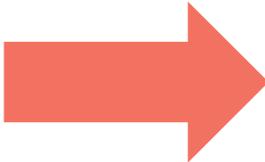
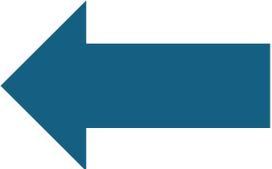


Finalidades do uso de Anabolizantes



≠

Terapêutico



**Não
Terapêutico**



Reposição
Hormonal

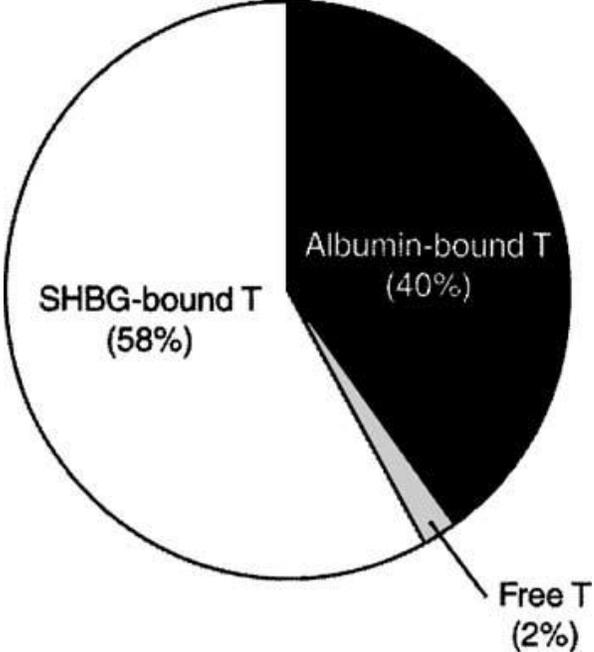
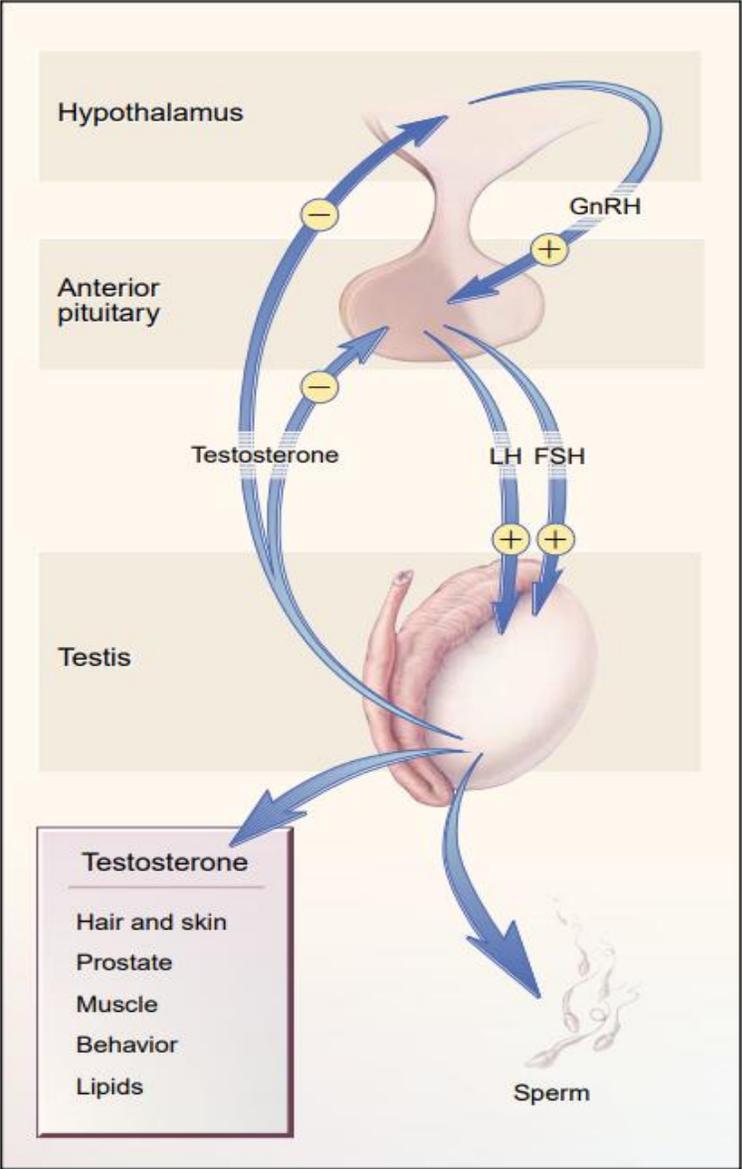


**Estética e
Performance**

**Existem
recomendações!**

**Não existem
recomendações!**

Limites fisiológicos



TT = 300 a 1000 ng/dL (mulher: 9 a 63 ng/dL)

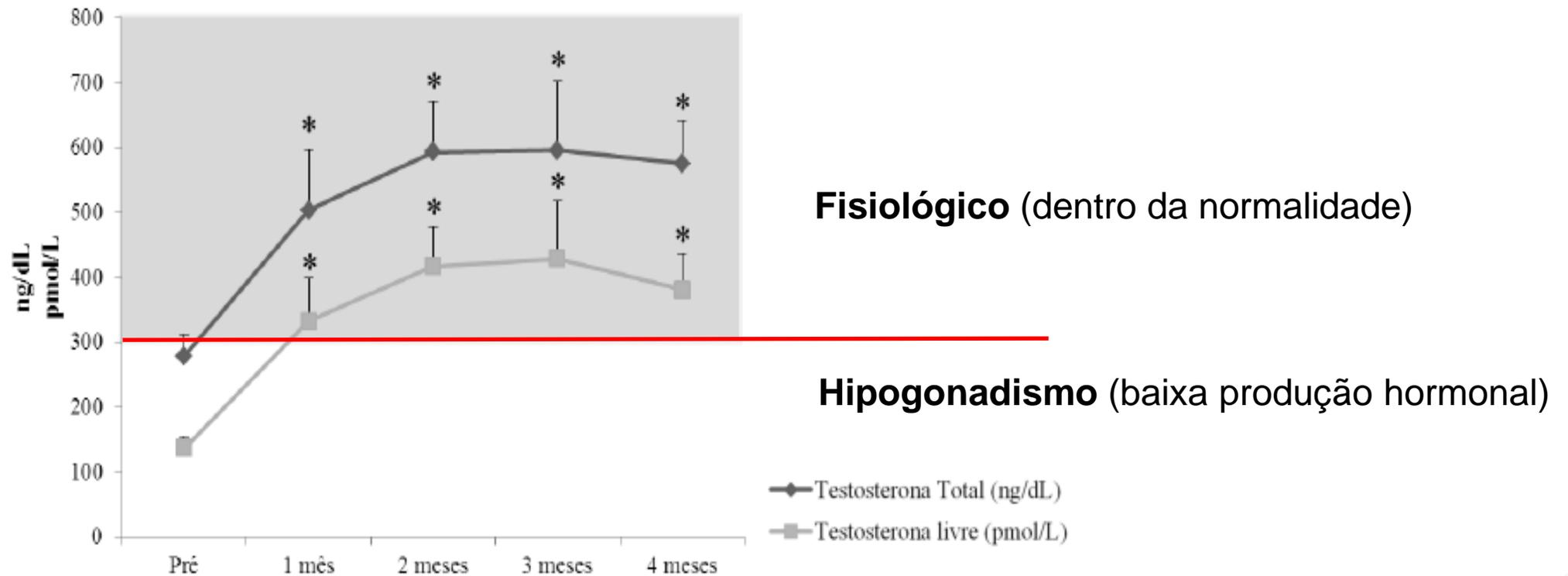
TL = 171 a 640 pmol/L (mulher: 2.4 a 37.0 pmol/L)



Indicação para reposição hormonal

Hipogonadismo

- Reposição hormonal como tratamento: hipogonadismo e perda de massa muscular



Investigação de hipogonadismo

Society, year	Total testosterone		Free testosterone	
	nmol/L	ng/dL	pmol/L	pg/mL
American Urological Association, 2018 ⁶	10.4	300	-	-
British Society for Sexual Medicine, 2017 ⁷	12	346	225	65
Canadian Medical Association, 2015 ⁸	Local laboratory ranges	-	-	-
Endocrine Society, 2018 ⁹	9.2	264	-	-
Endocrine Society of Australia, 2016 ^{10,11}	7.4 in young men and 6.6 men older than 70 y	216/190	-	-
European Academy of Andrology, 2020 ¹²	12	350	-	-
European Association of Urology, 2020 ¹³	12	350	225	65
International Consultation for Sexual Medicine, 2019 ¹⁴	12.1	350	225-347	65-100
International Society for the Study of Aging Male, 2015 ¹⁵	12	350	225-243	65-70

Testosterona total e livre

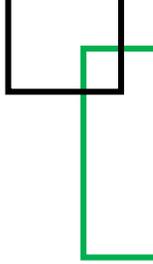
H: 300 a 1000 ng/dL (171 a 640 pmol/L)

M: 9 a 63 ng/dL (2.4 a 37.0 pmol/L)

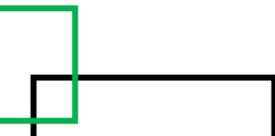
Investigação de hipogonadismo

Society, year	Time of the day	Metabolic status
American Urological Association, 2018 ⁶	Early morning fashion	-
British Society for Sexual Medicine, 2017 ⁷	Between 7 and 11 AM	fasting testing is appropriate for a first test
Canadian Medical Association, 2015 ⁸	Between 7 and 11 AM	-
Endocrine Society, 2018 ⁹	Morning	Fasting
Endocrine Society of Australia, 2016 ^{10,11}	Between 8 and 10 AM	Fasting results in higher serum testosterone levels
European Academy of Andrology, 2020 ¹²	Between 7 and 11 AM	Fasting
European Association of Urology, 2020 ¹³	between 7 and 11 AM	Fasting

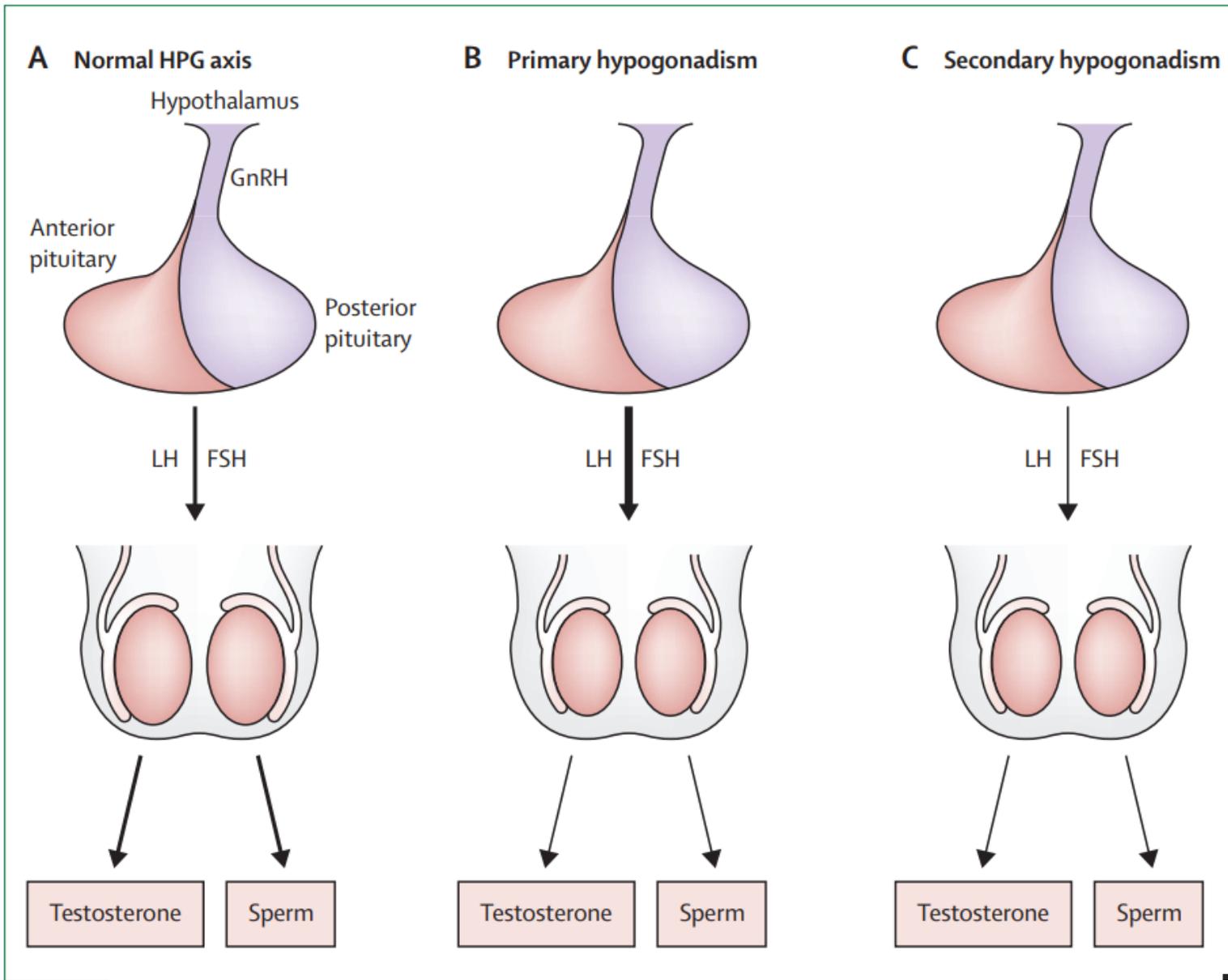
Investigação de hipogonadismo



Target populations to screen for testosterone deficiency	LoE	Grade
Screen for TD in adult men with consistent and multiple signs of TD	3	C
Screen all men presenting with ED or loss of spontaneous erections, or reduced sexual desire	1	A
Screen for TD in all men with type 2 diabetes, BMI >30 kg/m ² or waist circumference >102 cm	2	A
Consider screening for TD in all men post covid-19 infection, cirrhosis, rheumatoid arthritis and testicular cancer or associated therapy	2	C
Screen for TD in all men with CKD	2	A
Screen for TD in all men on long term prescribed opiate analgesics, antipsychotic, anticonvulsant, Roaccutane or finasteride therapy	2	B
Screen for TD in men with anaemia	2	A
Screen for TD in men with osteoporosis	2	A



Tipos de hipogonadismo



Hipogonadismo orgânico

Hipogonadismo funcional

(Outras complicações –
obesidade, DCV, cânceres)

TABLE 1 Aetiology of male hypogonadism

Congenital disorders	Acquired diseases
Primary gonadal insufficiency	
Klinefelter syndrome	Gonadectomy—bilateral
Uncorrected bilateral cryptorchidism	Trauma or torsion—bilateral
Testicular regression (vanishing testes)	Orchitis—bilateral
Partial androgen insensitivity syndrome	Chemotherapy—alkylating
inactivating LHCG receptor mutations	Radiotherapy—pelvic
Congenital adrenal hyperplasia	Ageing and age-associated comorbidities
	Heavy tobacco smoking
	Chronic alcohol abuse
	Systemic diseases:
	- HIV infection
	- Sickle cell disease
	- Coeliac disease
	- Uraemia

Central hypogonadism

Isolated GnRH deficiency

- Kallmann syndrome
- Normosmic congenital HH

Syndromic forms of GnRH deficiency:

- Combined pituitary hormone deficiency
- Septo-optic dysplasia
- CHARGE syndrome
- Bardet-Biedl syndrome?
- Prader-Willi syndrome
- *Adrenohypoplasia congenita (NROB1)*
- Leptin deficiency/leptin resistance

Parasellar tumours, especially prolactinoma

Inflammatory/Infiltrative diseases

- Sarcoidosis
- Histiocytosis
- Iron overload, for example, genetic Haemochromatosis

Trauma/vascular/radiation

- Military blast trauma
- Pituitary apoplexy or stalk transection
- Cranial surgery and irradiation

Drug-induced

- Opioids and narcotics
- High-dose glucocorticoids
- Androgen deprivation therapy
- Anti-dopaminergic antipsychotics
- Cannabinoids
- Androgenic anabolic steroids
- Estrogens

Sinais e sintomas de hipogonadismo

Sociedade Britânica de Medicina Sexual, 2017

Sexual dysfunction, especially low sexual desire, **decreased morning and night-time erections** and erectile dysfunction are prominent, commonly presenting symptoms particularly suggestive when associated with each other. Less specific symptoms include fatigue, sleep disturbance, loss of physical strength, decreased energy and motivation and depressed mood.

- Sexual: delayed puberty, small testes, infertility, decreased sexual desire and activity, **decreased frequency of sexual thoughts**, erectile dysfunction, **delayed ejaculation**, decreased volume of ejaculate, decreased or absent morning or night-time erections
- Cardiometabolic: **increased body mass index or obesity**, visceral obesity, **metabolic syndrome**, **insulin resistance and type 2 diabetes**
- Physical: **decreased body hair**, gynaecomastia, decreased muscle mass and strength, hot flushes or sweats, **sleep disturbances**, fatigue, osteoporosis, height loss and low-trauma fractures
- Psychological: **changes in mood** (eg anger, irritability, sadness and depression), **decreased well-being** or poor self-rated health and **decreased cognitive function** (including impaired concentration, verbal memory and spatial performance)

Associação Médica Canadense, 2015

- Sexual: decreased libido, erectile dysfunction, decreased frequency of morning erections and decreased performance
- Somatic: increased visceral body fat/obesity, decreased lean muscle mass, decreased strength, fatigue/loss of energy, decreased physical activity/vitality, **low bone mineral density**, anaemia, flushes, **loss of facial, axillary and pubic hair/slow beard growth**, and decline in general feeling of well-being
- Psychological: depression/depressed mood, **mood changes**, irritability, inability to concentrate and **insomnia/sleep disturbances**

Sociedade de Endocrinologia, 2018

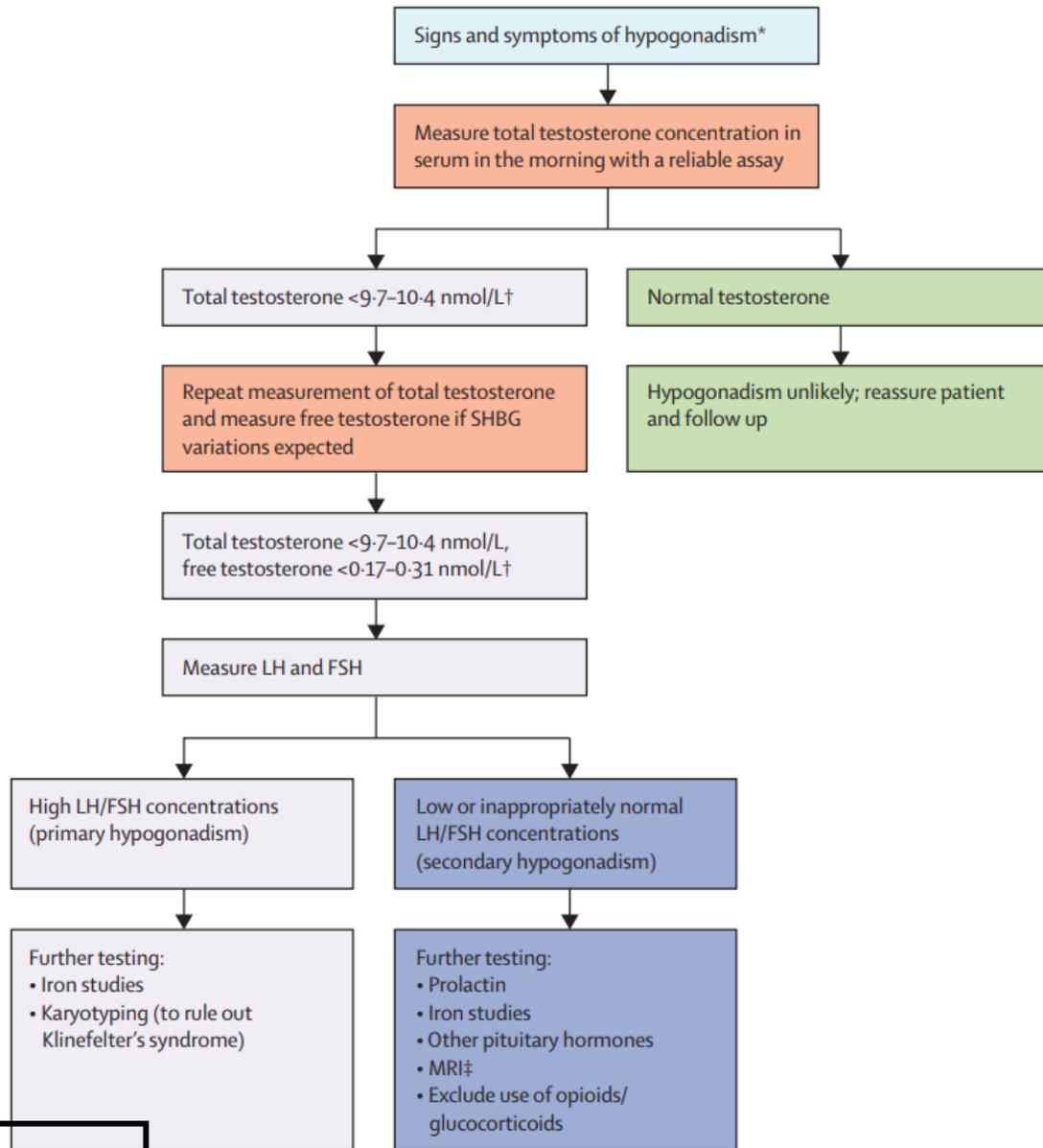
- Specific symptoms and signs: incomplete or delayed sexual development, loss of body (axillary and pubic) hair and very small testes (<6 mL)
- Suggestive symptoms and signs: reduced sexual desire (libido) and activity, **decreased spontaneous erections**, erectile dysfunction, breast discomfort, gynaecomastia, eunuchoidal body proportions, **inability to father children**, low sperm count, height loss, low-trauma fracture, low bone mineral density, **hot flushes and sweats**
- Non-specific symptoms and signs: **decreased energy**, motivation, initiative, and self-confidence, feeling sad or blue, **depressed mood**, persistent low-grade, depressive disorder, **poor concentration and memory**, **sleep disturbance**, increased sleepiness, mild unexplained anaemia (normochromic, normocytic), **reduced muscle bulk and strength**, **increased body fat and body mass index**

Sinais e sintomas de hipogonadismo

Academia Europeia de Andrologia, 2020

- **Specific symptoms:** reduced libido, decreased spontaneous erections and erectile dysfunction
- **Less specific symptoms:** decreased energy, decreased physical strength/function/activity, decreased motivation, low mood, decreased concentration and hot flushes
- **Less specific signs:** loss of body/facial hair, decreased testicular volume, increased body fat/reduced muscle mass, osteoporosis/low bone density and central obesity

Fluxograma para diagnóstico de hipogonadismo



Postpubertal onset*

- Decreased libido
- Decreased spontaneous erections
- Decrease in testicular volume
- Gynaecomastia
- Hot flashes
- Decreased bone mass
- Height loss or minimum-trauma fracture
- Decreased pubic and axillary hair
- Decreased frequency of shaving
- Galactorrhoea (prolactinoma; rare)
- Visual-field defects (pituitary lesion)
- Decreased muscle mass
- Decreased energy and motivation

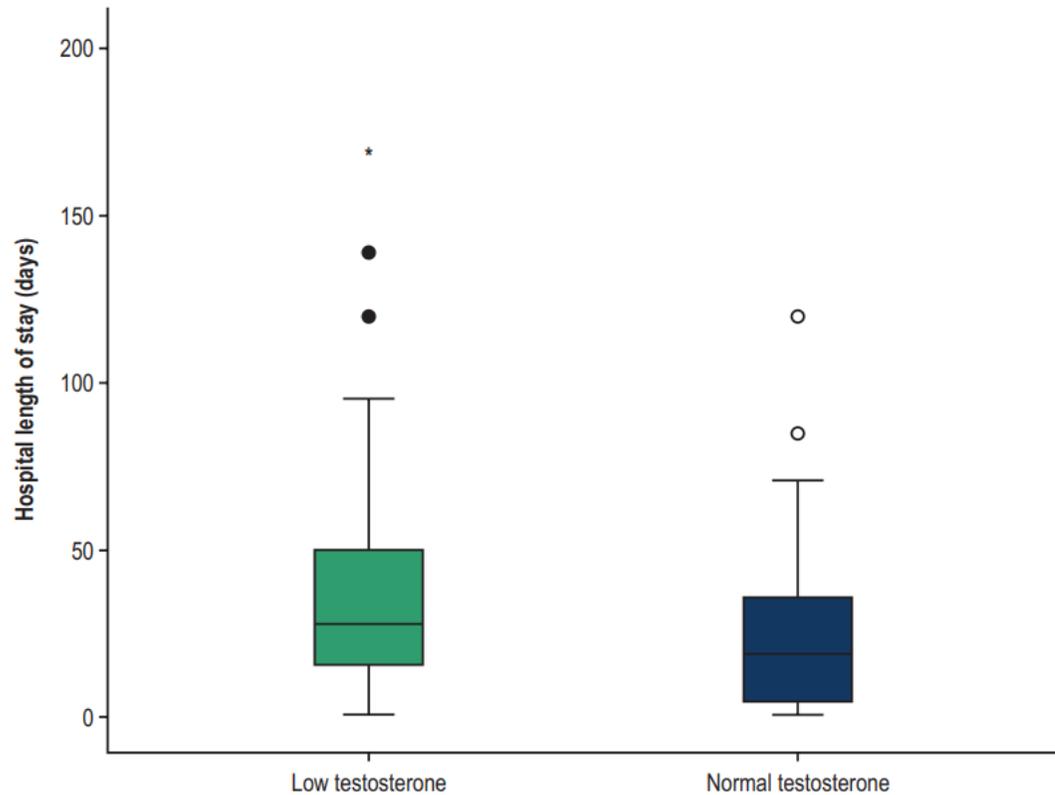
*These patients have normal skeletal proportions, penile length, voice, and prostate size.

Irritabilidade, depressão, redução da concentração, memória, distúrbios do sono

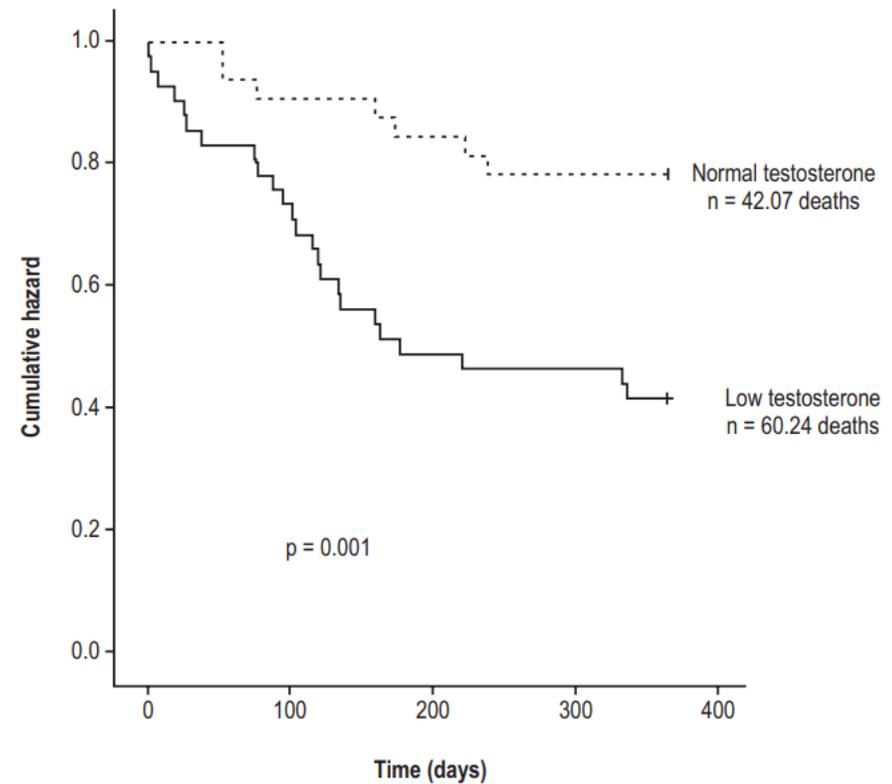
Testosterone Deficiency Increases Hospital Readmission and Mortality Rates in Male Patients with Heart Failure

Marcelo Rodrigues dos Santos¹, Ana Luiza Carrari Sayegh¹, Raphaela Vilar Ramalho Groehs¹, Guilherme Fonseca¹, Ivani Credidio Trombetta^{1,2}, Antônio Carlos Pereira Barretto¹, Marco Antônio Arap³, Carlos Eduardo Negrão^{1,4}, Holly R. Middlekauff⁵, Maria-Janieire de Nazaré Nunes Alves¹

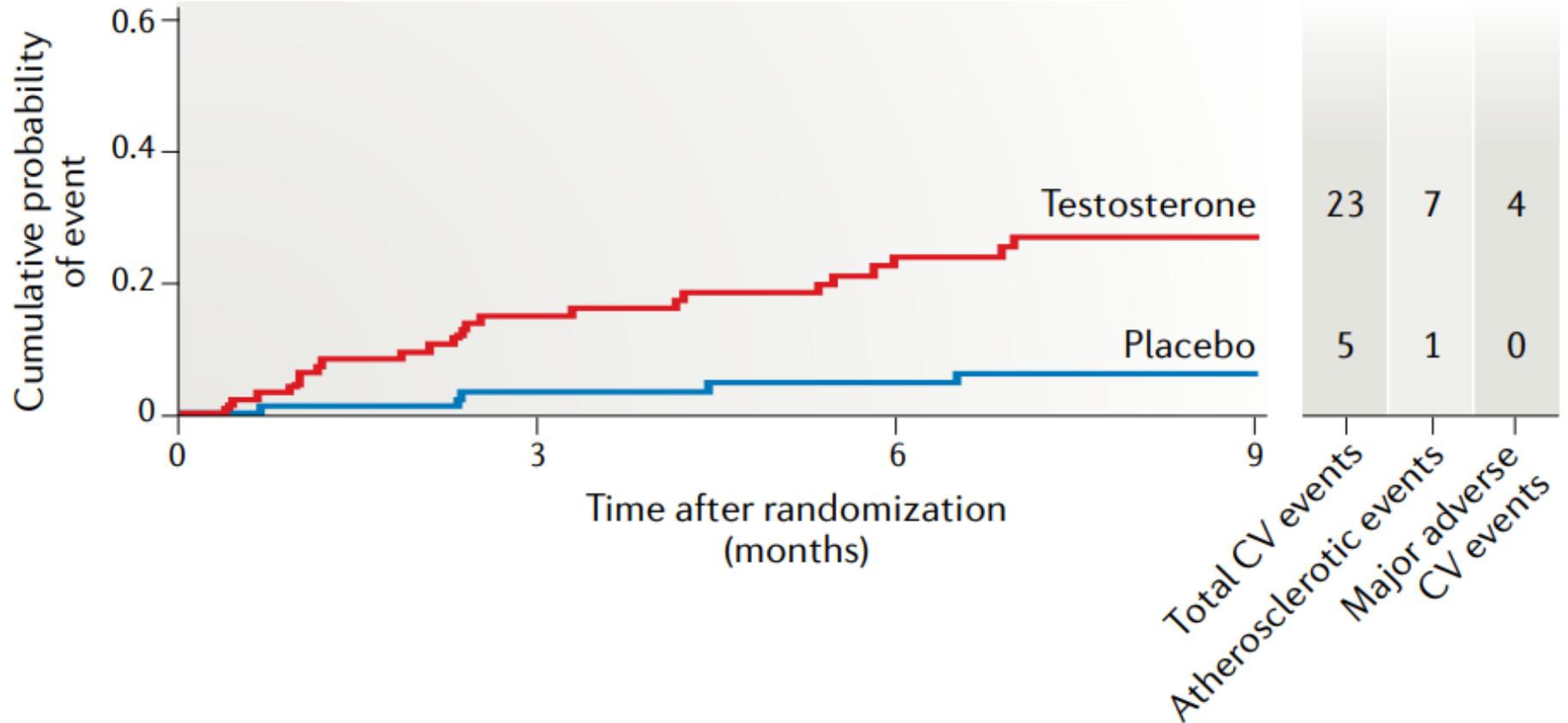
Tempo de internação



Taxa de mortalidade



TRT e eventos cardiovasculares



- N=209 homens
- Idade > 65 anos
- Alto prevalência de doenças crônicas

Fig. 1 | Time-to-event analysis of cardiovascular adverse events in the TOM trial.

Recomendação do uso de TRT

CLINICAL PRACTICE GUIDELINE

Testosterone Therapy in Men With Hypogonadism: An Endocrine Society* Clinical Practice Guideline

Shalender Bhasin,¹ Juan P. Brito,² Glenn R. Cunningham,³ Frances J. Hayes,⁴
Howard N. Hodis,⁵ Alvin M. Matsumoto,⁶ Peter J. Snyder,⁷ Ronald S. Swerdloff,⁸
Frederick C. Wu,⁹ and Maria A. Yialamas¹⁰

Formulation	Typical Starting Doses
T enanthate or cypionate	150–200 mg IM every 2 wk or 75–100 mg/wk
T transdermal gels: 1%, 1.62%, or 2%	50–100 mg of 1% transdermal gel; 20.25–81 mg of 1.62% gel or 40–70 mg of 2% transdermal gel applied to skin; check package insert for application site and instructions
T Axillary Solution	60 mg of T solution applied in the axillae

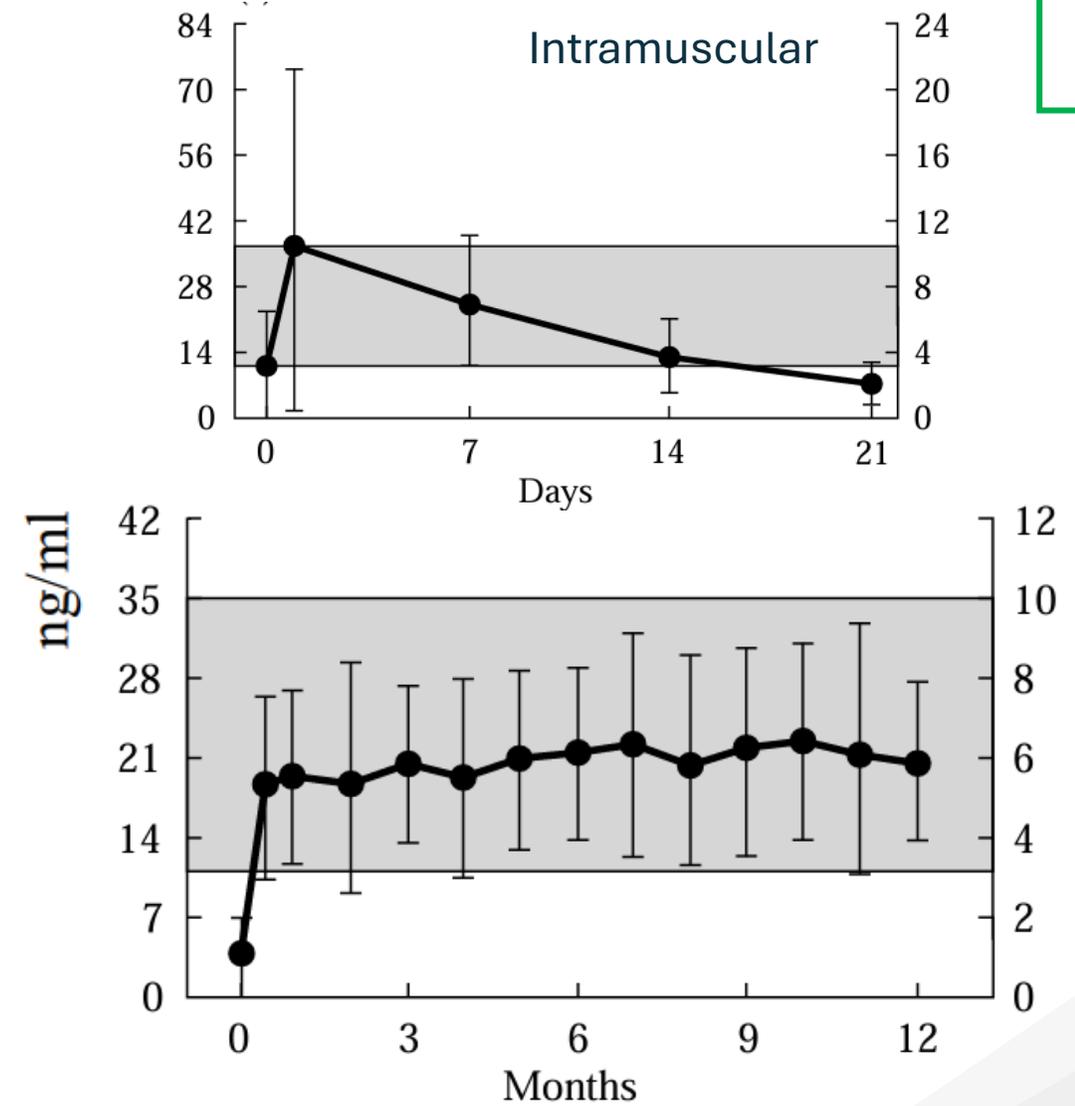
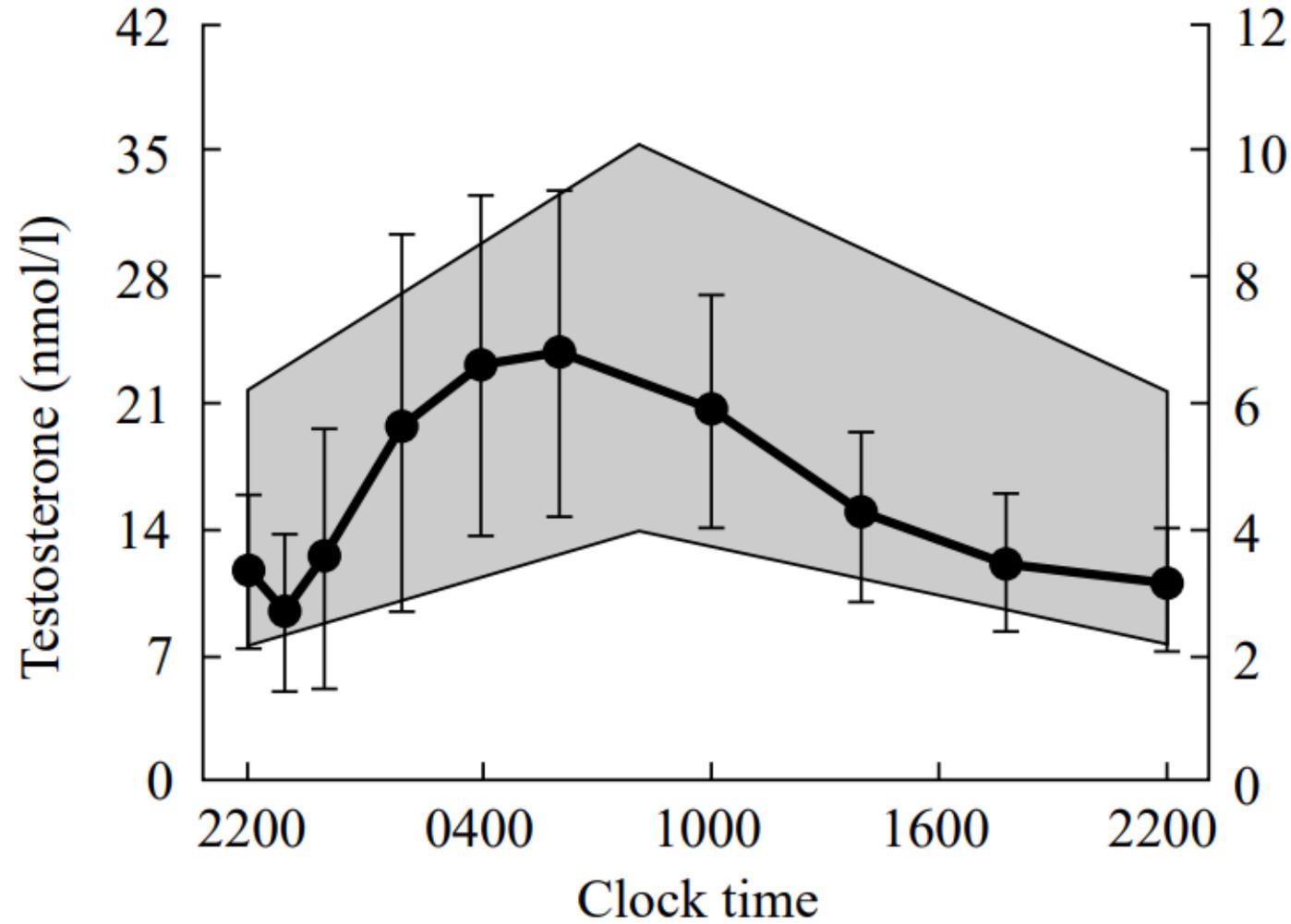
Transdermal T patch	One or two patches, designed to nominally deliver 2–4 mg of T during 24 h applied every day on nonpressure areas
Buccal, bioadhesive T tablets	30-mg controlled release, bioadhesive tablets twice daily
T pellets	Pellets containing 600–1200 mg T implanted SC; the number of pellets and the regimen may vary with formulation
Injectable long-acting T undecanoate in oil	United States regimen: 750 mg IM, followed by 750 mg at 4 wk, and 750 mg every 10 wk

Investigação de hipogonadismo

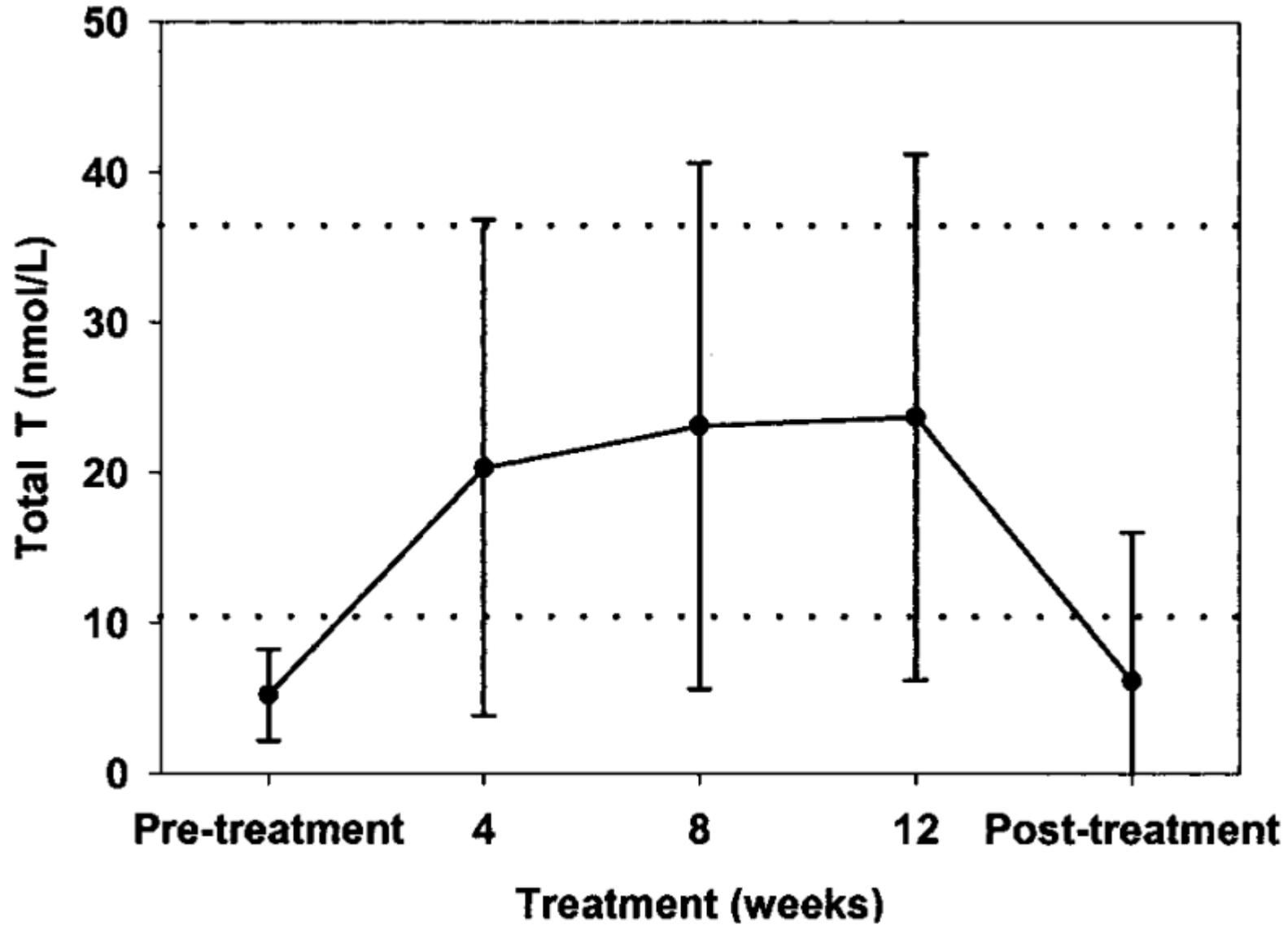
Society, year	Target
American Urological Association, 2018 ⁶	In the middle tertile of the normal reference range (15.6-20.8 nmol/L; 450-600 ng/dL)
British Society for Sexual Medicine, 2017 ⁷	In the mid to upper range for healthy young men (15-30 nmol/L; 433-865 ng/dL)
Canadian Medical Association, 2015 ⁸	In the mid-normal range for healthy young men (14-17.5 nmol/L; 404-505 ng/dL)
Endocrine Society, 2018 ⁹	In the mid-normal range for healthy young men (9.2-31.8 nmol/L; 264-916 ng/dL)
Endocrine Society of Australia, 2016 ^{10,11}	In the lower part of the reference interval for eugonadal men (not reported)
European Academy of Andrology, 2020 ¹²	In the mid-normal range for young men (9.6-30 nmol/L; 280-873 ng/dL)
European Association of Urology, 2020 ¹³	The average normal range for young men (9.6-30 nmol/L; 280-873 ng/dL)

Meta da TRT
400-900 ng/dL

Testosterona em adesivo



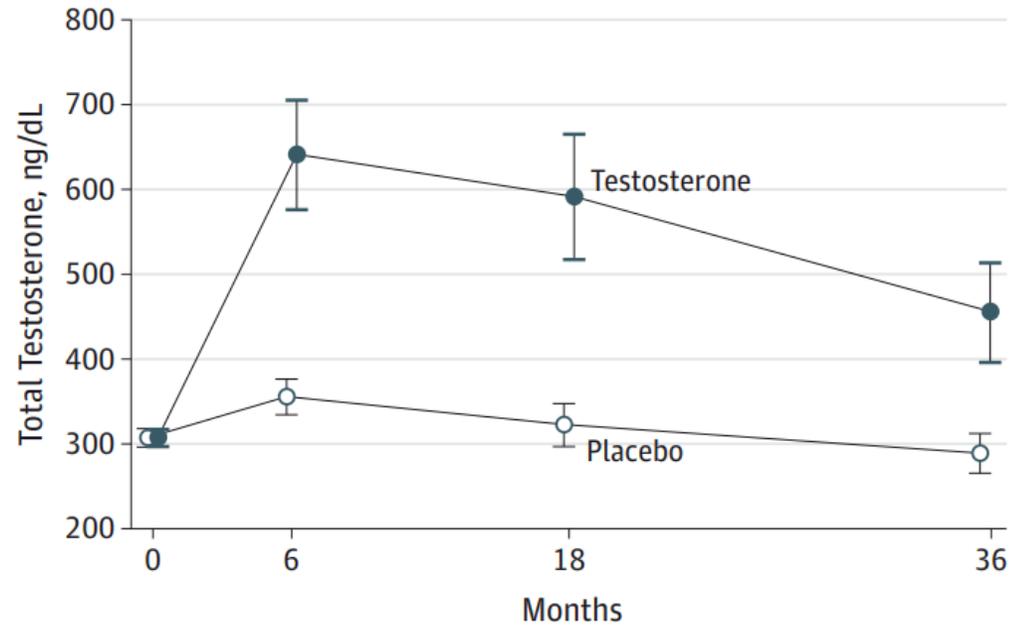
Testosterona sublingual



**2x dia /
12 semanas**

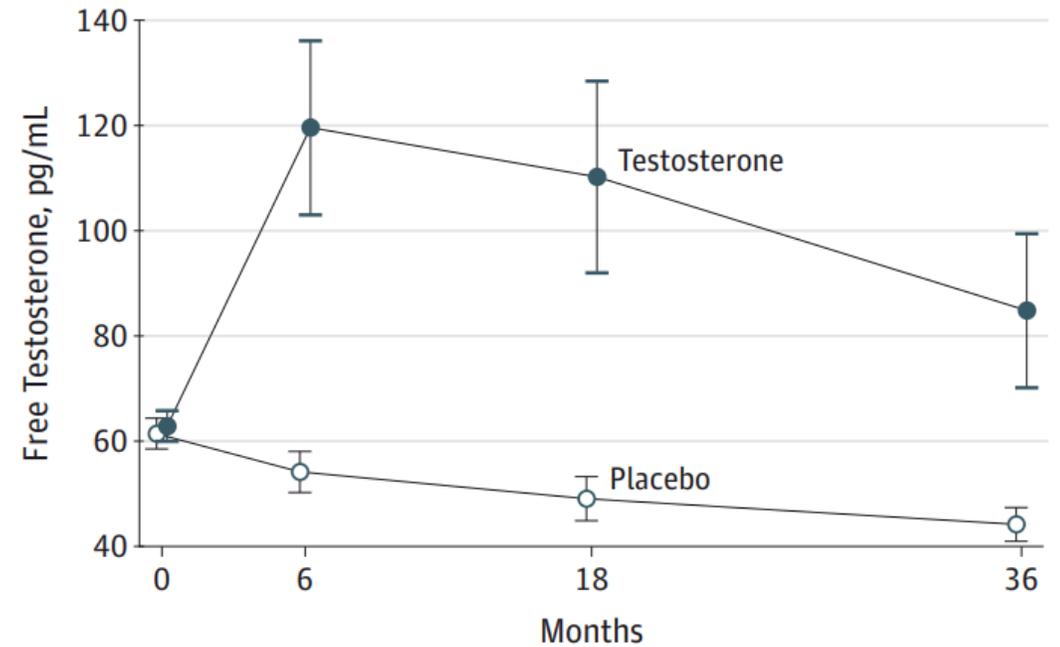
Testosterone replacement therapy

Total testosterone



No. of patients		0	6	18	36
Testosterone	155	122	102	109	
Placebo	151	121	106	96	

Free testosterone



No. of patients		0	6	18	36
Testosterone	155	122	102	109	
Placebo	151	121	105	96	

Contraindicação da TRT

Panel 3: Contraindications to testosterone therapy

- Prostate cancer
- Breast cancer
- Nodule or induration on prostate examination (unless biopsy is negative)
- Prostate-specific-antigen concentration $>4.0 \mu\text{g/L}$, or $>3.0 \mu\text{g/L}$ in high-risk men (eg, African Americans, first-degree relatives of men with prostate cancer) unless urological assessment is negative
- Severe lower-urinary-tract symptoms (international prostate symptom score >19)
- Haematocrit $>50\%$
- Untreated severe sleep apnoea
- Uncontrolled congestive heart failure

Parâmetros de controle clínico

Monitoring plan	
General health	Assess for efficacy and adverse effects at 3 and 6 months after the start of treatment and annually thereafter if stable; check for formulation-specific adverse effects
Testosterone concentration	Adjust dose to maintain testosterone concentrations in serum in the mid-normal range (according to local laboratory reference)
Digital rectal examination	No data available about benefits in healthy men younger than 40 years Perform at baseline in men aged 40–49 years who are African American, have first-degree relatives of men with prostate cancer, or who have baseline PSA concentrations $>0.6 \mu\text{g/L}$ Perform at baseline in all men older than 50 years Repeat 3–6 months after the start of therapy and annually thereafter; discontinue therapy if nodules or induration are detected
PSA concentration	Check at baseline in all men older than 40 years Check at 3–6 months after the start of therapy and annually thereafter; discontinue therapy and assess further if PSA concentration increases by $>1.4 \mu\text{g/L}$ in a 1-year period or PSA velocity is $>0.4 \mu\text{g/L}$ per year (applicable if >2 years of data are available, with the 6-month value taken as reference)
Lower-urinary-tract symptoms	Discontinue therapy and assess if the patient complains of severe symptoms or if the international prostate symptom score is >19
Haematocrit	Check at baseline to exclude sleep apnoea, hypoxaemia, and haematological disorders Check at 3–6 months after the start of therapy and annually thereafter; discontinue therapy if haematocrit $>54\%$; if the value reverts to normal, treatment can be restarted at a lower dose
Sleep apnoea	Assess symptoms of sleep apnoea (snoring, daytime somnolence, etc)
Bone density	Measure baseline bone-mineral density if indicated (minimum-trauma fracture, osteoporosis, height loss, etc) and repeat every 1–2 years

Eficácia = 3-6 meses depois do início

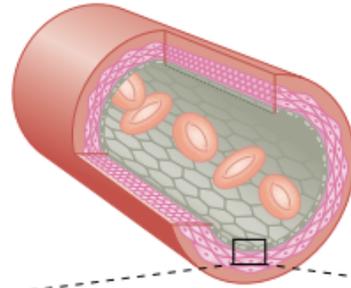
Toque retal = 3-6 meses depois do início

PSA $> 1,4 \mu\text{g/L}$ em 1 ano ou $> 0,4$ anualmente

Interromper em caso de LUTS

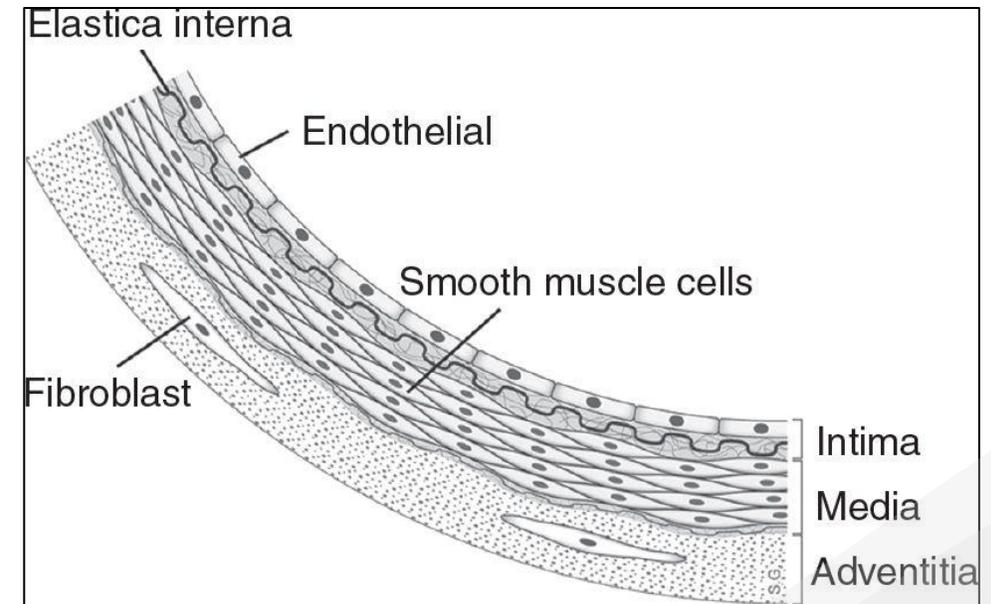
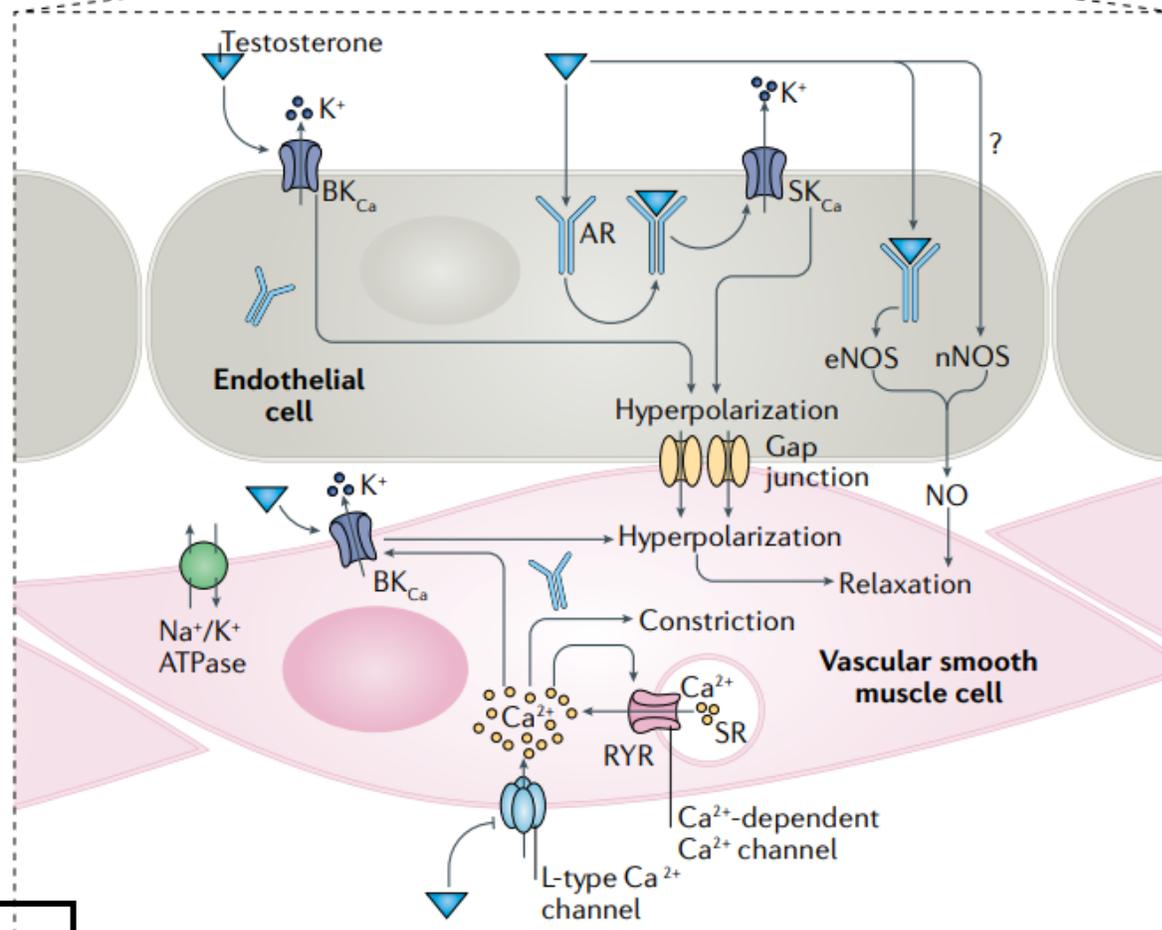
Interromper em caso de hematócrito $> 54\%$

Efeito vascular da testosterona



Produção de eNOS

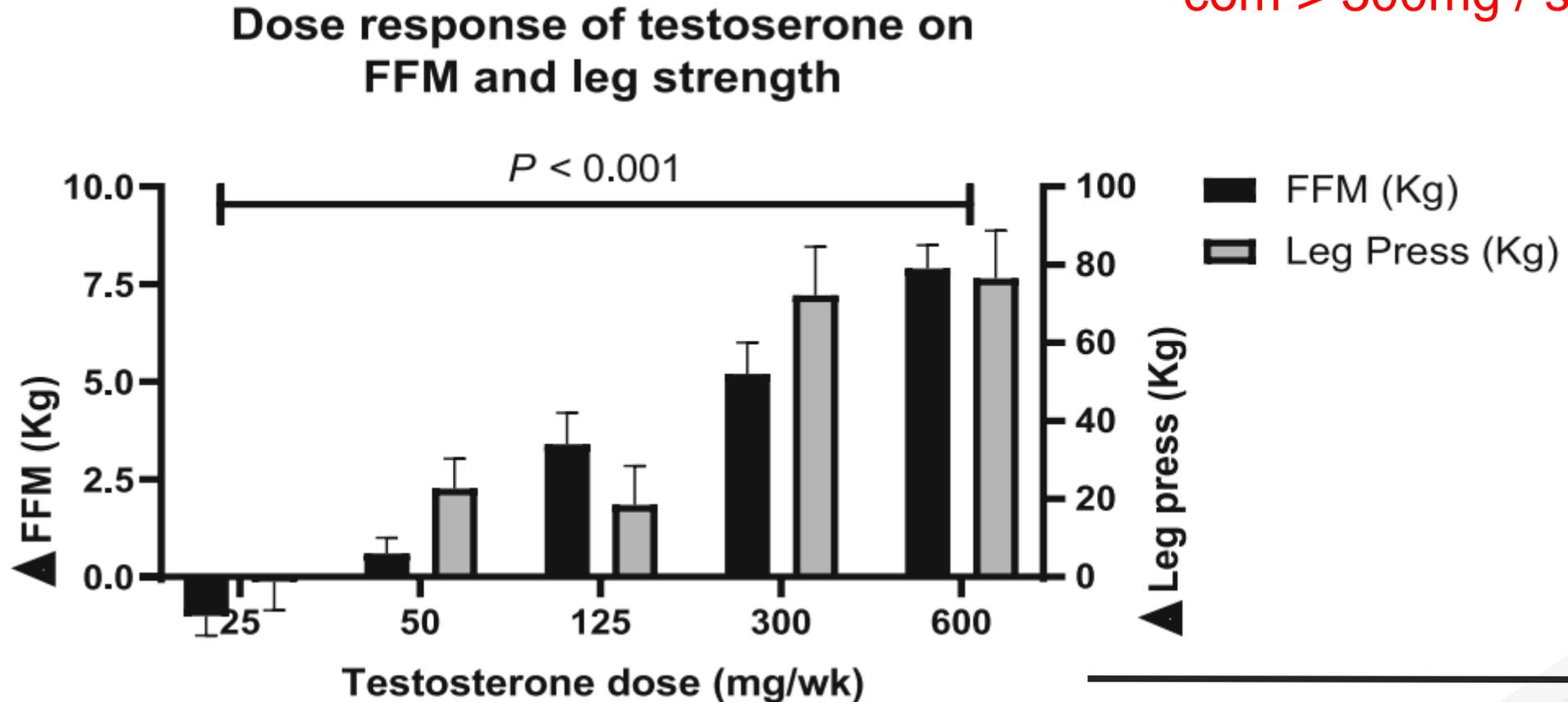
Inibição dos canais de cálcio tipo L



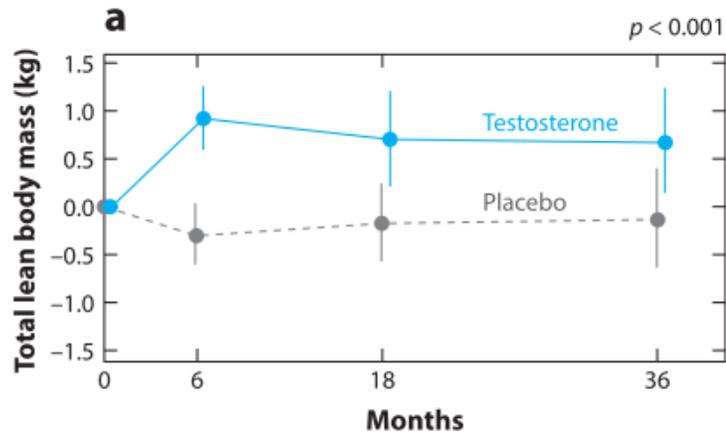
How the love of muscle can break a heart: Impact of anabolic androgenic steroids on skeletal muscle hypertrophy, metabolic and cardiovascular health

Deaglan McCullough¹, Richard Webb², Kevin J Enright³, Katie E Lane³, Jim McVeigh⁴, Claire E Stewart³, Ian G Davies⁵

Hipertrofia e força muscular com > 300mg / semana

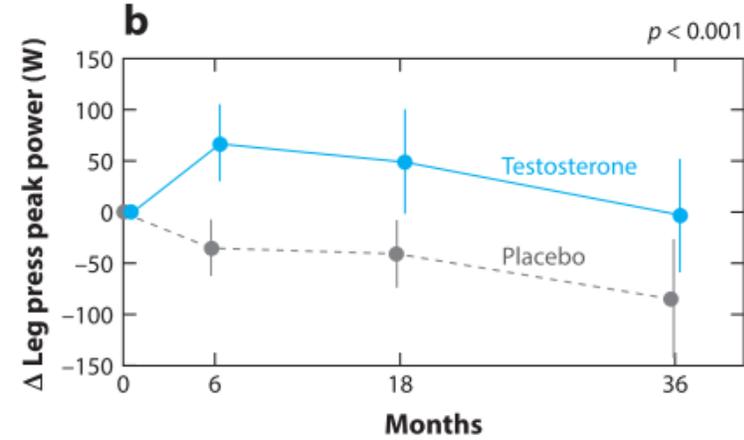


Testosterona melhora a capacidade funcional

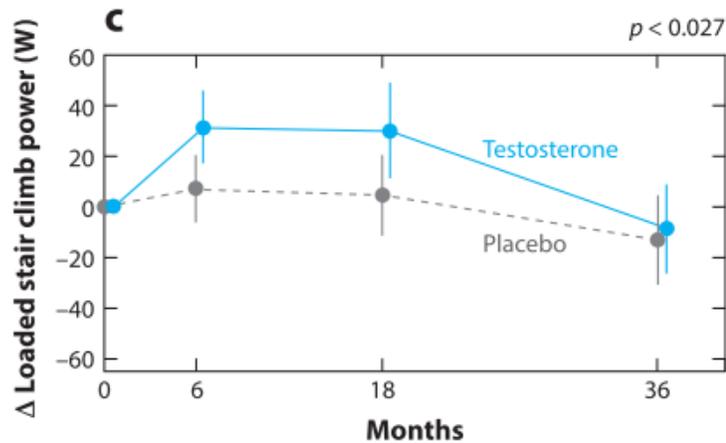


Number of participants

Placebo	118	111	106	98
Testosterone	132	127	113	106

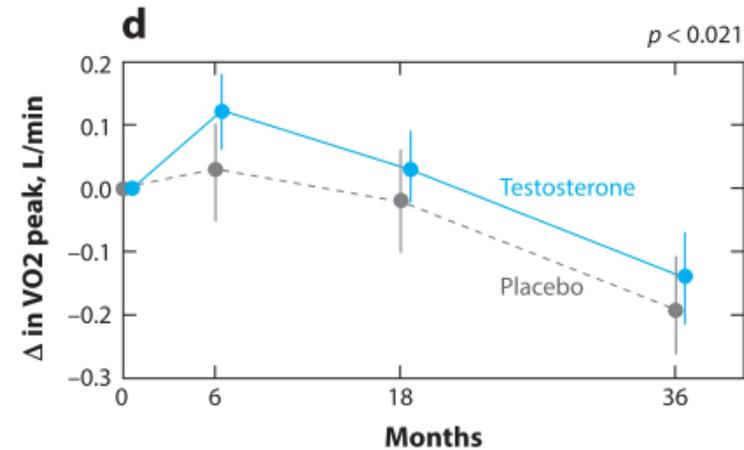


106	93	88	65
123	113	88	80



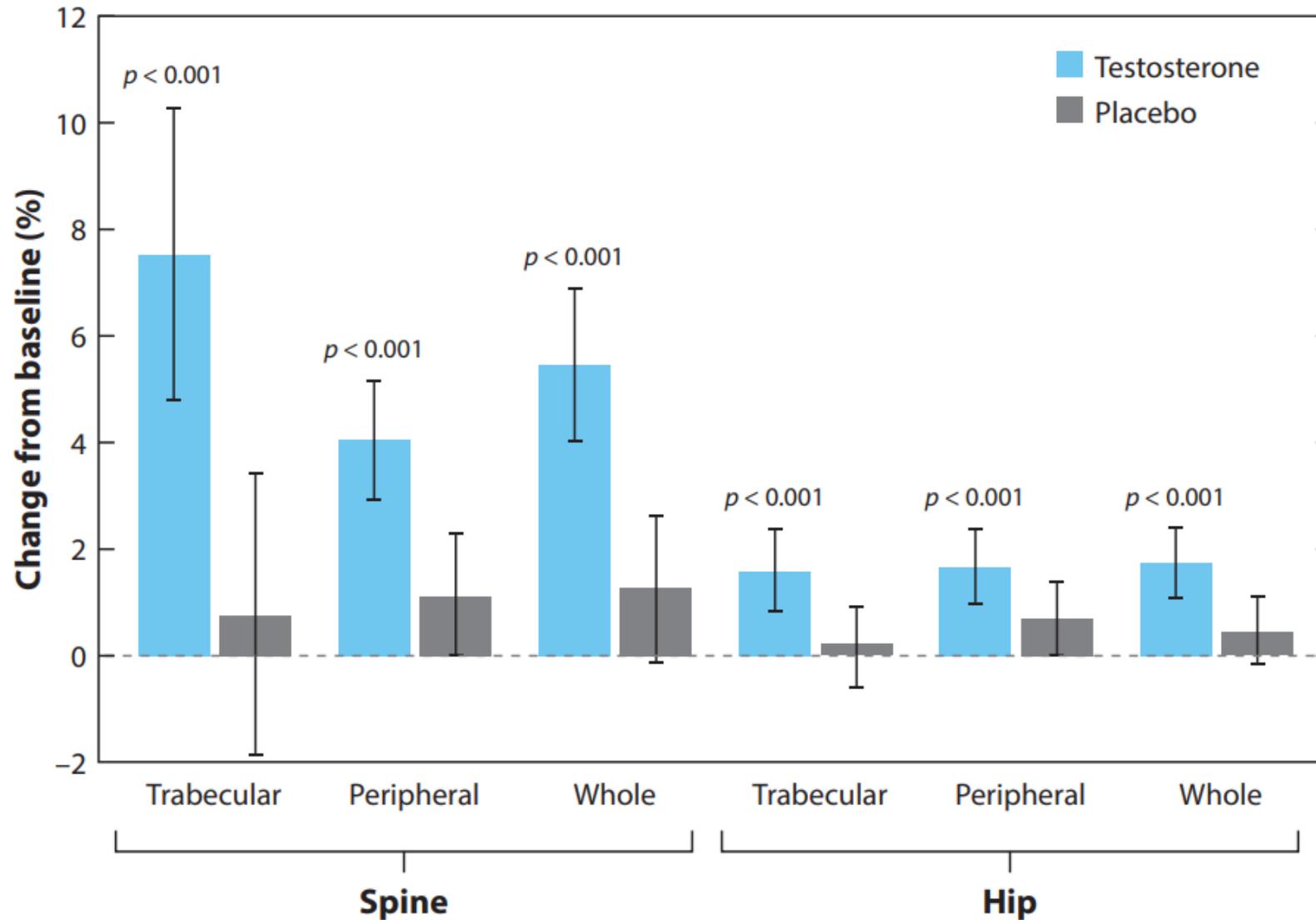
Number of participants

Placebo N:	89	80	72	54
Testosterone	106	98	77	67

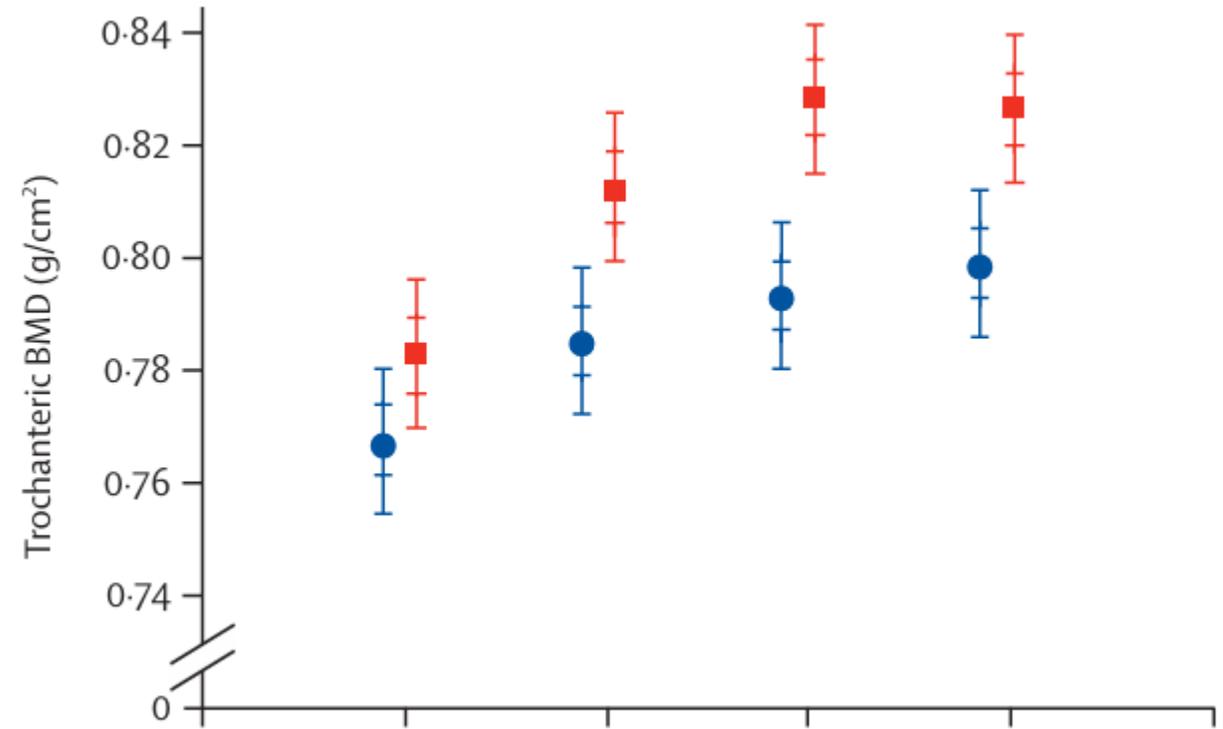
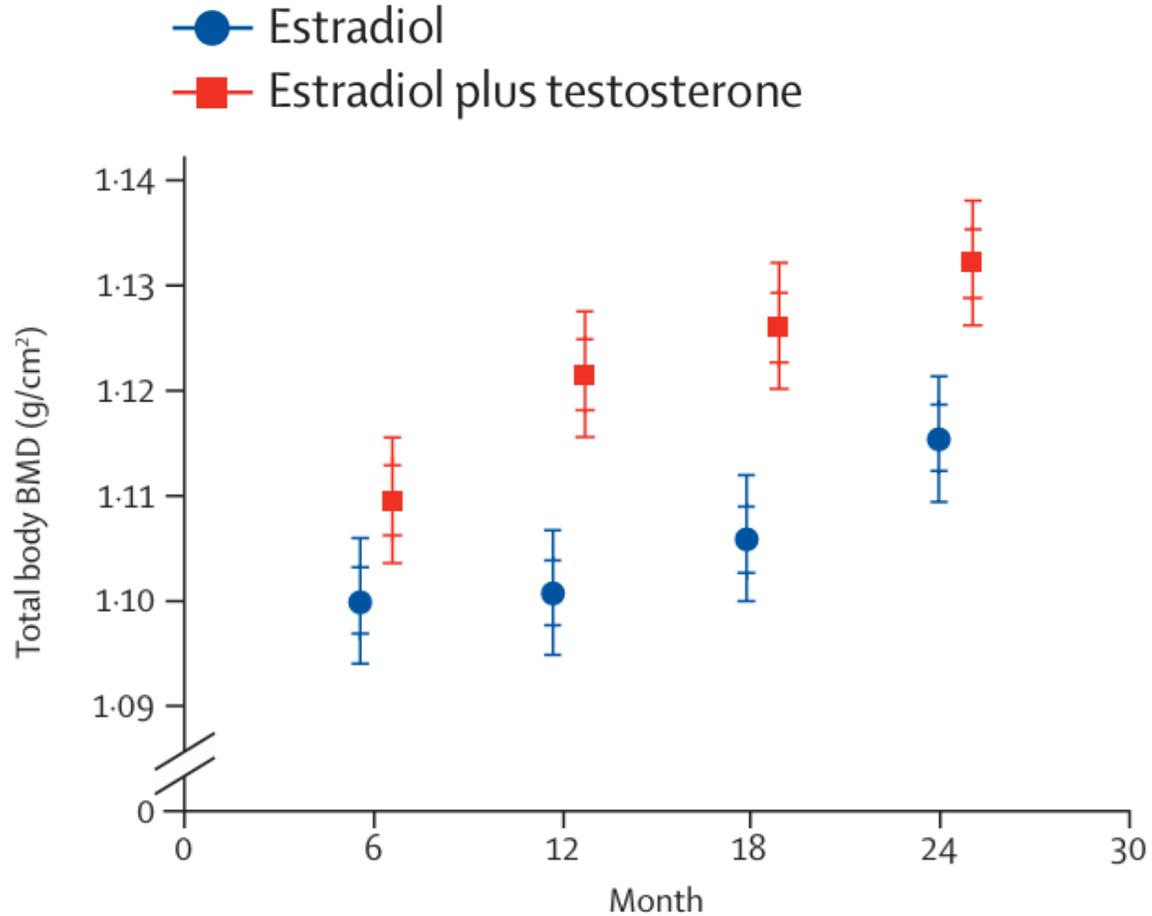


60	56	52	43
69	68	60	62

Testosterona e densidade mineral óssea

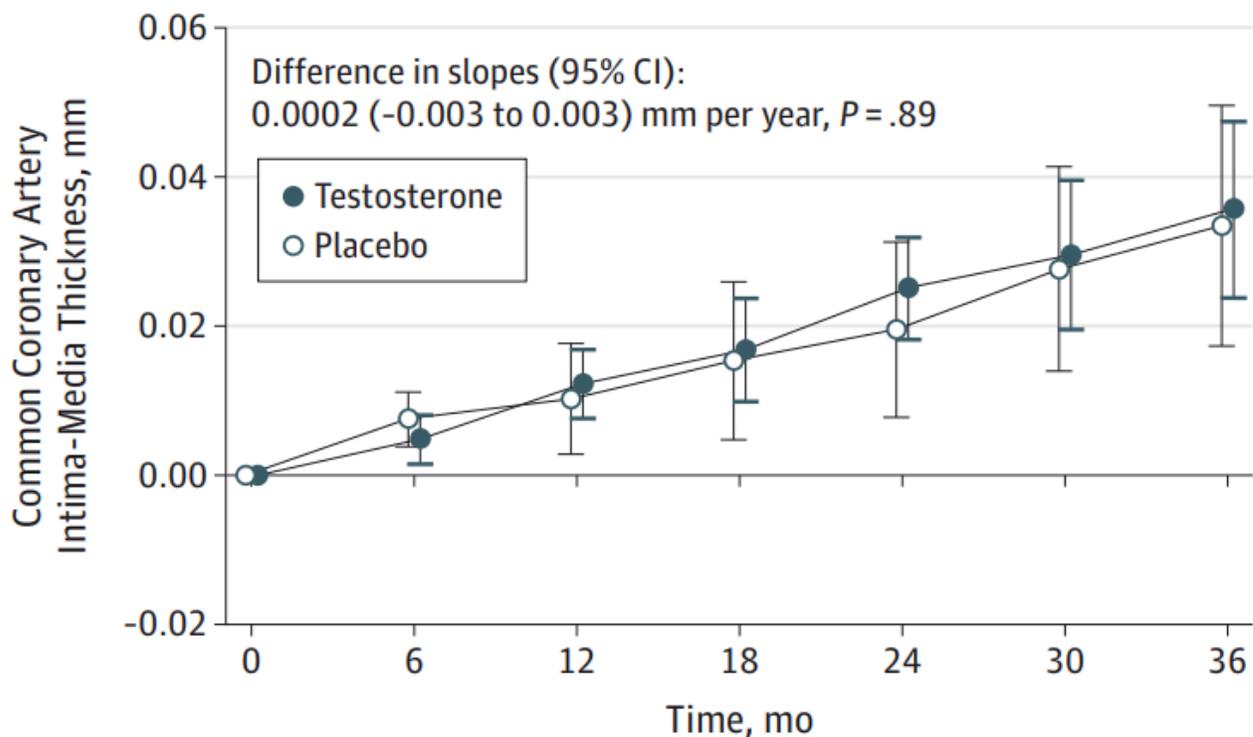


Testosterona e DMO em mulheres

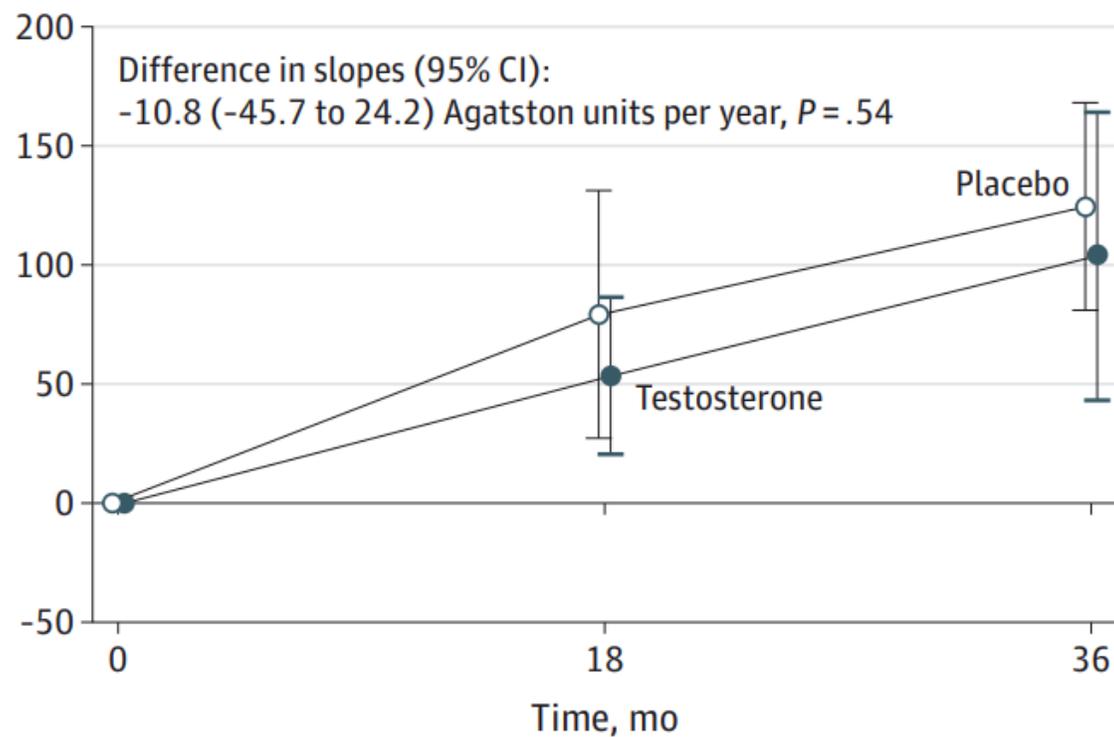


Testosterona e aterosclerose: TEAAM trial

Common coronary artery intima-media thickness



Coronary artery calcium

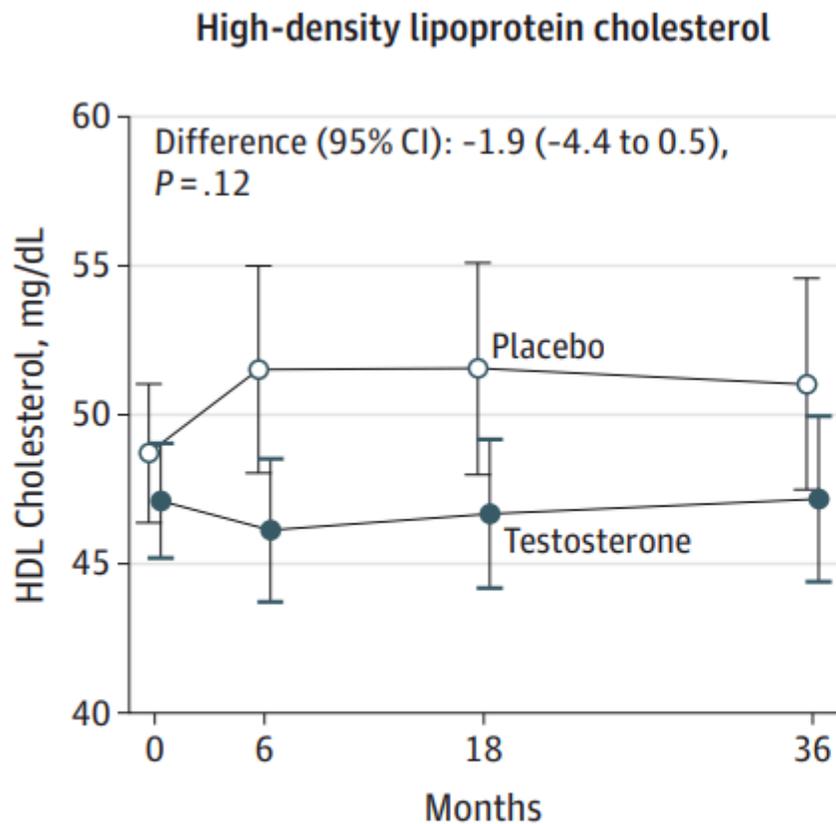


No. of patients

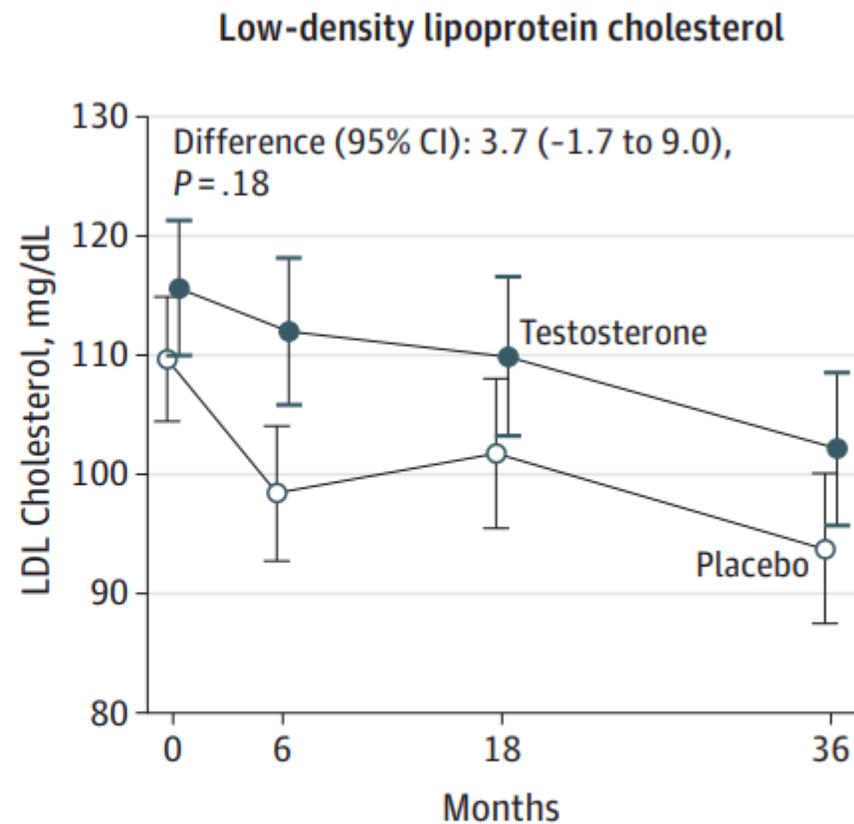
Testosterone	155	132	120	109	103	101	101
Placebo	151	120	114	105	102	95	92

	140	97	92
	132	92	92

Testosterona e aterosclerose: TEAAM trial

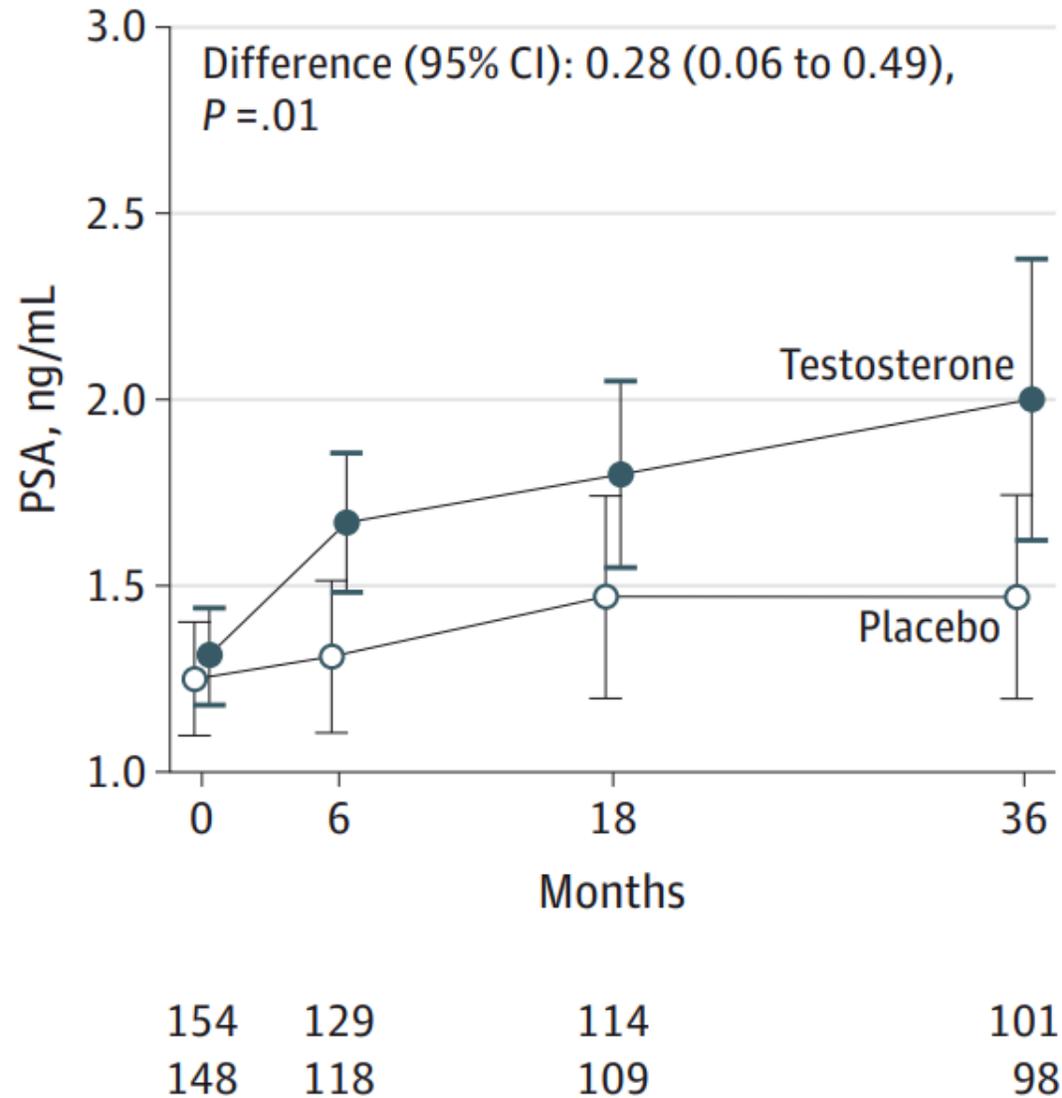


152	128	111	100
146	113	107	95



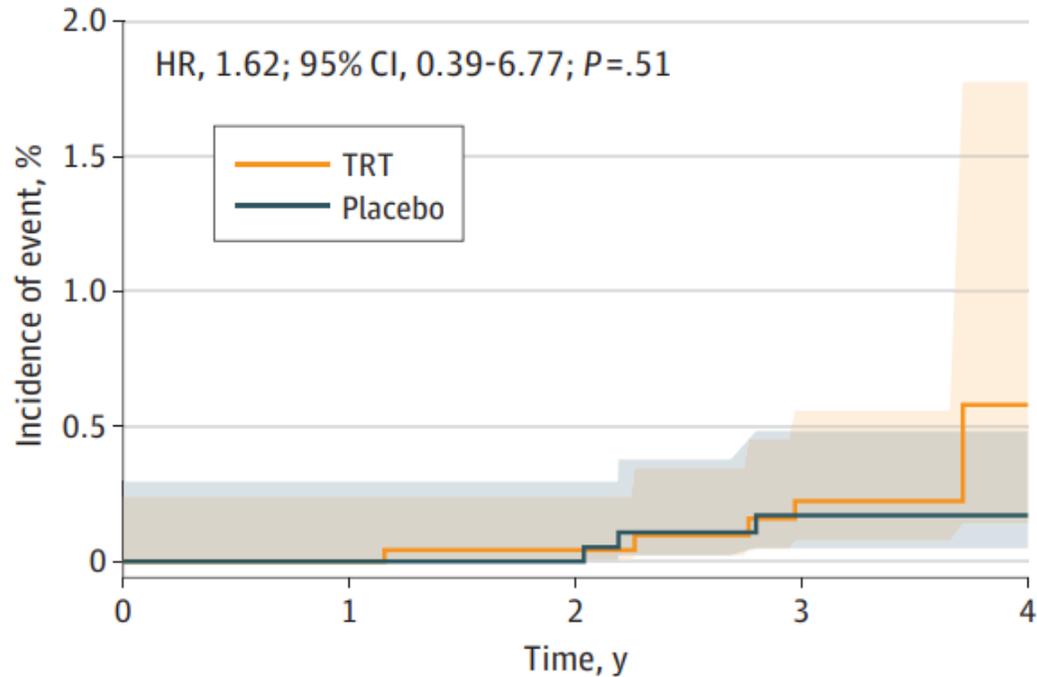
151	127	110	99
146	114	106	95

Testosterona e aterosclerose: TEAAM trial



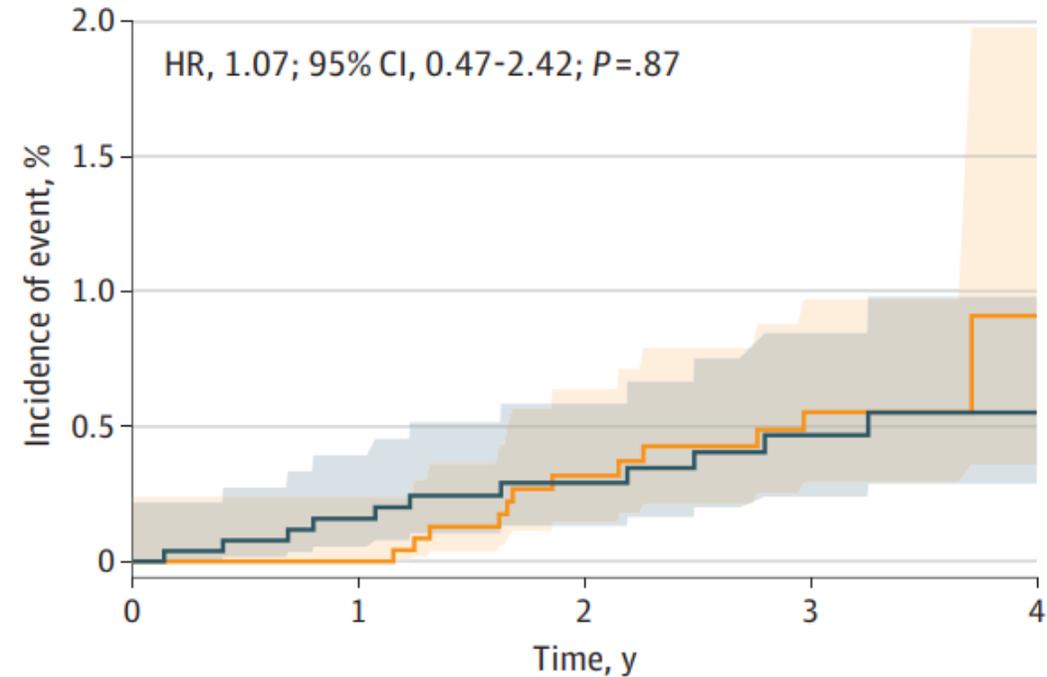
Testosterona e Câncer de próstata: TRAVERSE trial

A High-grade prostate cancer



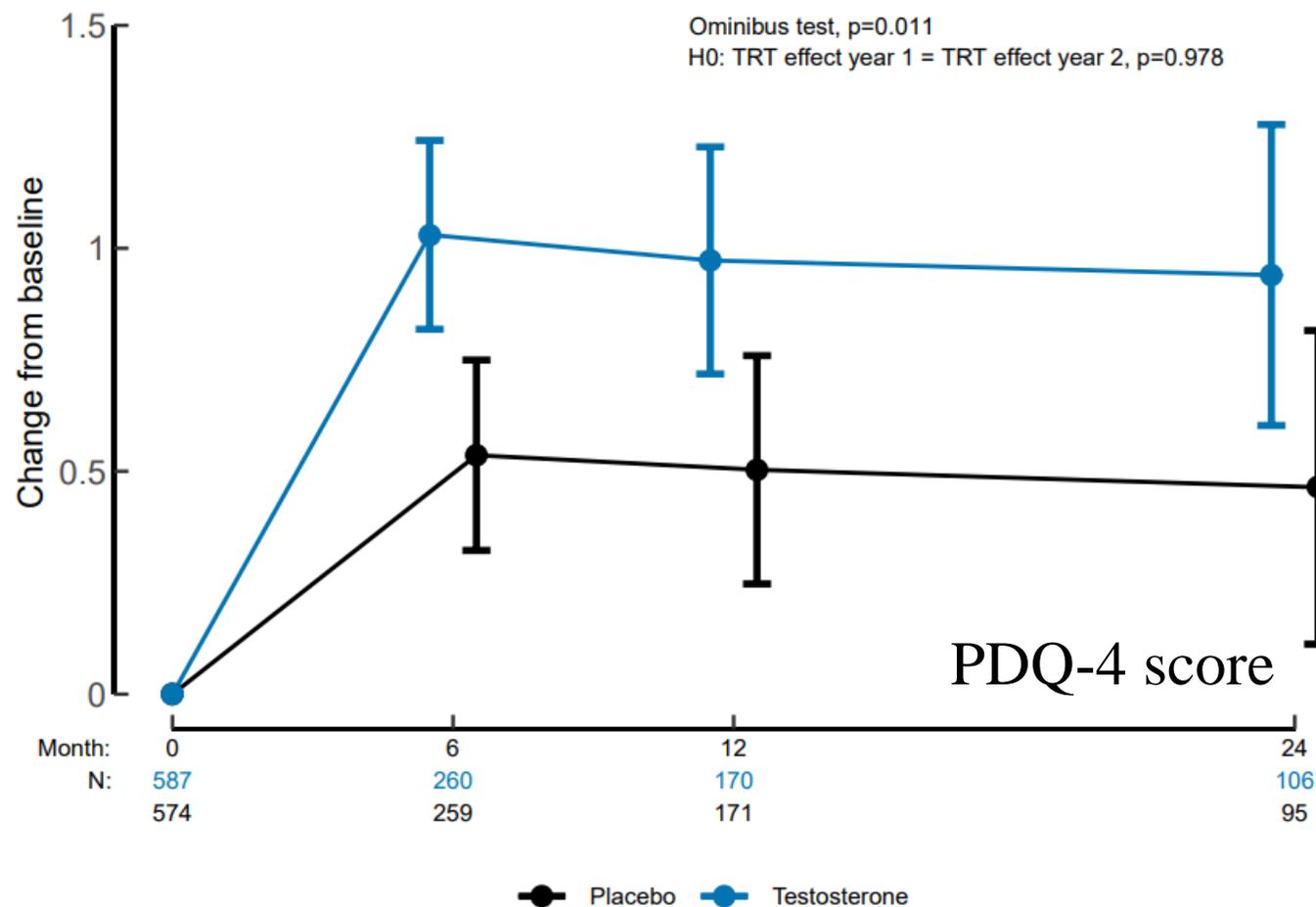
No. at risk	0	1	2	3	4
TRT	2596	2374	1874	1420	40
Placebo	2602	2360	1845	1387	34

B Any prostate cancer



No. at risk	0	1	2	3	4
TRT	2596	2374	1869	1415	40
Placebo	2602	2356	1838	1381	34

Testosterona e função sexual: TRAVERSE trial



>5mil indivíduos
entre 45-80 anos
com T <300 ng/dL

Conclusion: In middle-aged and older men with hypogonadism and low libido, TRT for 2 years improved sexual activity, hypogonadal symptoms, and sexual desire, but not erectile function.

Testosterona melhora a capacidade funcional

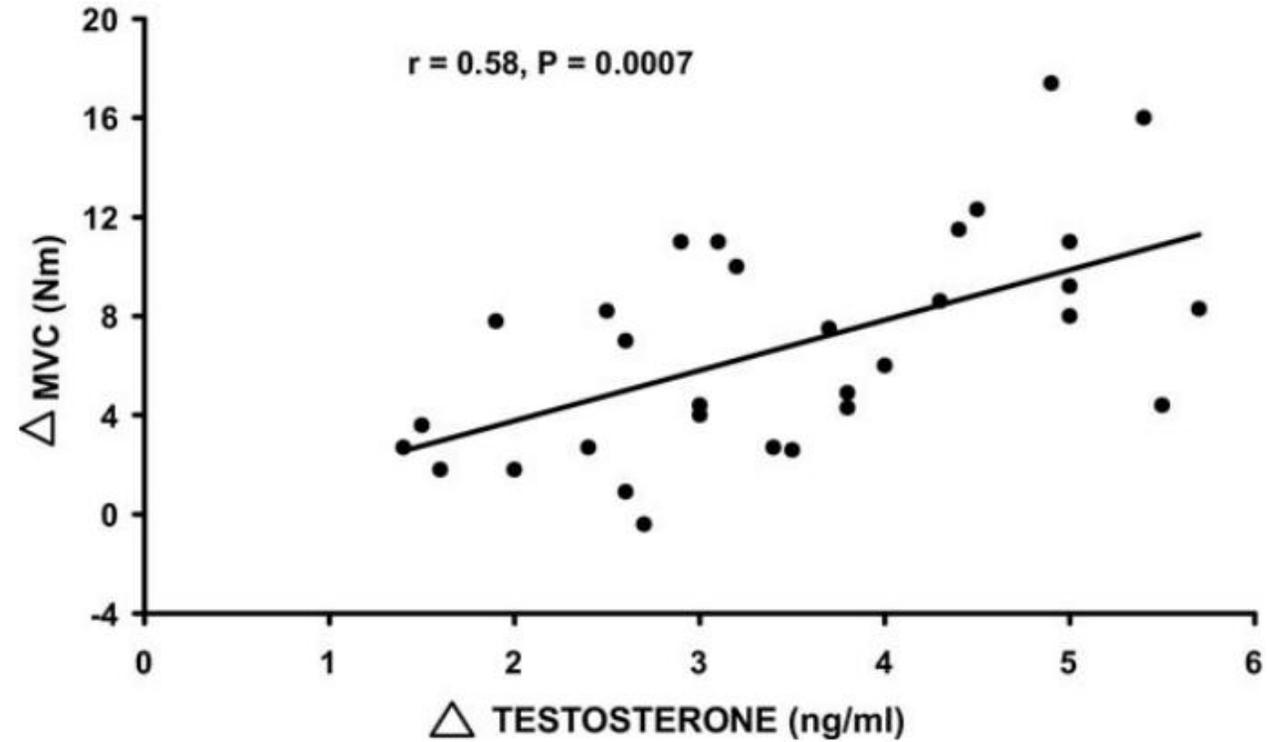
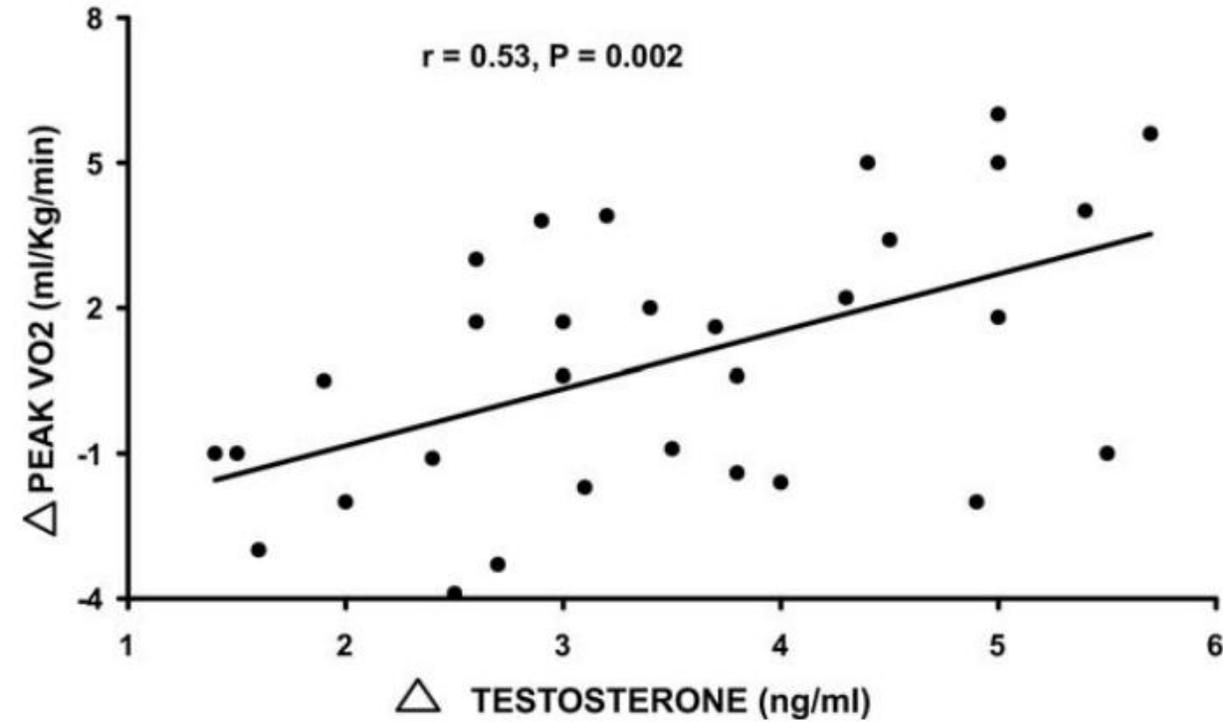
Table 2 Cardiorespiratory and Muscular Results Before and After 3 Months of Testosterone Supplementation Therapy

	Testosterone Group (n = 31)		Placebo Group (n = 33)		Changes (Δ)	
	Before	After	Before	After	Testosterone	Placebo
BMI, kg/m ²	26.4 \pm 3.7	28.7 \pm 4.3*†	26.1 \pm 4.4	26.6 \pm 3.6	2.4 \pm 0.2†	0.5 \pm 0.06
Body weight, kg	63.5 \pm 13.7	66.8 \pm 11.4*	64.7 \pm 8.3	65 \pm 12.9	0.5 \pm 0.02	0.3 \pm 0.02
SBP, mm Hg	125.6 \pm 6.2	121.3 \pm 42.7	128.2 \pm 46.3	125.0 \pm 37.9	-3.3 \pm 1.2	-3.2 \pm 0.9
DBP, mm Hg	92 \pm 13.0	80 \pm 12.0*	89 \pm 11.7	83 \pm 11.7	-12 \pm 3.0	-6.4 \pm 1.7
Resting HR, beats/min	74.3 \pm 7.2	70 \pm 11.5	77.6 \pm 8.2	71.4 \pm 8.7	-4.3 \pm 1.8	-3.2 \pm 1.2
Peak VO ₂ , ml/kg/min	13.4 \pm 4.4	16.3 \pm 1.7*†	13.8 \pm 3.2	14.1 \pm 3.6	2.9 \pm 0.8†	0.3 \pm 0.07
VE/VCO ₂ slope	33.6 \pm 7.0	29.2 \pm 5.1*†	34.1 \pm 9.5	32.6 \pm 8.8	-4.4 \pm 1.0†	-1.5 \pm 0.4
Peak workload, W	78.3 \pm 16.0	88.2 \pm 18.7*†	77.3 \pm 14.2	74.3 \pm 18.0	9.9 \pm 2.4†	2.0 \pm 0.7
6MWT, m	386.6 \pm 121.0	472.8 \pm 138.4*†	390.9 \pm 107.4	428.2 \pm 112.0	86.2 \pm 14.5†	37.3 \pm 8.7
MVC, Nm	116.7 \pm 26.3	135.6 \pm 21.2*†	116.7 \pm 26.3	119.7 \pm 26.3	18.9 \pm 3.3†	3.0 \pm 1.1
PTmax, Nm	74.0 \pm 17.4	83.4 \pm 16.3*†	74.2 \pm 14.4	76.3 \pm 19.2	9.6 \pm 1.2†	2.1 \pm 0.5
EF, %	31.5 \pm 9.9	32.1 \pm 7.2	33.8 \pm 6.5	32.8 \pm 10.4	0.6 \pm 0.04	-1.0 \pm 0.03
LVEDD, mm	68 \pm 35.7	66.9 \pm 23.2	67.3 \pm 27.2	66.8 \pm 25.4	-1.1 \pm 0.03	0.5 \pm 0.03

Data are expressed as mean \pm SD. *Within groups differences; †between groups differences at p < 0.05.

6MWT = 6-min walking test; BMI = body mass index; DBP = diastolic blood pressure; EF = ejection fraction; HR = heart rate; LVEDD = left ventricular end-diastolic diameter; MVC = maximal voluntary contraction; Nm = Newton meter; PTmax = isokinetic power torque; SBP = systolic blood pressure; VE/VCO₂ = ventilation/carbon dioxide output; VO₂ = oxygen consumption.

Testosterona melhora a capacidade funcional



Testosterona melhora a capacidade funcional

Table 3 Metabolic and Hormonal Results Before and After 3 Months of Testosterone Supplementation Therapy

	Testosterone Group (n = 31)		Placebo Group (n = 33)		Changes (Δ)	
	Before	After	Before	After	Testosterone	Placebo
Fasting glycemia, mg/dl	114.8 \pm 37.1	119.2 \pm 33.5	111 \pm 37.3	116 \pm 41.3	4.4 \pm 1.3	5.2 \pm 2.0
Fasting insulinemia, μ U/ml	10.4 \pm 2.0	7.9 \pm 1.4*†	11.0 \pm 3.1	10.8 \pm 2.8	-2.5 \pm 0.7†	-0.2 \pm 0.1
HOMA-IR	2.6 \pm 1.4	1.8 \pm 0.8*†	2.5 \pm 1.1	2.6 \pm 1.0	-0.8 \pm 0.02†	0.1 \pm 0.06
Total cholesterol, mg/dl	142.5 \pm 43.7	148.5 \pm 39.3	147.3 \pm 54.2	150.6 \pm 67.3	3.0 \pm 1.4	3.2 \pm 1.3
HDL cholesterol, mg/dl	36.3 \pm 7.1	36.0 \pm 5.7	37.0 \pm 6.2	36.6 \pm 6.9	-0.3 \pm 0.05	-0.4 \pm 0.02
Triglycerides, mg/dl	131.2 \pm 39.7	142.5 \pm 44.1	138.6 \pm 32.5	135.2 \pm 38.1	11.7 \pm 4.3	-3.2 \pm 1.5
Total testosterone, ng/ml	2.3 \pm 1.8	5.2 \pm 2.2*†	2.1 \pm 2.1	2.3 \pm 1.7	2.9 \pm 0.6†	0.2 \pm 0.1
Free testosterone, pg/ml	11.3 \pm 5.6	32.0 \pm 11.2*†	12.1 \pm 6.0	12.4 \pm 5.7	21.3 \pm 6.4†	0.3 \pm 0.2
Total PSA, ng/ml	1.4 \pm 1.1	1.5 \pm 1.0	1.3 \pm 0.7	1.4 \pm 0.5	0.1 \pm 0.02	0.1 \pm 0.04
Free PSA, ng/ml	0.4 \pm 0.2	0.6 \pm 0.3	0.4 \pm 0.1	0.5 \pm 0.1	0.2 \pm 0.04	0.1 \pm 0.03
C-reactive protein, mg/dl	0.3 \pm 0.2	0.3 \pm 0.2	0.4 \pm 0.2	0.3 \pm 0.1	0.3 \pm 0.02	-0.1 \pm 0.02
Creatinine, mg/dl	1.4 \pm 0.4	1.5 \pm 0.3	1.4 \pm 0.5	1.4 \pm 0.3	0.1 \pm 0.03	0.07 \pm 0.01

Com hipogonadismo vs. Sem hipogonadismo?

Table 4

Cardiorespiratory, Muscular, and Metabolic Results at Baseline and After 3 Months of Testosterone Supplementation Therapy in Patients With Low (i.e., <12 nmol/l) and Normal Baseline Testosterone Levels

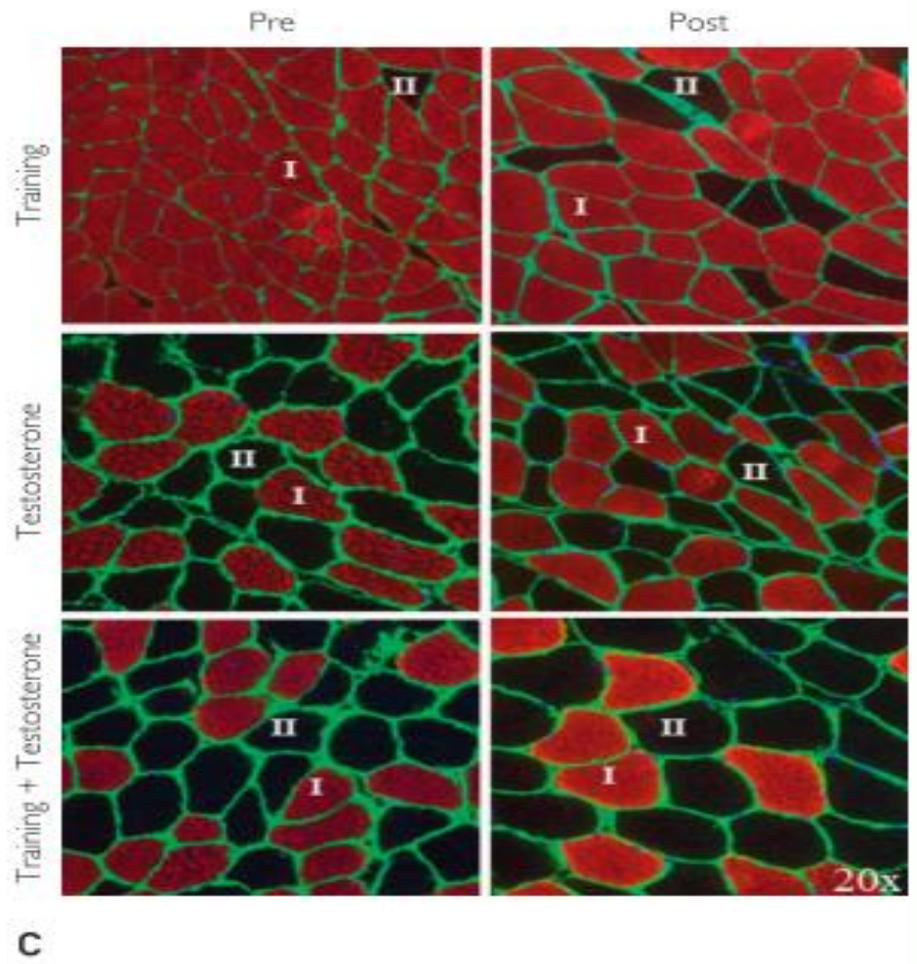
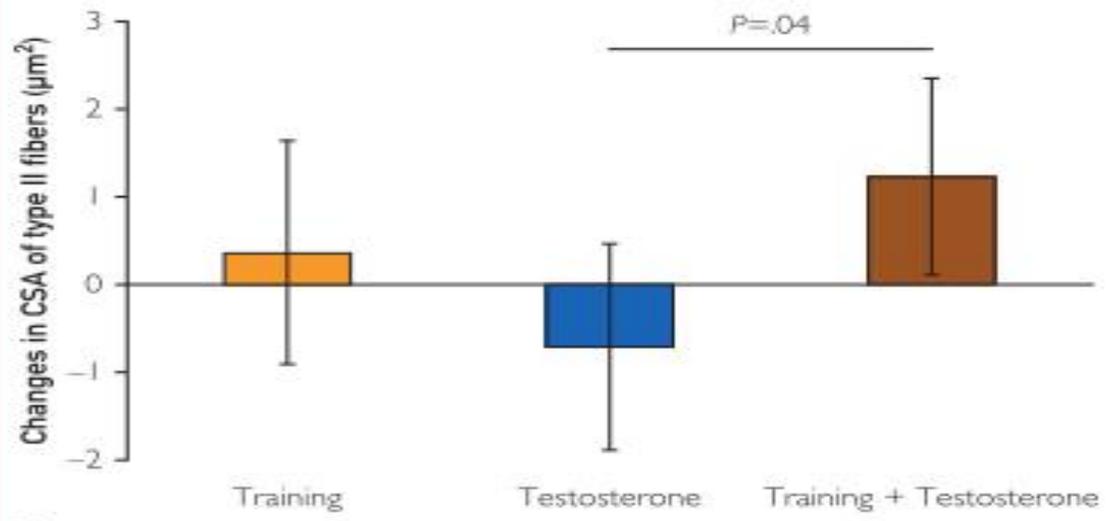
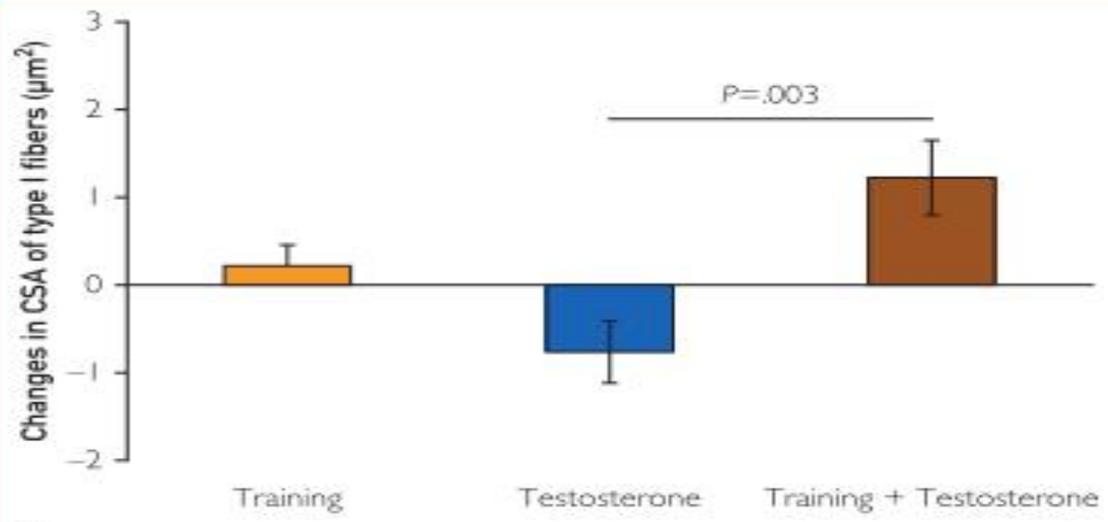
	Low Testosterone Group (n = 12)		Normal Testosterone Group (n = 19)	
	Before	After	Before	After
Peak VO ₂ , ml/kg/min	11.1 ± 2.4*	15.1 ± 2.0†	14.3 ± 2.2	16.9 ± 1.7†
VE/VCO ₂ slope	34.0 ± 7.2	29.8 ± 6.0†	33.1 ± 6.1	29.0 ± 5.4†
6MWT, m	369.5 ± 98.2	466.0 ± 104.7†	397.9 ± 100.4	478.6 ± 93.2†
MVC, Nm	92.3 ± 18.1*	131.6 ± 21.2†	124.66 ± 15.3	140.6 ± 21.2†
PTmax, Nm	73.8 ± 17.4	83.8 ± 12.3†	74.0 ± 17.4	84.4 ± 11.3†
HOMA-IR	2.4 (1.9-2.8)	1.9 (1.5-2.2)†	2.2 (1.8-2.5)	1.8 (1.4-2.3)†

Effect of Exercise Training and Testosterone Replacement on Skeletal Muscle Wasting in Patients With Heart Failure With Testosterone Deficiency

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TABLE 1. Baseline Variables^{a,b,c}

Variable	Training (n=13)	Testosterone (n=12)	Training + Testosterone (n=14)	P value
Age (y)	52±11	49±12	52±9	.60
Height (m)	1.68±0.02	1.68±0.10	1.70±0.02	.77
LVEF (%)	27±6	26±9	24±4	.45



Reposição Hormonal isolada e associada com exercício físico

TABLE 4. Body Composition in Male Patients With Heart Failure With Testosterone Deficiency After 4 mo^{a,b}

Variable	Training (n=13)	Testosterone (n=12)	Training + Testosterone (n=14)
Weight (kg)			
Pre	75±12	72±13	79±13
Post	80±11 ^c	67±12 ^c	86±13 ^{c,d}
BMI (kg/m ²)			
Pre	26±5	25±4	27±5
Post			
Lean mass (kg)	+5,45%	-12,28%	+12,73%
Pre	55±8	57±8	55±9
Post	58±9 ^c	50±8 ^c	62±10 ^{c,d}
Fat (kg)			
Pre	17±7	18±7	19±8
Post	19±8	16±6	24±9 ^{c,d}
Fat (%)			
Pre	22±6	20±5	24±5
Post	23±6	19±6	26±5
FMI (kg/m ²)			
Pre	5.2±0.67	3.9±0.70	5.6±0.95
Post	5.7±1.01	3.8±0.64	6.1±1.07

^aBMI = body mass index; FMI = fat mass index; Post = after 4 months; Pre = at baseline.
^bData are presented as mean ± SD.
^cSignificant difference within groups (Pre vs Post period, *P*<.01).
^dSignificant difference between groups (training + testosterone group vs testosterone group, *P*<.05).

TESTOSTERONA E DOENÇA CARDIOVASCULAR: DO TRATAMENTO AO USO ABUSIVO

TESTOSTERONE AND CARDIOVASCULAR DISEASE: FROM TREATMENT TO ABUSE

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Tabela 1. Efeitos da reposição de testosterona sobre variáveis relacionadas com o sistema cardiovascular em pacientes com DAC e IC.

	DAC	IC
Reposição de testosterona isolada	↓PCR, ↓IL-1 β , ↓TNF α , ↔espessura da íntima média da artéria carótida, ↔escore de cálcio na artéria coronária, ↑perfusão miocárdica, ↓ <i>Angina pectoris</i> , ↓Episódios de isquemia, ↓HOMA-IR, ↓CT, ↓TG.	↓PAD, ↓VE/VCO ₂ , ↓HOMA-IR, ↑BRS, ↑VO _{2máx} , ↑6MWT, ↓QTd.
Reposição de testosterona associada ao treinamento físico		↓ANSM, ↑carga de trabalho, ↑massa muscular, ↑CSA tipo I e II.

ANSM, atividade nervosa simpática muscular; BRS, sensibilidade barorreflexa; CSA, área de secção transversa; CT, colesterol total; DAC, doença arterial coronariana; HOMA-IR, índice de resistência insulínica; IC, insuficiência cardíaca; IL-1 β , interleucina 1 beta; PAD, pressão arterial diastólica; PCR, proteína C-reativa; QTd, intervalo QT prolongado; TG, triglicérides; TNF- α , fator de necrose tumoral alfa; VE/VCO₂, equivalente ventilatório de CO₂; VO_{2máx}, consumo máximo de oxigênio; 6MWT, 6-minute walk test.

Whole-body oxidative stress reduction during testosterone therapy in aging men: A randomized placebo-controlled trial

TABLE 2 Bivariate associations between Δ -oxidative stress markers and Δ -testosterone, body composition, and insulin resistance ($N = 38$).

	Δ -8-oxodG/24 h	Δ -8-oxoGuo/24 h
Δ -TT (nmol/L)	-0.29 (0.09)	-0.35 (0.04)*
Δ -BioT (nmol/L)	-0.28 (0.11)	-0.37 (0.03)*
Δ -Waist (cm)	0.14 (0.43)	0.17 (0.34)
Δ -Lean body mass (kg)	-0.38 (0.03)*	-0.23 (0.20)
Δ -Whole-body fat (kg)	0.40 (0.02)*	0.47 (<0.01)**
Δ -CFM (kg)	0.33 (0.06)	0.42 (0.01)*
Δ -SAT (%)	0.09 (0.64)	-0.16 (0.40)
Δ -VAT (%)	-0.03 (0.86)	0.16 (0.39)
Δ -Fasting insulin (pmol/L)	0.19 (0.28)	0.04 (0.80)
Δ -HOMA-IR	0.23 (0.17)	0.25 (0.15)

Table 1. Summary of testosterone replacement therapy (TRT) outcomes

TRT outcomes	TTtrials	Other RCTs	Observational studies	Meta-analyses
Sexual function				
Erectile dysfunction	↑ ⊕ ⊕	↑ ⊕ ⊕	↑ ⊕ ⊕ ⊕	↑ ⊕ ⊕
Libido	↑ ⊕ ⊕	↑ ⊕ ⊕ ⊕	↑ ⊕ ⊕ ⊕	↑ ⊕ ⊕ ⊕
Ejaculation	NA	↑ ⊕	↑ ⊕ ⊕	↑ ⊕
TRT + PDE5i				
Erectile dysfunction	NA	↑ ⊕ ↔	↑ ⊕ ⊕	↔
Body composition				
Fat mass	NA	↓ ⊕	↓ ⊕ ⊕	↓ ⊕
Lean mass	NA	↑ ⊕	↑ ⊕ ⊕	↑ ⊕
Body mass index	NA	↓ ⊕	↓ ⊕ ⊕ ⊕	↓ ⊕
Weight	NA	↔	↓ ⊕ ⊕ ⊕	↔
Metabolic control				
Glucose metabolism	NA	↑ ⊕ ↔	↑ ⊕ ⊕ ⊕	↑ ⊕
Lipid profile	NA	↑ ⊕ ↔	↑ ⊕ ⊕ ⊕	↑ ⊕ ↔
Blood pressure	NA	↔	↑ ⊕ ⊕	↔
Bone				
Bone mass	↑ ⊕	↑ ⊕	↑ ⊕ ⊕	↑ ⊕
Fracture risk	NA	NA	NA	NA
Mood/cognition				
Depressive symptoms	↑ ⊕	↑ ⊕	↑ ⊕ ⊕	↑ ⊕
Cognition	↔	↔	↑ ⊕	NA
Mobility				
	↑ ⊕ ↔	↑ ⊕ ↔	↑ ⊕	↑ ⊕

Incidência de câncer de próstata e mortalidade

Table 3. Association of testosterone replacement therapy (TRT) on all-cause, prostate cancer (PCa), and cardiovascular disease (CVD) deaths.

	Death due to any cause		PCa death		CVD death	
	Age adjusted HR (95% CI)	Multivariate adjusted HR (95% CI)	Age adjusted HR (95% CI)	Multivariate adjusted HR (95% CI)	Age adjusted HR (95% CI)	Multivariate adjusted HR (95% CI)
Non-users	Ref	Ref	Ref	Ref	Ref	Ref
Ever users	0.81 (0.75–0.87)	0.93 (0.87–1)	0.49 (0.29–0.85)	0.52 (0.3–0.91)	0.79 (0.68–0.92)	0.87 (0.75–1.01)
Active users	0.47 (0.4–0.57)	0.56 (0.46–0.68)	*	*	0.64 (0.46–0.9)	0.7 (0.5–0.99)
Previous users	1 (0.93–1.06)	1.13 (1.06–1.21)	0.84 (0.58–1.22)	0.92 (0.63–1.35)	0.97 (0.85–1.11)	1.07 (0.94–1.2)
Total use (DDD) (calculated for ever-users)						
None	Ref	Ref	Ref	Ref	Ref	Ref
<40	0.82 (0.72–0.92)	0.94 (0.84–1.06)	0.39 (0.15–1.05)	0.35 (0.13–0.92)	0.83 (0.65–1.06)	0.93 (0.73–1.19)
40–160	0.86 (0.76–0.97)	0.99 (0.87–1.1)	0.56 (0.23–1.36)	0.74 (0.31–1.79)	0.77 (0.59–1.01)	0.84 (0.64–1.09)
>160	0.74 (0.65–0.85)	0.87 (0.76–0.99)	0.55 (0.21–1.48)	0.61 (0.23–1.79)	0.77 (0.59–1.01)	0.85 (0.64–1.09)
Years of use (calculated for ever-users)						
None	Ref	Ref	Ref	Ref	Ref	Ref
≤1	0.8 (0.72–0.89)	0.9 (0.81–0.99)	0.15 (0.04–0.59)	0.14 (0.03–0.55)	0.8 (0.64–0.99)	0.87 (0.7–1.08)
1–3 years	0.81 (0.7–0.93)	0.94 (0.82–1.08)	1.38 (0.74–2.57)	1.62 (0.86–3.05)	0.76 (0.56–1.02)	0.87 (0.64–1.17)
>3	0.82 (0.71–0.94)	0.94 (0.82–1.08)	0.18 (0.03–1.27)	0.25 (0.04–1.81)	0.82 (0.61–1.11)	0.89 (0.67–1.2)
Intensity of use (DDD/year) (calculated for ever-users)						
None	Ref	Ref	Ref	Ref	Ref	Ref
<25.0011	0.9 (0.79–1.01)	0.92 (0.83–1.02)	0.6 (0.25–1.44)	0.53 (0.22–1.27)	0.89 (0.69–1.14)	0.99 (0.77–1.28)
25.0011–60.0000	0.82 (0.73–0.92)	0.96 (0.84–1.1)	0.31 (0.1–0.97)	0.39 (0.13–1.21)	0.8 (0.62–1.02)	0.87 (0.68–1.1)
>60.0000	0.71 (0.62–0.81)	0.94 (0.82–1.08)	0.6 (0.25–1.44)	0.65 (0.27–1.58)	0.69 (0.52–0.92)	0.76 (0.57–1.01)



Efeitos Colaterais



EAA – esteroide Anabolizante androgênico

Fonte: CEBRID-UNIFESP, SBEM e outras

Efeitos desejados

(uso não terapêutico)

Hipertrofia muscular
Diminuição da gordura
Vigor físico

EAA mais utilizados por adolescentes e atletas de diversos esportes

Decadurabolin (nandrolona)
Durateston
Winstrol (stanozolol)
Trembolona (veterinário)
Testosterona
Anavar (Oxandrolona)
Halostestin
Primobolan
Dianabol
Boldenona
Oximetolona

Efeitos colaterais

Meninas

Irregularidade menstrual
Pelos na face e corpo
Engrossamento da voz
Crescimento do clitóris
Diminuição dos seios

Meninos

Redução dos testículos
Aparecimento de mamas
Diminuição dos espermatozóides

Ambos

Acnes
Disfunção e tumores no fígado
Agressividade, paranoia e psicoses
Coágulos de Sangue
Aumento da pressão arterial