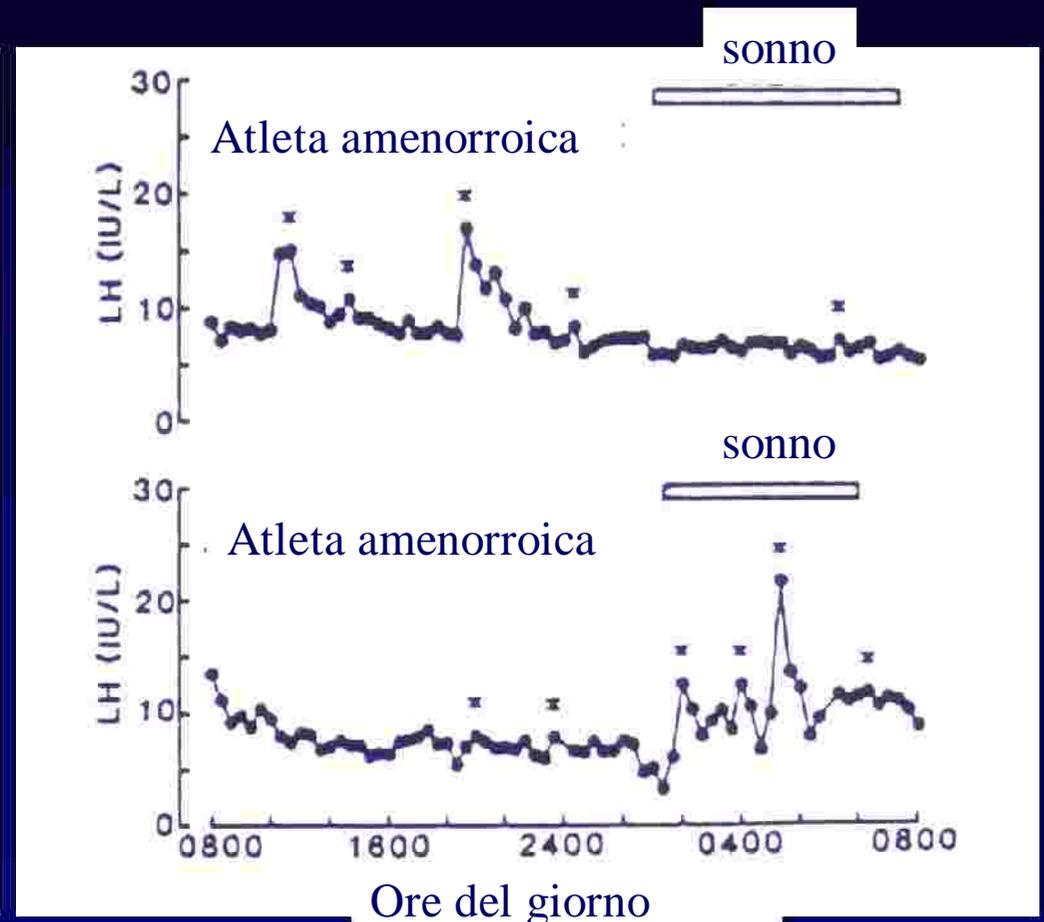
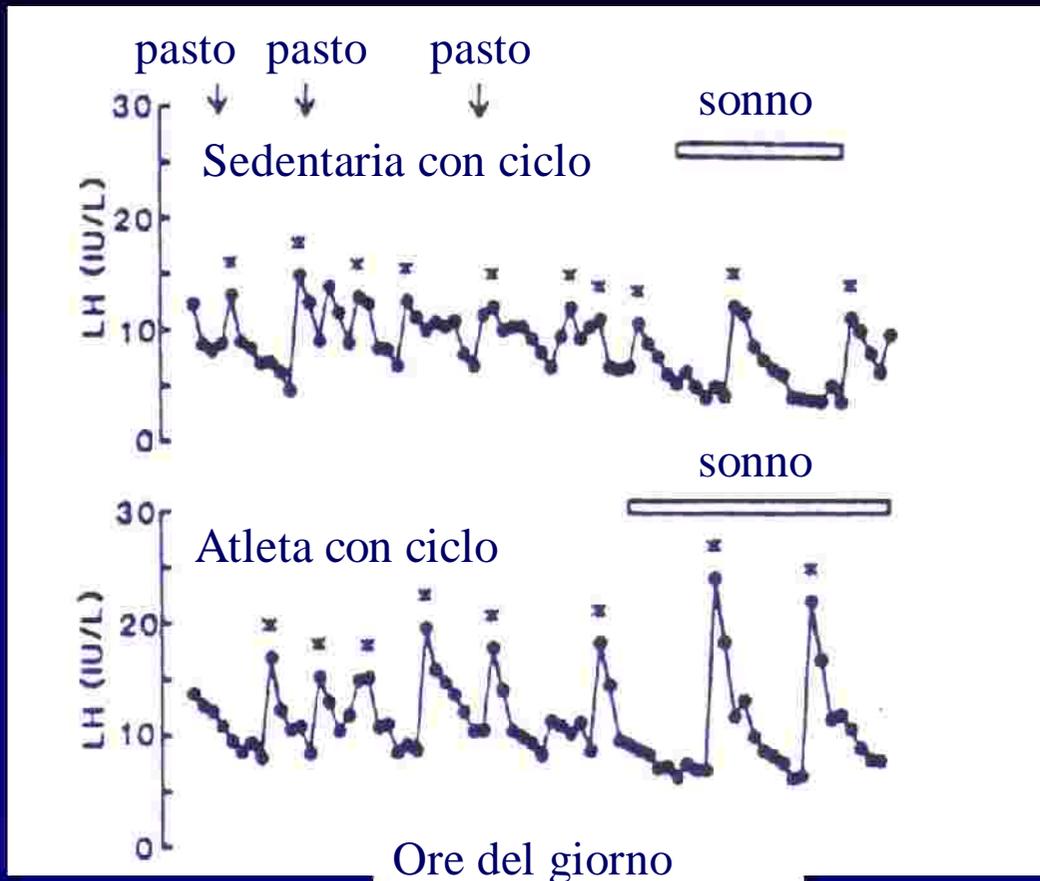
# MECCANISMI DELL'AMENORREA DELL'ATLETA

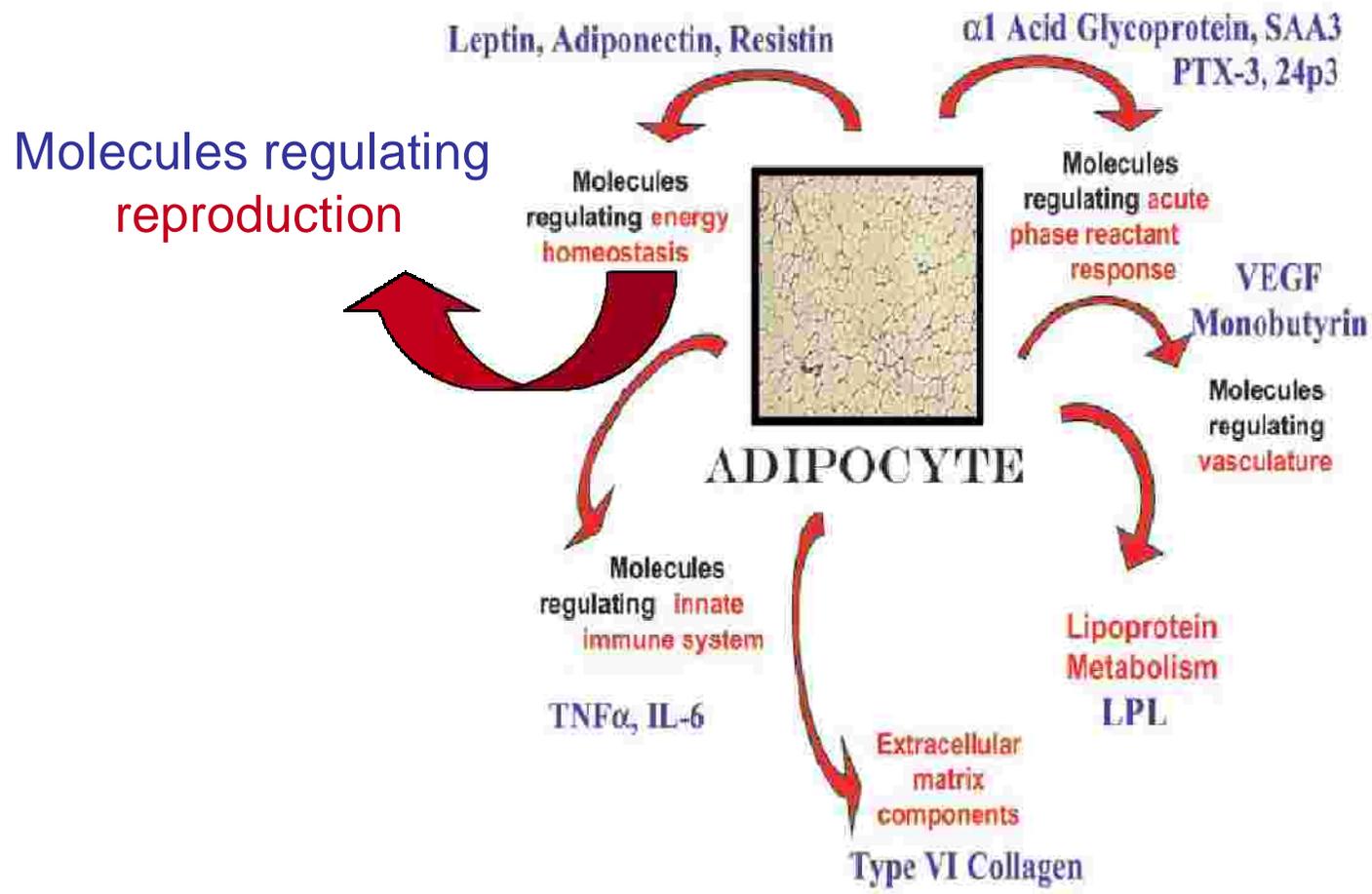
- Iperattività dell'asse ipotalamo-ipofisi-surrene
- Inadeguato introito calorico
- Riduzione depositi adiposi
- Eccesso relativo di androgeni per ridotta conversione in estrogeni
- Alterato metabolismo degli estrogeni
- Eccesso assoluto di androgeni

# AMENORREA DELL'ATLETA

- Prevalenza riportata assai variabile (5-25%)
- Frequenza influenzata dal tipo di sport e dal livello agonistico
- Può associarsi a disturbi del comportamento alimentare e a osteoporosi (*triade dell'atleta*)

# Alterazioni della secrezione di gonadotropine nelle atlete (ballerine)





ORIGINAL ARTICLE

## Recombinant Human Leptin in Women with Hypothalamic Amenorrhea

Corrine K. Welt, M.D., Jean L. Chan, M.D., John Bullen, B.A., Robyn Murphy, M.S., Patricia Smith, B.S., Alex M. DePaoli, M.D., Aspasia Karalis, B.A., and Christos S. Mantzoros, M.D., D.Sc.

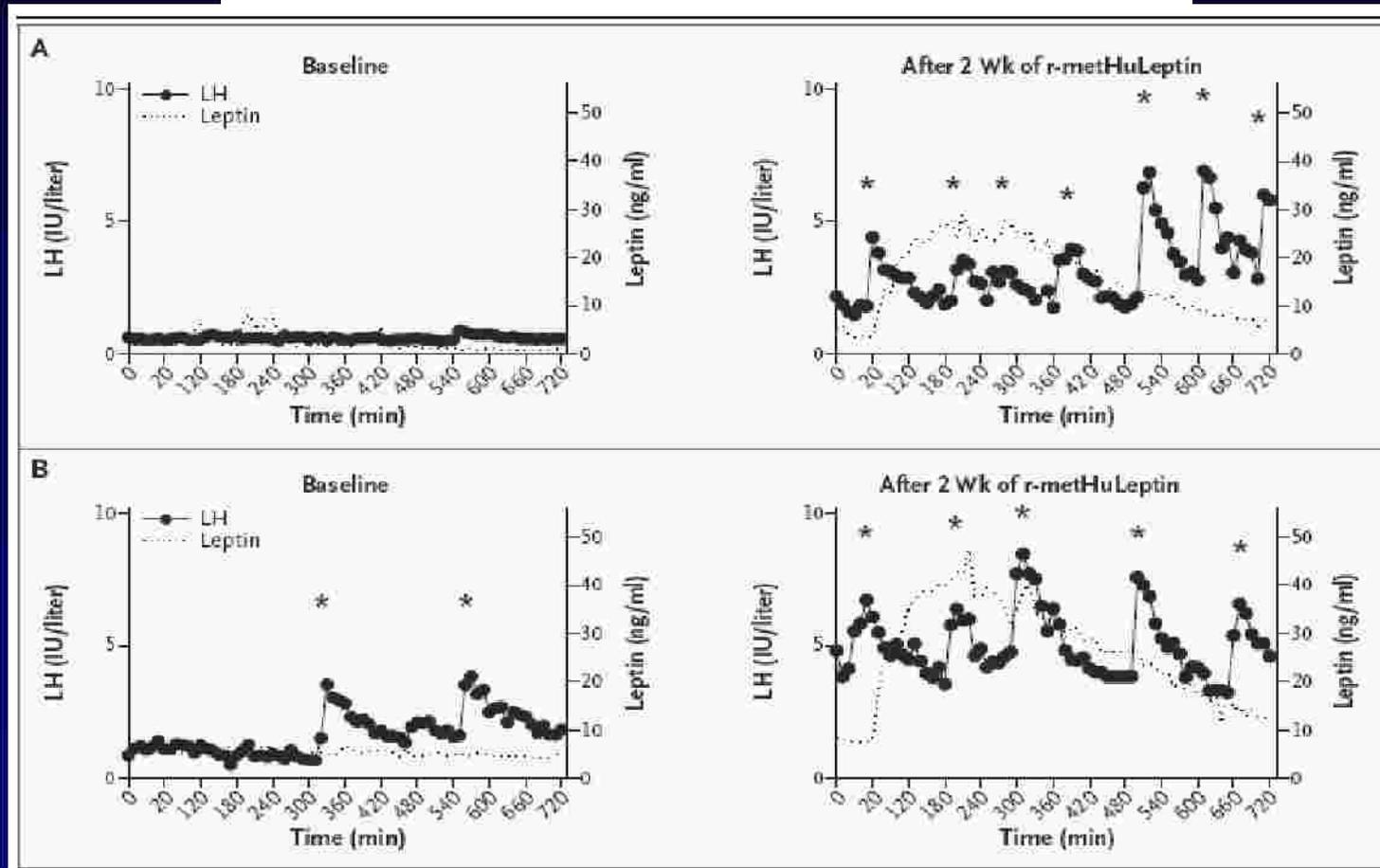
**Table 2. Body Composition, Hormone Levels, and Bone-Marker Levels during r-metHuLeptin Treatment.\***

Variable	Baseline (N=8)	Month 1 (N=8)	Month 2 (N=7)	Month 3 (N=5)	One-Month Follow-up (N=7)	Overall P Value†
<b>Body composition</b>						
Body weight (kg)	54.7±4.5	54.1±4.3‡§	54.0±3.6‡	52.2±3.5‡	53.6±3.8	<0.001
Fat mass						
kg	12.5±2.8	11.8±2.2‡§	11.1±2.0‡§	9.6±1.7‡	10.2±1.9	<0.001
%	22.4±3.7	21.4±3.2§	20.4±2.9‡¶	18.1±2.9‡	18.6±2.9	<0.001
<b>Hormones</b>						
Leptin (ng/ml)	3.4±1.5	9.7±4.1‡	20.6±15.7‡§	37.4±30.1‡§	9.4±10.1	<0.001
LH (IU/liter)	3.1±3.6	5.1±4.5‡¶	5.7±2.7‡§	6.7±4.2‡§	2.2±2.0	<0.001
FSH (IU/liter)	6.2±1.3	7.0±1.2	6.9±1.6	6.6±1.8	5.7±1.5	0.16
Estradiol (pg/ml)	26.9±7.7	44.1±25.7‡	54.4±20.9‡¶	71.2±22.8‡	28.4±9.6	<0.001
Inhibin A (IU/ml)	0.89±0.4	1.15±0.5	1.66±1.2	1.85±1.8	0.88±0.5	0.37
Inhibin B (pg/ml)	99.7±46.8	136.3±54.3	126.1±35.1	145.0±55.5	110.7±53.2	0.54
Free T <sub>3</sub> (pg/ml)	1.90±0.2	1.99±0.3	2.23±0.4‡	2.59±0.4‡	2.23±0.4	<0.001
Free T <sub>4</sub> (ng/dl)	1.08±0.1	1.08±0.1	1.17±0.2‡	1.28±0.1‡	1.12±0.2	<0.001
Thyrotropin (μIU/ml)	2.48±1.3	2.90±1.1	3.06±1.3	4.52±2.2‡	2.63±1.8	0.056
Cortisol (μg/dl)	17.2±3.3	19.3±4.2¶	20.1±4.7¶	19.9±4.4	15.3±4.6	0.07
Corticotropin (pg/ml)	18.1±7.2	20.3±7.1	19.2±7.9	20.2±6.0	14.6±7.6	0.40
IGF-1 (ng/ml)	191.3±31.1	219.7±49.6‡	253.8±57.4‡¶	281.3±59.5‡§	212.4±44.8	<0.001
IGF-binding protein 3 (μg/ml)	4.46±0.6	4.44±0.8	4.80±0.9‡	5.20±0.3‡	4.51±1.0	<0.001

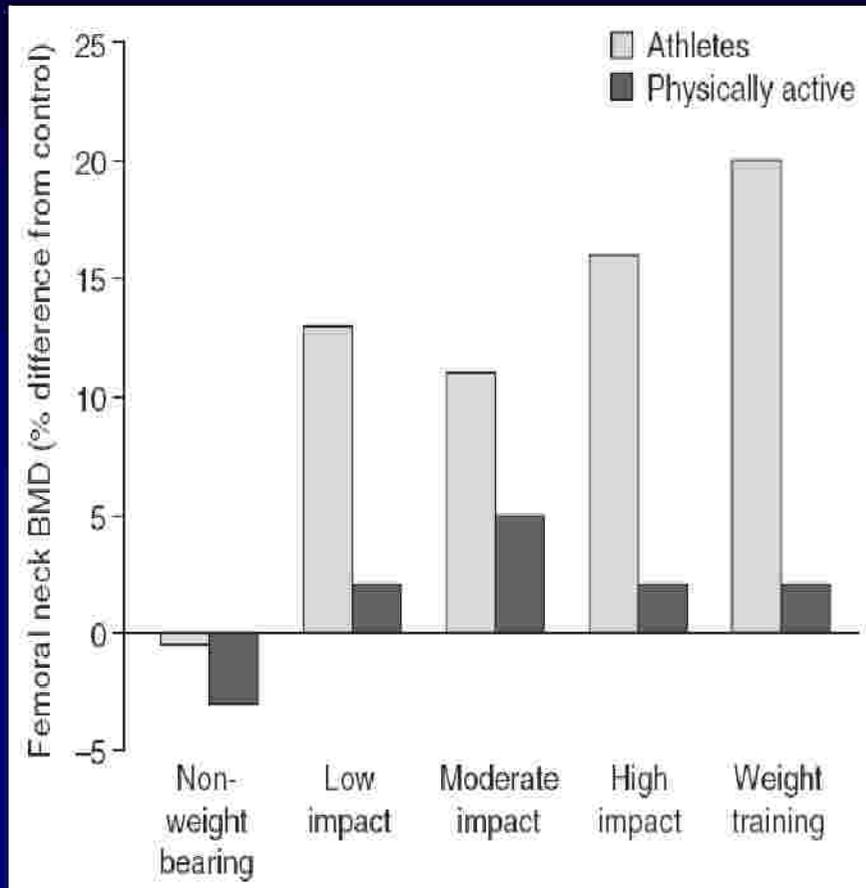
ORIGINAL ARTICLE

## Recombinant Human Leptin in Women with Hypothalamic Amenorrhea

Corrine K. Welt, M.D., Jean L. Chan, M.D., John Bullen, B.A., Robyn Murphy, M.S.,  
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and Christos S. Mantzoros, M.D., D.Sc.



# Differenze della densità ossea nella donna in rapporto a livello e categoria di sport (in % rispetto a controlli)



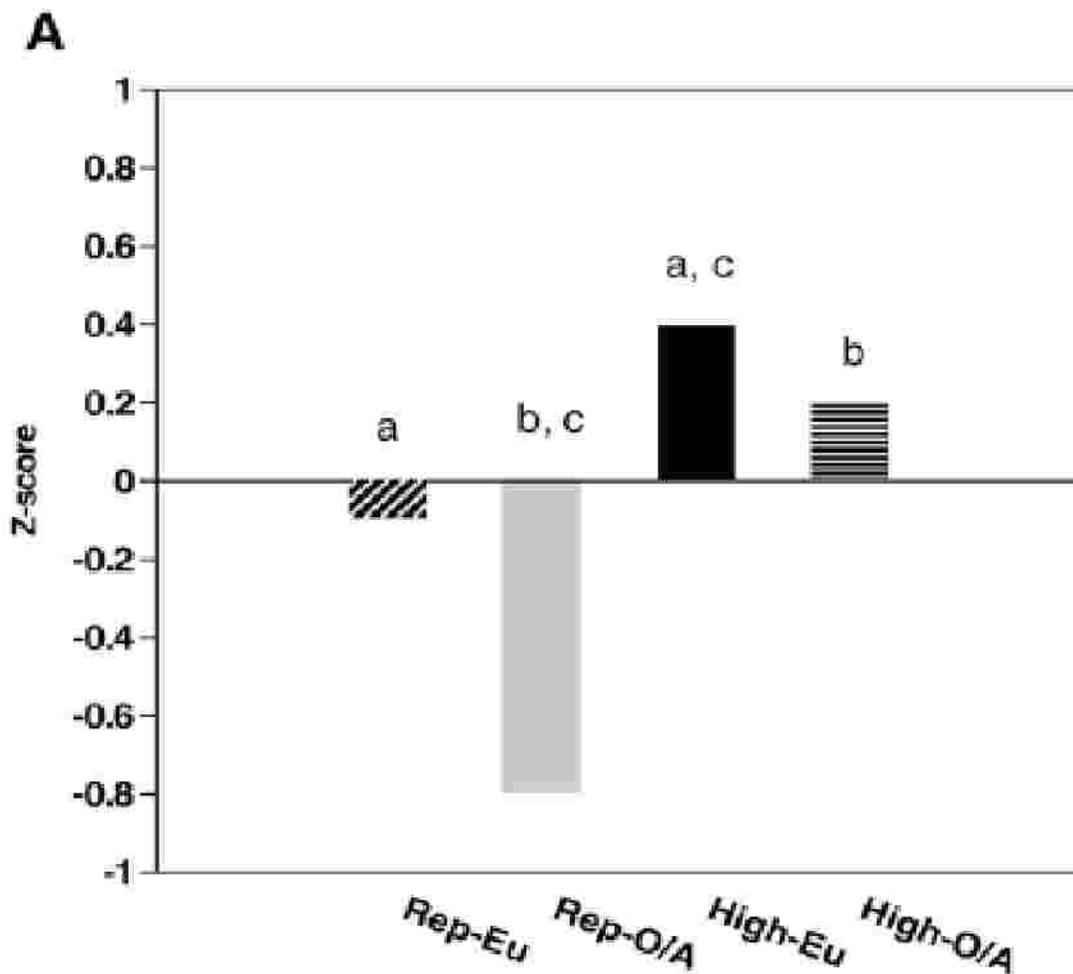
**Non-weight bearing:** nuoto, ciclismo, etc

**Low impact:** cammino, sci, etc

**Moderate impact:** tennis, pattinaggio veloce, etc

**High impact:** ginnastica, volley, etc

# Densità ossea (colonna lombare, valore rispetto a quello atteso per l'età) in atlete liceali in rapporto a categoria di sport e ciclo



**Rep:** repetitive/non impact (nuoto, mezzofondo, fondo)

**High:** high/odd impact (calcio, volley, sprint, tennis)

**Eu:** ciclo regolare

**O/A:** oligoamenorrea

## Despite a High Prevalence of Menstrual Disorders, Bone Health Is Improved at a Weight-Bearing Bone Site in World-Class Female Rhythmic Gymnasts

**Table 2.** Comparison Between RG Groups According to Menarche and Menstrual Cycle Status and Oral Contraceptive Use<sup>a</sup>

Parameters	RGs With Primary Amenorrhea	RGs With Menstrual Irregularities	RGs Taking Contraceptive Pills	RGs Without Menstrual Irregularities	CONs
Number of subjects	n = 17	n = 36	n = 5	n = 24	n = 51
Age, y	16.7 ± 0.7 <sup>d</sup>	18.2 ± 2.3	18.9 ± 1.6	19.4 ± 3.1 <sup>f</sup>	19.3 ± 3.0
Weight, kg	49.2 ± 3.5 <sup>d</sup>	52.3 ± 4.4 <sup>d</sup>	54.5 ± 6.7	54.3 ± 4.4 <sup>g</sup>	57.3 ± 7.2
BMI, kg/m <sup>2</sup>	17.8 ± 1.1 <sup>d</sup>	18.9 ± 1.1 <sup>d,g</sup>	20.4 ± 0.9 <sup>g</sup>	19.0 ± 1.2 <sup>d,g</sup>	21.3 ± 2.5
Body fat mass, kg	6.1 ± 1.8 <sup>d</sup>	7.1 ± 2.1 <sup>d</sup>	9.2 ± 3.2 <sup>g</sup>	7.6 ± 2.0 <sup>d</sup>	13.8 ± 4.6
Body fat mass, %	12.3 ± 2.9 <sup>d</sup>	13.5 ± 3.5 <sup>d</sup>	16.8 ± 3.7 <sup>c</sup>	14.0 ± 3.2 <sup>d</sup>	23.9 ± 6.0
Muscle mass, kg	41.3 ± 3.1	44.4 ± 3.4 <sup>b</sup>	41.9 ± 3.9	45.3 ± 3.9 <sup>b</sup>	41.5 ± 4.2
Training, h/wk	42.6 ± 11.8	41.2 ± 13.3	47.2 ± 14.7	39.7 ± 16.5	
BUA <sub>v</sub> , dB/MHz	67.9 ± 4.6	69.0 ± 4.7 <sup>c</sup>	68.5 ± 4.6	68.6 ± 4.6 <sup>b</sup>	65.4 ± 3.3

<sup>a</sup> Values are presented as mean ± SD, except for adjusted BUA values for age and weight, which are presented as mean ± SEM.

<sup>b-d</sup> Significant differences between RGs and CONs: <sup>b</sup>  $P < .05$ ; <sup>c</sup>  $P < .01$ ; <sup>d</sup>  $P < .001$ .

<sup>e-g</sup> Significant difference with RGs without menarche: <sup>e</sup>  $P < .05$ ; <sup>f</sup>  $P < .01$ ; <sup>g</sup>  $P < .01$ .

# TERAPIA DELL'AMENORREA DELL'ATLETA

## Orientamento dei medici dell'American Society of Sport Medicine

- **Terapia ormonale sostitutiva** 92%
- Supplementazione di calcio 87%
- Aumento introito calorico 64%
- Riduzione intensità attività fisica 57%
- Aumento peso corporeo 43%

# TERAPIA SOSTITUTIVA NELLE ATLETE AMENORROICHE

Viene suggerita per i rischi connessi allo stato di ipoestrogenismo

Non sembra avere rilevanti effetti sulla performance atletica

Richiede l'esclusione preliminare di altre cause di amenorrea

# Cause di aumento della prolattina

## Iperprolattinemia fisiologica

- gravidanza, allattamento, stimolaz. capezzolo
- esercizio
- stress (ipoglicemie)
- sonno

## Iperprolattinemia patologica

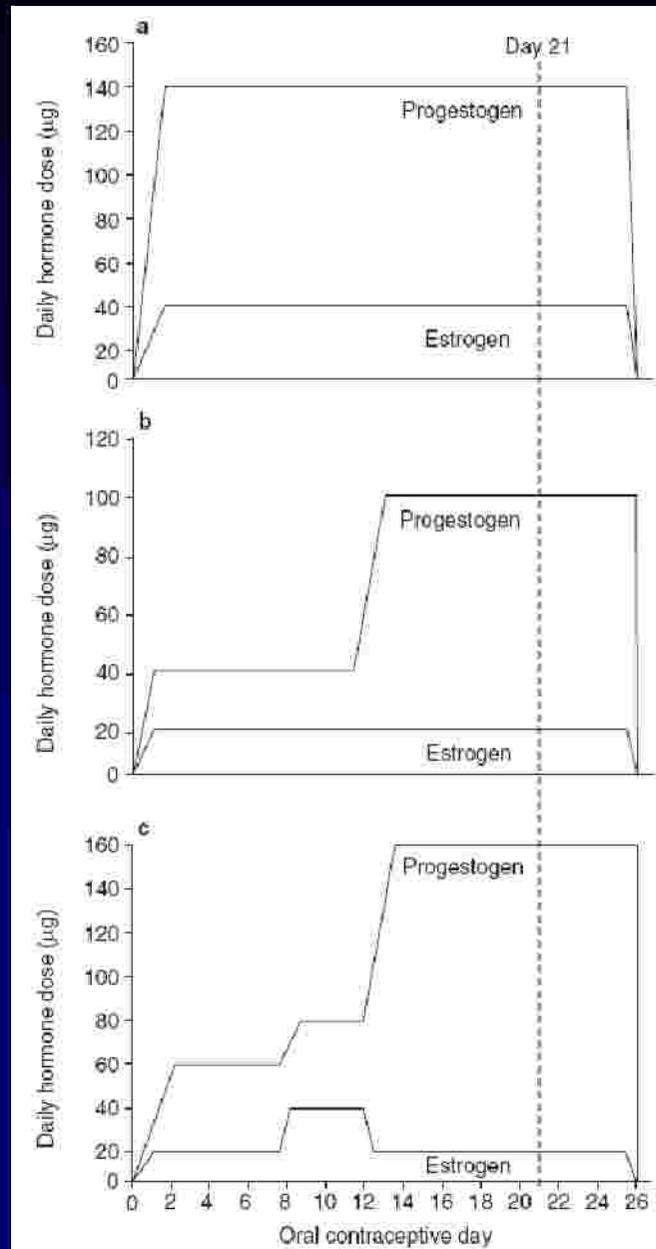
- prolattinoma
- altre patologie ipotalamo-ipofisarie
- ipotiroidismo primario
- insufficienza renale grave
- malattie o traumi mammella o parete toracica, lesioni midollo

## Iperprolattinemia da farmaci

monofasici

bifasici

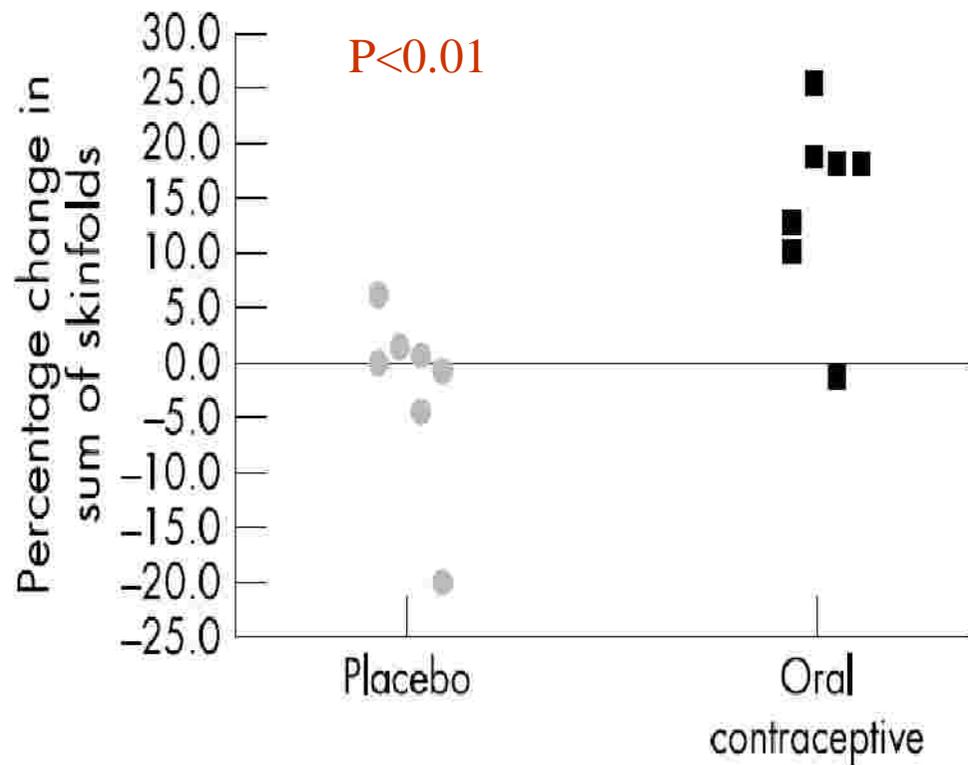
trifasici



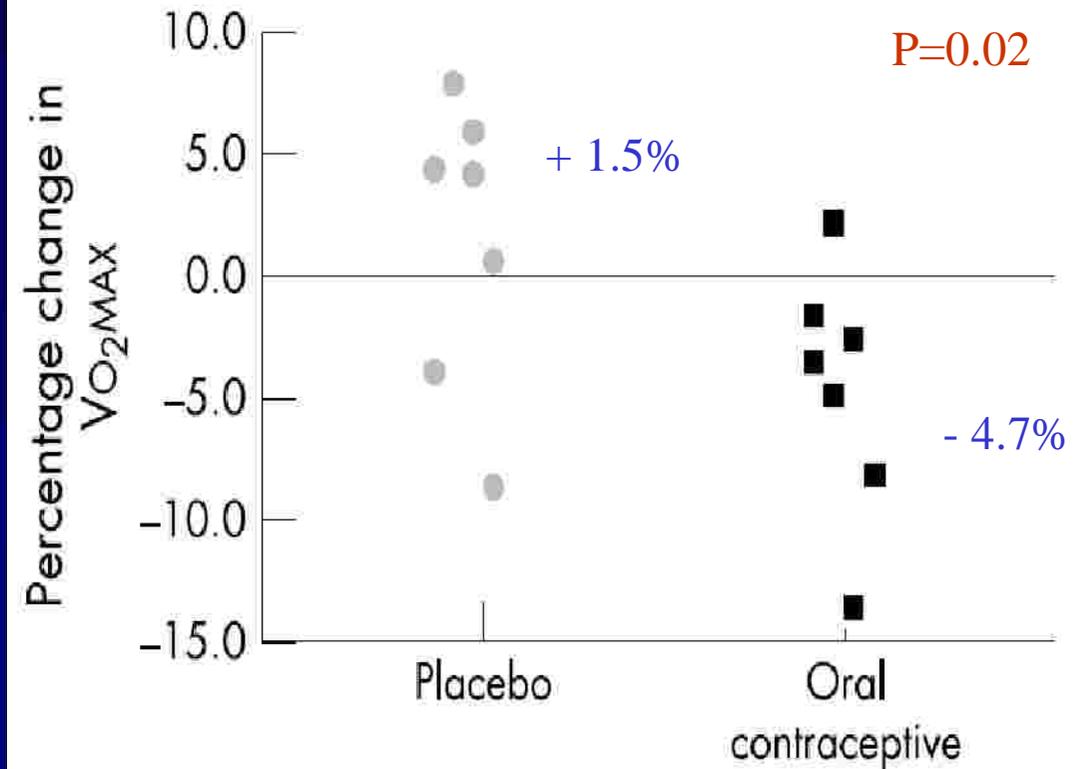
Schema delle  
variazioni ormonali  
associate a diverse  
tipologie di  
contraccettivi orali

# Variazioni % di adiposità e $\text{VO}_2\text{max}$ in 14 atlete dopo assunzione per 2 mesi di pillola trifasica o placebo

## Plicometria



## $\text{VO}_2\text{max}$

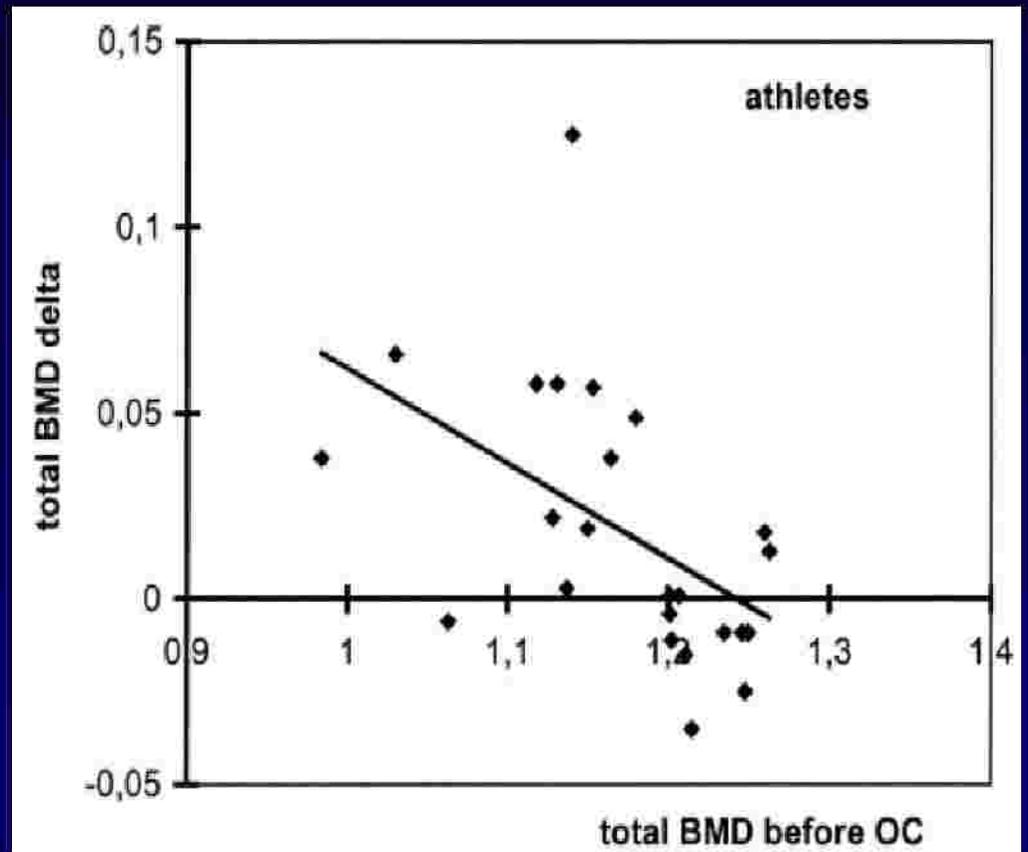
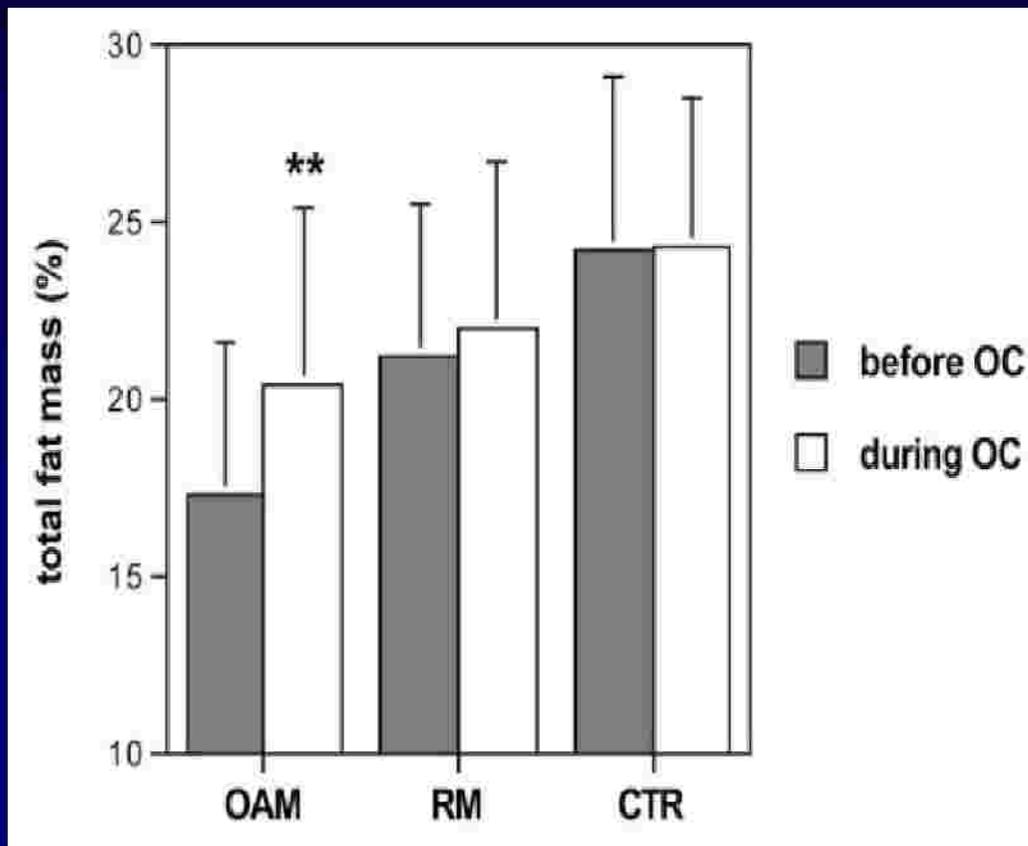


# Effetti sulla performance di atlete della assunzione per 2 mesi di una pillola trifasica

Nessuna variazione di:

- forza isocinetica (dinamometro Cybex II)
- capacità anaerobica (anaerobic speed test)
- resistenza aerobica (al 90%  $VO_{2max}$ )

Variazioni di adiposità in atlete con oligoamenorrea o cicli regolari e in controlli (pannello sn) e relazione fra valore iniziale e variazioni della densità ossea nelle atlete (pannello dx) dopo assunzione per 10 mesi di basse dosi di un contraccettivo orale monofasico



# Variazioni di performance dopo assunzione per 10 mesi di basse dosi di un contraccettivo orale monofasico in atlete con oligoamenorrea o cicli regolari e in controlli

TABLE 4. Effects of combined OC on physical performance in amenorrheic or oligomenorrheic athletes (OAM), regularly menstruating athletes (RM), and sedentary controls (CTR)

Groups	OAM (n = 13)		RM (n = 13)		CTR (n = 12)	
	Before	During OC	Before	During OC	Before	During OC
<b>Treadmill</b>						
Time to exhaustion (min)	10.8 ± 0.8 <sup>a</sup>	10.5 ± 1.2	10.2 ± 1.2	10.8 ± 1.7	6.4 ± 0.6	6.5 ± 0.7
VO <sub>2</sub> max (liters/min)	3.25 ± 0.38 <sup>a</sup>	3.27 ± 0.38	3.15 ± 0.18	3.23 ± 0.22	2.41 ± 0.28	2.43 ± 0.27
VO <sub>2</sub> max (ml/kg × min)	56.7 ± 4.1 <sup>a</sup>	55.6 ± 4.5	55.3 ± 4.4	55.6 ± 3.1	41.9 ± 3.3	41.7 ± 3.1
V <sub>E</sub> (liters/min)	99 ± 16 <sup>b,c</sup>	100 ± 12	103 ± 11	102 ± 10	82 ± 12	84 ± 15
Peak heart rate (beats/min)	189 ± 6	192 ± 7	191 ± 10	194 ± 9	196 ± 6	196 ± 7
Blood lactate (mmol/liter)	9.6 ± 1.6	9.9 ± 1.6	8.7 ± 1.7	8.9 ± 1.6	9.9 ± 1.4	8.9 ± 1.4
Perceived dyspnea-exertion (points)	16.3 ± 0.9	16.6 ± 1.3	16.9 ± 1.6	17.3 ± 1.3	16.9 ± 2.0	17.7 ± 1.3
<b>Beep test</b>						
Performance (levels)	12.1 ± 1.0 <sup>a</sup>	11.4 ± 1.3 <sup>d</sup>	11.6 ± 1.0	11.6 ± 1.1	7.1 ± 1.1	6.7 ± 1.0
Peak heart rate (beats/min)	188 ± 8	190 ± 8	193 ± 10	194 ± 9	194 ± 8	192 ± 12
Blood lactate (mmol/liter)	8.3 ± 2.3 <sup>c</sup>	8.3 ± 1.9	7.6 ± 0.7	8.2 ± 1.1	10.0 ± 1.1	8.6 ± 1.6
Perceived dyspnea-exertion (points)	16.0 ± 3.5	16.8 ± 1.5	15.4 ± 1.8	16.1 ± 2.3	15.1 ± 2.5	15.6 ± 1.6
<b>Isometric measurements</b>						
Knee extension (N)	143 ± 35	144 ± 36	135 ± 21	140 ± 22	119 ± 17	122 ± 13
Hand grip (N)	33.4 ± 6.5	36.2 ± 3.7	32.2 ± 4.9	34.1 ± 3.6	33.6 ± 4.4	34.4 ± 4.4

Values are the mean ± SD. Significant differences within groups are indicated in the *During OC* columns. Significant differences in baseline levels between groups are indicated in the first OAM column.

<sup>a</sup> *P* < 0.001, OAM vs. CTR and RM vs. CTR.

<sup>b</sup> *P* < 0.05, OAM vs. CTR.

<sup>c</sup> *P* < 0.01, RM vs. CTR.

<sup>d</sup> *P* < 0.05.

Hormone replacement therapy improves contractile function and myonuclear organization of single muscle fibres from postmenopausal monozygotic female twin pairs

Table 1. Anthropometry and body composition in HRT-using twins and their non-using co-twins (n = 6 pairs)

Variable	HRT users	HRT non-users	IPD% (95% CI)	P value
Body height (cm)	162.7 ± 2.1	162.2 ± 2.2	0.31(-0.11 to 0.74)	0.250
Body weight (kg)	70.3 ± 4.5	78.4 ± 6.8	-9.0(-19.6 to 1.6)	0.156
BMI (kg m <sup>-2</sup> )			-9.5(-20.6 to 1.6)	0.156
Waist circumference (cm)			-8.3(-16.3 to 0.3)	0.094
Hip circumference (cm)	102.3 ± 3.0	106.6 ± 4.2	-3.8(-8.7 to 1.1)	0.156
Body fat (%)	33.1 ± 3.5	37.7 ± 3.8	-12.8(-26.2 to 0.59)	0.094

Table 2. Cross-sectional area (CSA), specific tension (ST), stiffness and maximum velocity of unloaded shortening (V<sub>0</sub>) in skinned single muscle fibres expressing different MyHC isoforms in HRT using and non-using co-twins

	Type I		Type I/IIa		Type IIa		Type IIax		Type IIx	
	HRT non-users	HRT users	HRT non-users	HRT users						
CSA (μm <sup>2</sup> )	(N = 6) 2550 ± 110 (n = 97)	(N = 6) 2460 ± 140 (n = 79)	(N = 4) 2630 ± 450 (n = 13)	(N = 6) 1860 ± 190 (n = 16)	(N = 6) 2240 ± 170 (n = 39)	(N = 6) 2260 ± 130 (n = 50)	(N = 4) 1850 ± 120 (n = 10)	(N = 6) 1560 ± 280 (n = 17)	(N = 2) 2050 ± 100 (n = 3)	(N = 1) 1320 (n = 2)
ST (N cm <sup>-2</sup> )			30.1 ± 5.3 (n = 9)	39.1 ± 4 (n = 11)			29.3 ± 3 (n = 9)	31.8 ± 4.8 (n = 15)	23 ± 2.3 (n = 3)	30.8 (n = 2)
Stiffness (N cm <sup>-2</sup> )	2550 ± 40 (n = 71)	2870 ± 170 (n = 48)	2450 ± 900 (n = 7)	2880 ± 460 (n = 8)	2140 ± 130 (n = 20)	2500 ± 70* (n = 32)	2200 ± 270 (n = 8)	2050 ± 230 (n = 6)		
V <sub>0</sub> (ML[LJ29] s <sup>-1</sup> )	1 ± 0.1 (n = 59)	0.90 ± 0.1 (n = 46)	1.6 ± 0.6 (n = 8)	1.8 ± 0.3 (n = 10)	2.1 ± 0.3 (n = 20)	2.3 ± 0.2 (n = 32)	2.5 ± 0.2 (n = 7)	2.7 ± 0.1 (n = 12)	2.3 ± 0.1 (n = 3)	2.5 (n = 2)

# CARATTERISTICHE ENDOCRINE PIU' COMUNI NELLE ATLETE CON AMENORREA

- Estrogeni                      ↓/=
- Androgeni                     ↓/=
- LH                                =/↓

# CARATTERISTICHE ENDOCRINE DELLE NUOTATRICI

- Estrogeni =/↑
- Androgeni ↑
- LH ↑

Iperandrogenismo esercizio-indotto o primitivo  
(vantaggio selettivo)?

## Molecular Diagnosis of 5 $\alpha$ -Reductase Deficiency in 4 Elite Young Female Athletes Through Hormonal Screening for Hyperandrogenism

**Results:** The 4 athletes presented as tall, slim, muscular women with a male bone morphotype, no breast development, clitoromegaly, partial or complete labial fusion, and inguinal/intralabial testes. All reported primary amenorrhea. The hormonal analysis evidenced plasma T within the male range, the karyotype was 46, XY, and molecular analysis of the 5 $\alpha$ -reductase type 2 (*srd5A2*) gene

# PREVALENZA DELL'IPERANDROGENISMO NELLA DONNA IN ETA' FERTILE

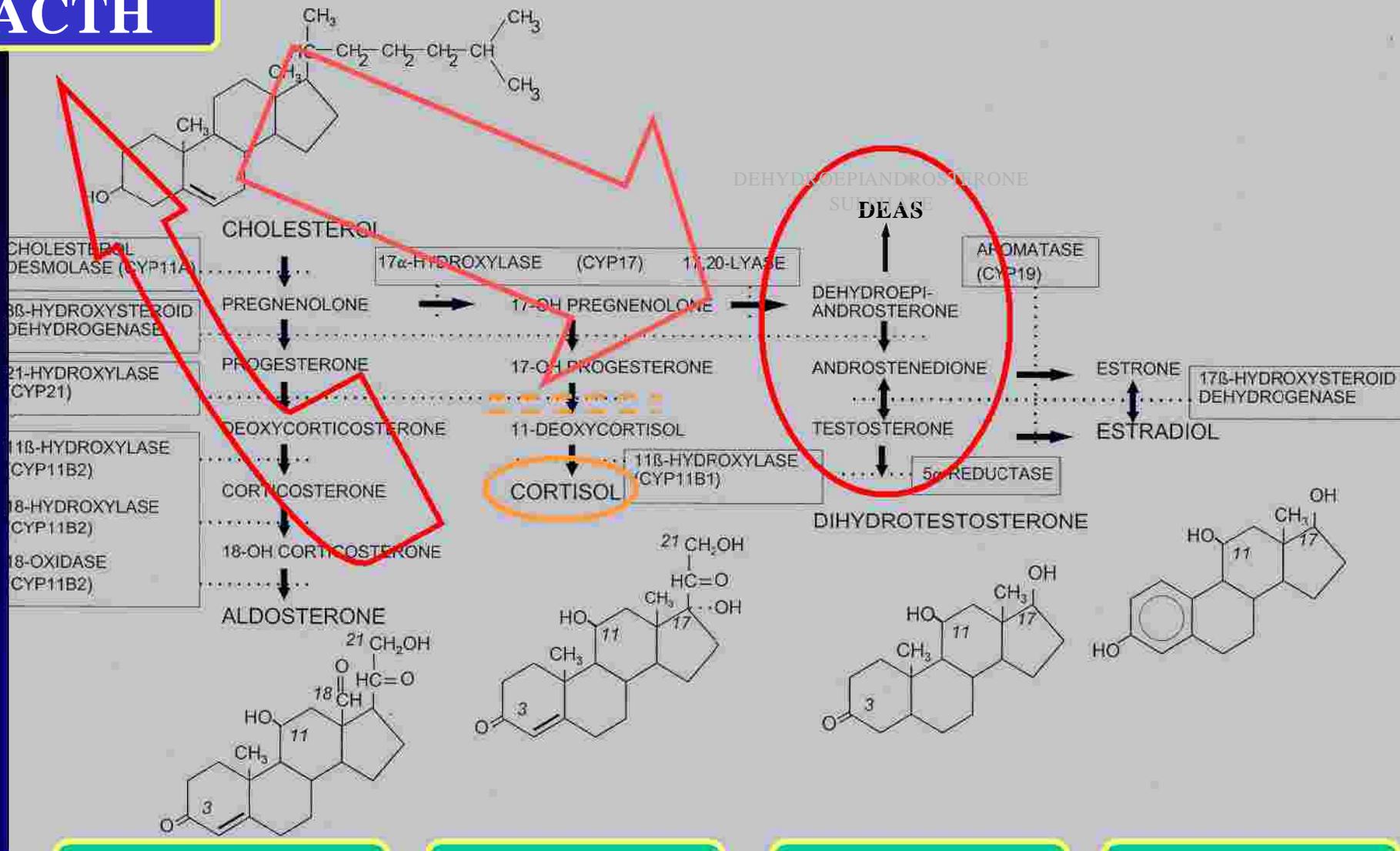
Da tutte le cause ~10%

- PCOS 6-8%
- Irsutismo idiopatico 1-2%
- Iperandrogenemia idiopatica 1-2%
- Deficit enzimatici ~ 0.1%
- Tumori rari

# 21-idrossilasi

- Enzima della steroidogenesi surrenalica, controlla la sintesi di cortisolo e aldosterone
- Un deficit genetico di questo enzima, di entità variabile, è relativamente comune
- Il deficit di cortisolo che ne consegue causa aumento della secrezione di ACTH e questo provoca, in presenza del blocco enzimatico, deviazione della steroidogenesi verso la sintesi di androgeni

# ACTH



MINERALCORTICOIDI

GLUCOCORTICOIDI

ANDROGENI

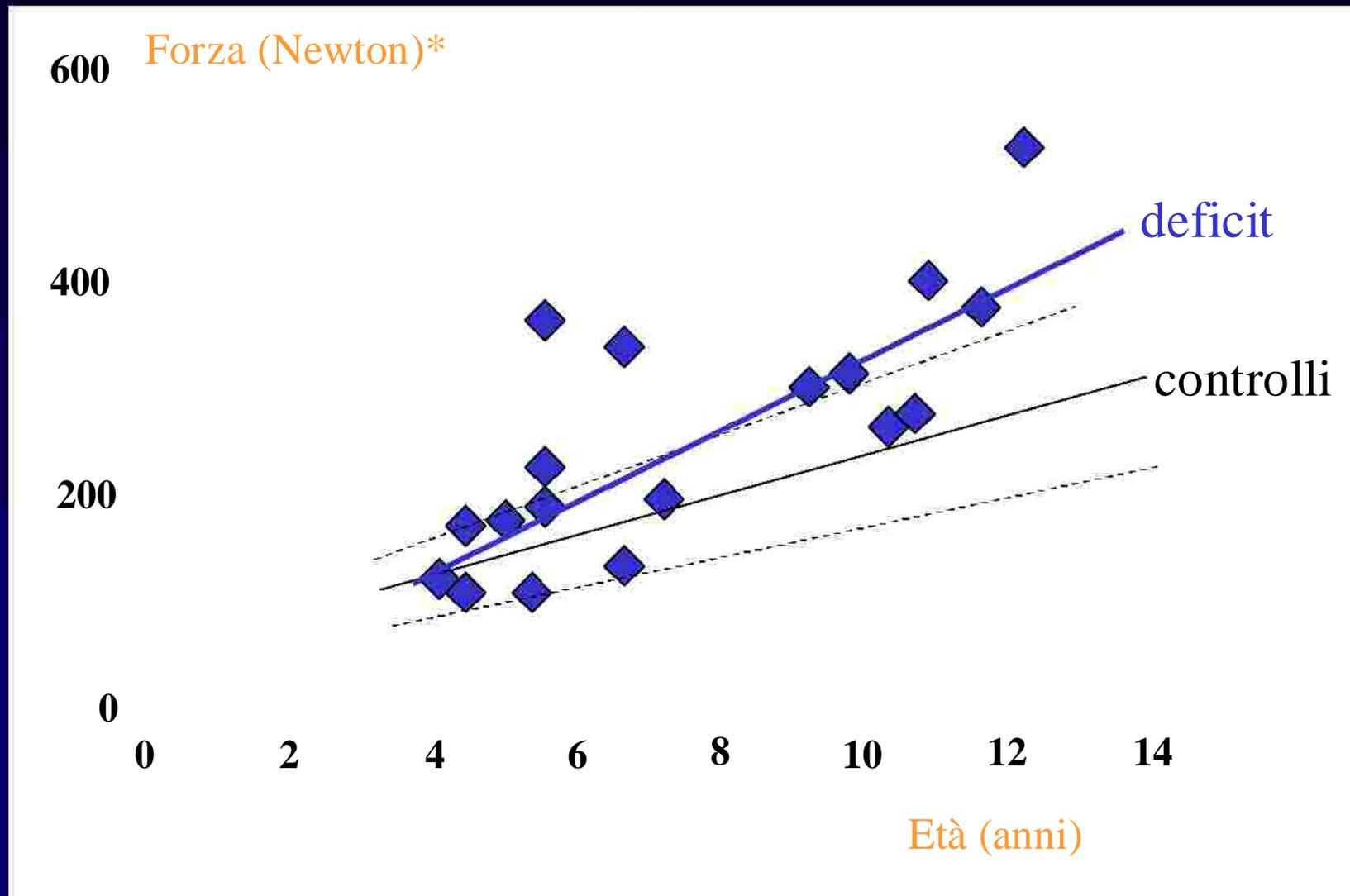
ESTROGENI

GLOMERULOSA

FASCICULATA

RETICULARIS

# Forza muscolare in funzione dell'età in bambine con deficit della 21 idrossilasi



\* strenght testing chair

Rodda et al 1987

# Criteri per la diagnosi di PCOS

- Consensus di Rotterdam -

Presenza di almeno due elementi fra:

- **Oligo-anovulazione**
- **Iperandrogenismo** (clinico e/o biochimico)
- **Ovaie micropolicistiche** (almeno 12 follicoli di 2-9 mm e/o volume ovarico >10ml)

dopo aver escluso altre cause

(Hum Reprod & Fertil Steril, 2004)

# Hyperandrogenism May Explain Reproductive Dysfunction in Olympic Athletes

MAGNUS HAGMAR<sup>1</sup>, BO BERGLUND<sup>2</sup>, KERSTIN BRISMAR<sup>3</sup>, and ANGELICA LINDÉN HIRSCHBERG<sup>1</sup>

<sup>1</sup>Department of Woman and Child Health, Division of Obstetrics and Gynecology, Karolinska Institutet, Stockholm, SWEDEN; <sup>2</sup>Department of Medicine, Karolinska Institutet, Stockholm, SWEDEN; and <sup>3</sup>Department of Molecular Medicine and Surgery, Karolinska Institutet, Stockholm, SWEDEN

MEDICINE & SCIENCE IN SPORTS & EXERCISE, 2009

90 atlete svedesi, 47% assumevano pillola contraccettiva

% con anomalie mestruali fra le donne che non assumevano pillola

TABLE 1. Classification of the Olympic sport events in which our subjects participated into power, endurance, and technical disciplines.\*

Power (n = 55)	Endurance (n = 20)	Technical (n = 15)
Snowboarding	CC-skiing	Curling
Downhill	Canoeing	Archery
Judo	Running	Equestrian
Tae kwon do	Cycling	Sailing
Tennis	Swimming	
Badminton		
Wrestling		
Boxing		
Football		
Ice hockey		

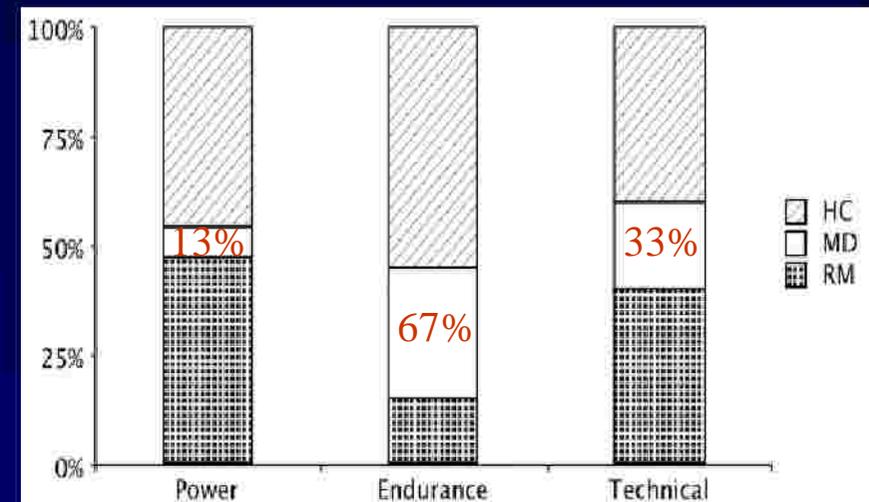


FIGURE 1—The proportion of athletes having regular menstruation (black), menstrual dysfunction (white), and using hormonal contraception (hatched) in power (n = 55), endurance (n = 20), and technical (n = 15) disciplines. Values are presented as percent of all athletes in each sport group. A significantly larger proportion of the endurance athletes (66.7%) than of those participating in power disciplines (13.3%;  $P < 0.01$ ) exhibited menstrual disturbances.

# Hyperandrogenism May Explain Reproductive Dysfunction in Olympic Athletes

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## Body composition and training loads

TABLE 3. The body compositions and self-estimated training loads of athletes participating in power, endurance, and technical sports.

Parameter (unit)	Power	Endurance	Technical
Weight (kg)	63.6 ± 6.7	63.9 ± 6.7	61.6 ± 6.1
Height (cm)	167.3 ± 5.9 <sup>a**</sup>	171.8 ± 5.4 <sup>c*</sup>	167.9 ± 5.2
BMI (kg·m <sup>-2</sup> )	22.7 ± 1.8 <sup>a*</sup>	21.6 ± 1.8	21.8 ± 1.3
Fat mass, trunk (%)	20.4 ± 5.7 <sup>a*</sup>	17.1 ± 5.2 <sup>c*</sup>	22.6 ± 7.3
Fat mass, legs (%)	24.3 ± 5.3 <sup>b**</sup>	22.2 ± 6.4 <sup>c*</sup>	28.6 ± 6.5
Ratio of upper-lower body fat mass	0.83 ± 0.12 <sup>a*</sup>	0.77 ± 0.09	0.78 ± 0.15
LBM, total (kg)	47.4 ± 4.2 <sup>b*</sup>	49.0 ± 4.4 <sup>c*</sup>	44.3 ± 3.7
BMD, total (g·cm <sup>-2</sup> )	1.29 ± 0.07 <sup>a***b***</sup>	1.20 ± 0.07	1.20 ± 0.07
BMD, spine (g·cm <sup>-2</sup> )	1.32 ± 0.15 <sup>a*b**</sup>	1.24 ± 0.15	1.19 ± 0.19
t-score, total body	2.2 ± 0.8 <sup>a***b***</sup>	1.1 ± 0.8	1.0 ± 0.9
Training load	9 (8-11)	8 (3-10)	8 (6-8.5)

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## Endocrine features according to menstrual status

RM= regular MD= menstrual dysfunction PCOS= polycystic ovary syndrome

TABLE 2. Serum levels of hormones in athletes with regular menstruation (RM) and menstrual dysfunction, with and without polycystic ovary syndrome (PCOS and non-PCOS MD).

Hormone (units)	RM (n = 35)	Non-PCOS MD (n = 7)	PCOS (n = 6)
FSH (IU·L <sup>-1</sup> )	7.4 ± 2.6	5.3 ± 0.9 <sup>a*</sup>	6.6 ± 1.4
LH (IU·L <sup>-1</sup> )	4.9 ± 2.4	3.6 ± 1.5	8.2 ± 4.6 <sup>b*c*</sup>
LH/FSH	0.7 ± 0.3	0.7 ± 0.4	1.2 ± 0.6 <sup>b**</sup>
T (nmol·L <sup>-1</sup> )	1.1 ± 0.4	1.0 ± 0.4	1.6 ± 0.8 <sup>b*</sup>
SHBG (nmol·L <sup>-1</sup> )	54.3 ± 19.9	51.9 ± 15.5	35.9 ± 12.1 <sup>b*</sup>
T/SHBG	0.023 ± 0.011	0.020 ± 0.008	0.05 ± 0.02 <sup>b***c*</sup>
A4 (nmol·L <sup>-1</sup> )	8.5 (6.4–9.9)	7.8 (5.4–8.4)	9.7 (7.5–10.0)
DHEAS (μmol·L <sup>-1</sup> )	5.4 (5.0–6.6)	5.5 (3.6–5.7)	7.8 (6.0–10.0) <sup>b*c*</sup>
17OHP (nmol·L <sup>-1</sup> )	1.6 ± 0.6	1.3 ± 0.4	3.1 ± 1.5 <sup>b***c*</sup>
E2 (pmol·L <sup>-1</sup> )	96.0 (64.0–133.0)	67.3 (43.4–157.0)	158.5 (80.5–236.8)
PRL (μg·L <sup>-1</sup> )	13.4 ± 5.8	11.7 ± 10.5	15.3 ± 10.6
TSH (mIU·L <sup>-1</sup> )	2.4 ± 1.7	1.7 ± 1.2	1.8 ± 1.1
fT4 (pmol·L <sup>-1</sup> )	17.3 ± 2.7	14.9 ± 1.3 <sup>a*</sup>	18.7 ± 2.8 <sup>c**</sup>

# PRINCIPALI ALTERAZIONI METABOLICHE DELLA DONNA IPERANDROGENICA

- Insulinoresistenza
- Aumentato rischio di IGT e diabete tipo 2
- Aumentato rapporto colesterolo LDL/HDL
- Ipertrigliceridemia

# TERAPIA FARMACOLOGICA DELLA DONNA IPERANDROGENICA

- Estroprogestinici
- Antiandrogeni
- Insulinosensibilizzanti
- Induttori dell'ovulazione

## Potenziati utilizzi dei farmaci estroprogestinici

- come contraccettivi, per evitare possibili gravidanze indesiderate;
- per ripristinare o regolarizzare il ciclo mestruale o comunque quando si voglia modulare con precisione la cadenza delle mestruazioni
- per ovviare alle conseguenze di una carenza di estrogeni, soprattutto a carico dell'osso, nell'amenorrea ipotalamica funzionale;
- per contrastare la produzione ovarica di ormoni androgeni nelle condizioni di iperandrogenismo e in particolare nella PCOS;
- dopo la menopausa o in vicinanza di questo momento della vita, per eliminare i disturbi associati alla brusca diminuzione degli estrogeni (vampate, etc).