Universidade de São Paulo
Escola de Educação Física e Esporte de Ribeirão Preto

Programa de Treinamento Esportivo

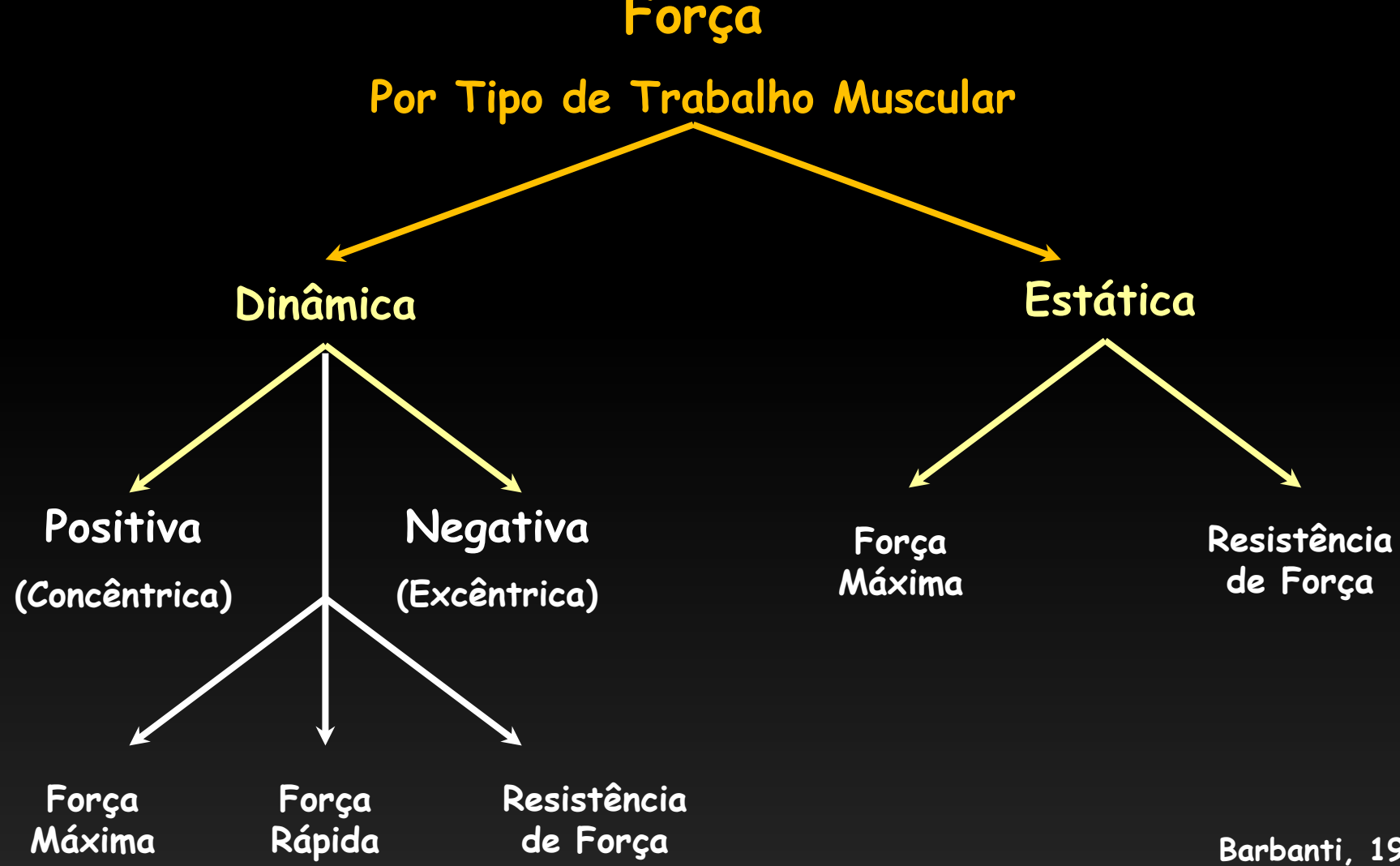
Força

Prof. Dr. Enrico F. Puggina

Ribeirão Preto
2020

Força

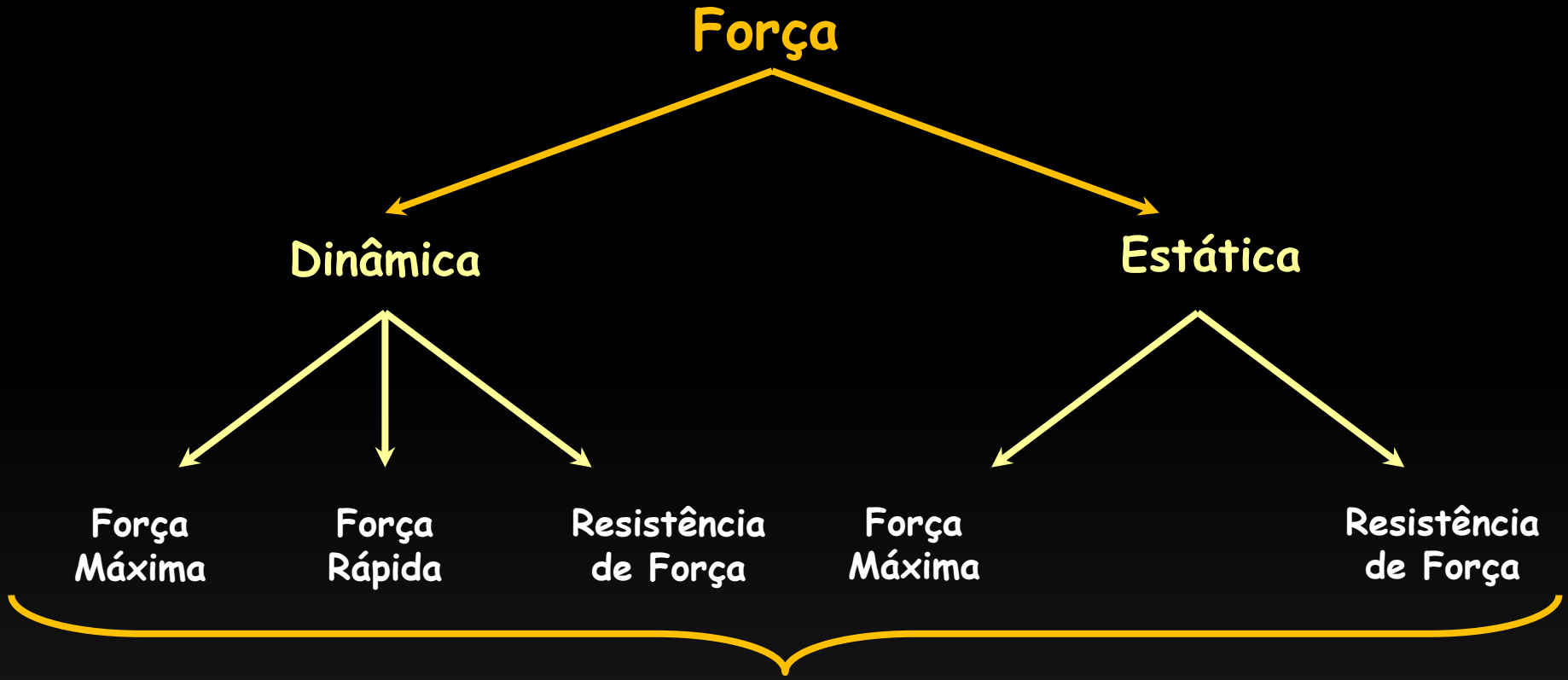
Transferência da Força Interna para o Aparelho Locomotor Passivo (ossos, tendões e ligamentos)



Barbanti, 1979

Força

Classificação por Formas de Manifestação



Geral e Local - % de massa muscular envolvida

Geral e Específica – Em relação à modalidade esportiva

Absoluta e Relativa - Em relação á massa corporal

Barbanti, 1979

Relação Volume de Carga x Resultado

Beachle e Earle, 2008

Muscular Adaptations in Response to Three Different Resistance-Training Regimens: Specificity of Repetition Maximum Training Zones

Amostra	
N	32
Sexo	Masculino
Idade	22,5 ± 5,8
Altura (cm)	178,3 ± 7,2
Peso (Kg)	77,8 ± 11,9

Grupos	Low	Intermediate	High	N Exercised
N	9	11	7	5
Repet.	3-5	9-11	20-28	--
Séries	4	3	2	--
Intervalo	3'	2'	1'	--

Campos; Luecke; Wendeln, *et all.*, 2002 (Eur. J. Appl. Physiol.)

Muscular Adaptations in Response to Three Different Resistance-Training Regimens: Specificity of Repetition Maximum Training Zones

Campos; Luecke; Wendeln, *et all.*, 2002 (Eur. J. Appl. Physiol.)

Resultados

Table 1. Total body mass and estimated percentage body fat. Values given are mean (SD). (*LOW REP* Low repetition group, *INT REP* intermediate repetition group, *HIGH REP* high repetition group, *Pre* pre-training, *Post* post-training)

Training condition	Body mass (kg)	% Body fat
CONTROL		
Pre	80.8 (23.3)	14.6 (6.6)
Post	81.4 (24.3)	14.0 (6.5)
LOW REP		
Pre	80.1 (8.4)	13.9 (3.7)
Post	82.4 (8.3)	14.3 (4.0)
INT REP		
Pre	79.5 (7.8)	14.7 (4.8)
Post	81.2 (8.3)	16.0 (5.3)
HIGH REP		
Pre	70.2 (9.5)	11.2 (3.9)
Post	71.5 (9.2)	11.4 (3.7)

Table 2. Cardiorespiratory data obtained from pre- and post-training endurance tests. Values given are mean (SD). ($\dot{V}O_2$ Oxygen consumption, $\dot{V}O_{2max}$ maximum oxygen consumption, $\dot{V}_E$ minute ventilation, *Max power* maximal aerobic power, *t* time to exhaustion)

Training condition	$\dot{V}O_{2max}$ (ml/kg/min)	$\dot{V}O_2$ (l/min)	$\dot{V}_E$ (l/min)	Max power (W)	*t* (min)
CONTROL					
Pre	48.7 (9.6)	3.81 (0.77)	152.0 (28.5)	276 (58)	8.5 (1.8)
Post	44.8 (7.6)	3.32 (0.70)	123.6 (38.6)*	276 (39)	8.4 (1.6)
LOW REP					
Pre	50.3 (5.6)	4.00 (0.45)	140.1 (22.9)	297 (41)	8.9 (1.3)
Post	48.5 (6.6)	3.97 (0.46)	132.1 (25.6)	307 (36)	9.2 (1.2)
INT REP					
Pre	48.1 (3.7)	3.88 (0.41)	149.8 (17.2)	290 (34)	9.0 (1.0)
Post	45.7 (4.4)	3.76 (0.45)	137.8 (25.2)	293 (33)	9.0 (1.2)
HIGH REP					
Pre	51.0 (10.4)	3.52 (0.55)	140.3 (33.5)	266 (47)	7.6 (1.8)
Post	52.5 (5.7)	3.74 (0.50)	153.7 (21.7)	309 (41)*	9.1 (1.3)*

*Significantly different from corresponding pre-training value

Campos; Luecke; Wendeln, *et all.*, 2002 (Eur. J. Appl. Physiol.)

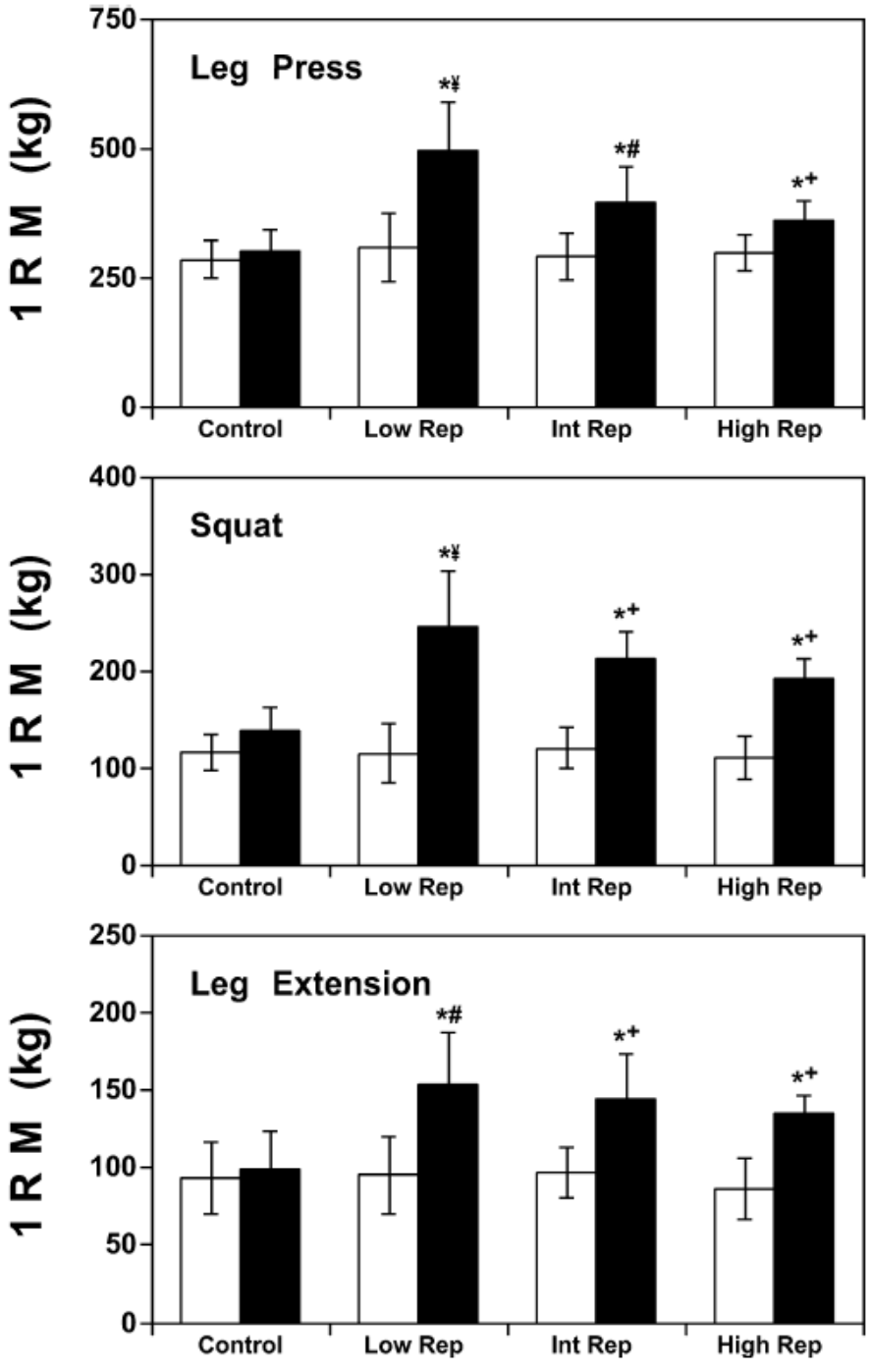


Fig. 3. Bar graphs comparing maximal strength (1-repetition maximum, *1RM*) values [mean (SD)] for the three lower-limb exercises pre- (■) and post-training (■). (*C* Control group, *Low Rep* low repetition group, *Int Rep* intermediate repetition group, *High Rep* high repetition group). *Significantly greater than corresponding pre-training value; ¥significantly greater than all corresponding post-training values; #significantly greater than corresponding High, Rep and Control post-training values; +significantly greater than corresponding Control post-training values

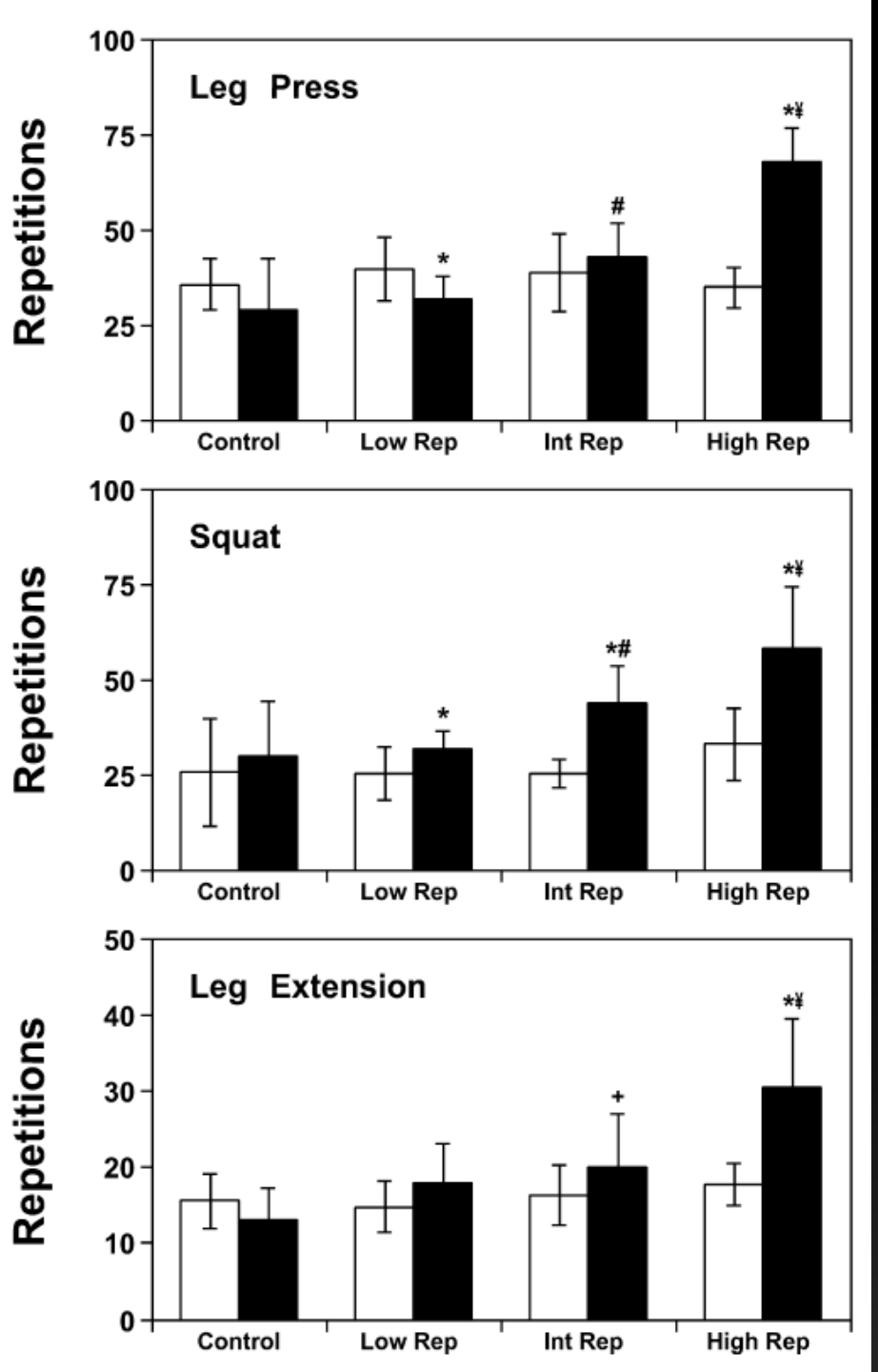


Fig. 4. Bar graphs comparing the maximal number of repetitions using 60% 1RM [mean (SD)] for the three lower-limb exercises pre- (■) and post-training (■). *Significantly different from corresponding pre-training value; ¥significantly greater than all corresponding post-training values; significantly greater than Low, Rep and Control corresponding post-training values; +significantly greater than corresponding Control post-training values

Resultados

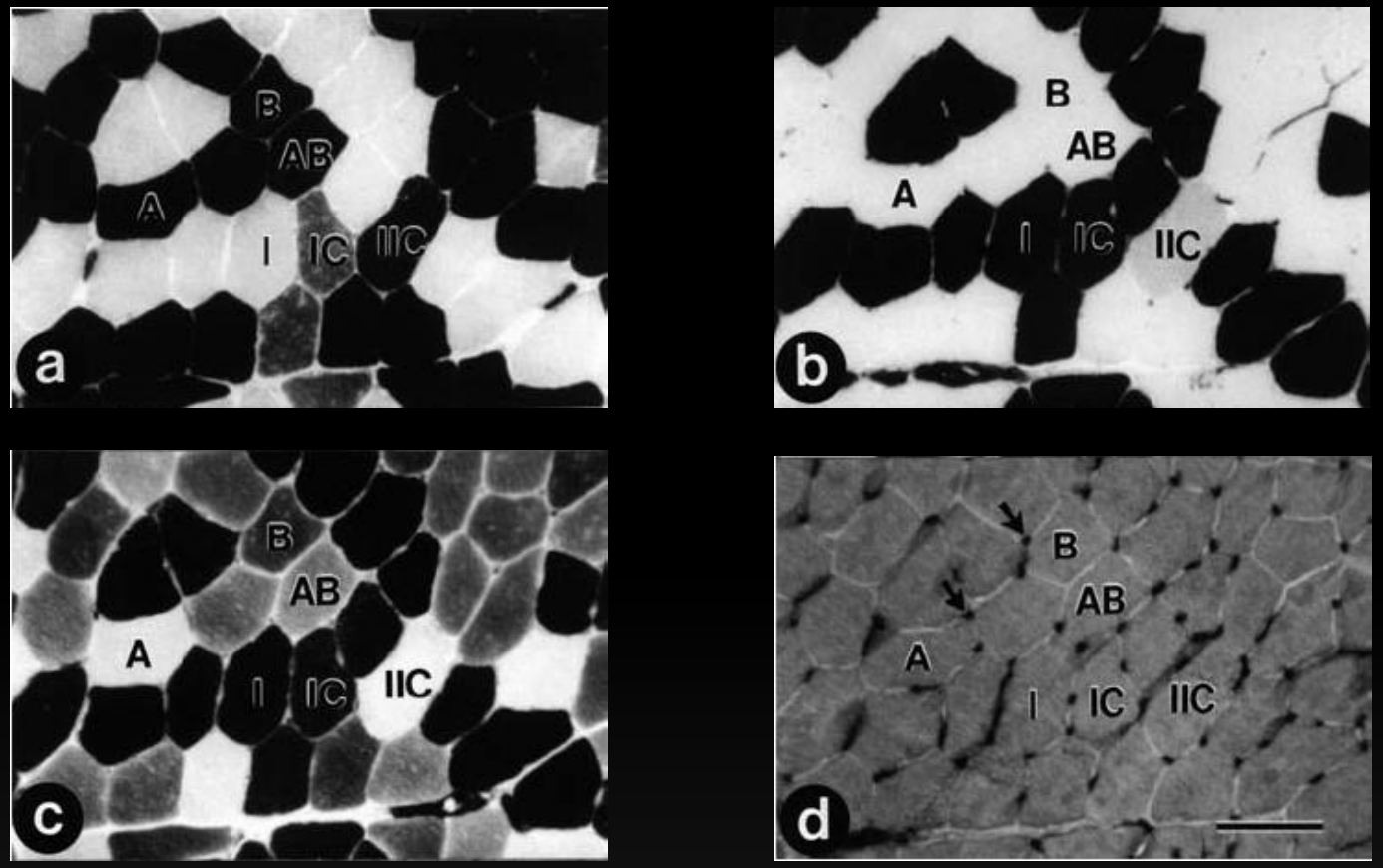


Fig. 1. Serial cross sections of muscle samples taken from a control subject demonstrating fiber-type delineation using myofibrillar adenosine triphosphatase histochemistry after preincubation at pH 10.4 (**a**), 4.3 (**b**), and 4.6 (**c**), and capillary supply using *Ulex europaeus* agglutinin lectin histochemistry (**d**). *Arrows* in **d** indicate capillaries. (*I* Type I muscle fiber, *IC* type IC muscle fiber, *IIC* type IIC muscle fiber, *A* type IIA muscle fiber, *AB* type IIAB muscle fiber, *B* type IIB muscle fiber). Bar = 100 μm

Campos; Luecke; Wendeln, *et all.*, 2002 (Eur. J. Appl. Physiol.)

Resultados

Table 5. Cross-sectional area (μm^2) of the three major muscle fiber types. Data are presented as mean (SD)

Training condition	Muscle fiber type		
	I	IIA	IIB
CONTROL			
Pre	5208 (1494)	6070 (1944)	4648 (1043)
Post	5155 (1239)	5982 (1547)	4813 (672)
LOW REP			
Pre	4869 (1178)	5615 (1042)	4926 (942)
Post	5475 (1425)*	6903 (1442)*	6171 (1436)*
INT REP			
Pre	4155 (893)	5238 (787)	4556 (877)
Post	4701 (809)*	6090 (1421)*	5798 (1899)*
HIGH REP			
Pre	3894 (1085)	5217 (1009)	4564 (1179)
Post	4297 (1203)	5633 (596)	5181 (714)

*Significantly different from corresponding pre-training values

Campos; Luecke; Wendeln, *et all.*, 2002 (Eur. J. Appl. Physiol.)

Resultados

Training condition	*n* caps/I	*n* caps/IIA	*n* caps/IIAB	*n* caps/IIB	*n* caps/fiber	*n* caps/mm^2
CONTROL ($n=5$)						
Pre	4.1 (0.3)	3.9 (0.6)	3.6 (0.5)	3.2 (0.5)	1.7 (0.6)	268 (89)
Post	4.7 (0.6)	4.3 (0.3)	4.4 (1.0)	3.6 (0.9)	1.6 (0.3)	273 (29)
LOW REP ($n=7$)						
Pre	4.5 (0.7)	4.7 (0.7)	3.9 (0.9)	3.7 (0.6)	1.6 (0.4)	273 (32)
Post	4.7 (0.8)	4.8 (0.7)	4.2 (1.1)	4.5 (1.0)	1.7 (0.4)	251 (39)
INT REP ($n=6$)						
Pre	3.7 (0.4)	3.7 (0.4)	3.5 (0.5)	3.2 (0.4)	1.2 (0.2)	244 (50)
Post	4.4 (0.5)	4.7 (0.5)*	4.5 (0.8)	4.1 (0.4)	1.5 (0.2)	254 (39)
HIGH REP ($n=5$)						
Pre	3.7 (0.3)	3.8 (0.7)	3.7 (0.3)	3.6 (0.7)	1.3 (0.1)	263 (44)
Post	4.1 (0.4)	4.7 (0.7)	4.7 (0.6)	3.9 (0.2)	1.5 (0.3)	282 (34)

*Significantly different from corresponding pre-training value

Campos; Luecke; Wendeln, *et all.*, 2002 (Eur. J. Appl. Physiol.)

Resultados

Training condition	Muscle fiber type						
	I	IC	IIC	IIA	IIAB	IIB	*n*
CONTROL							
Pre	35.6 (11.3)	1.0 (1.7)	0.7 (1.2)	28.2 (10.3)	4.6 (2.6)	29.9 (5.6)	1040 (451)
Post	39.9 (9.6)	1.4 (1.9)	0.6 (0.5)	31.2 (10.3)	3.2 (0.9)	23.7 (2.8)	1100 (452)
LOW REP							
Pre	38.3 (10.9)	0.3 (0.6)	0.6 (0.9)	33.3 (7.3)	5.4 (2.1)	22.1 (9.0)	1022 (255)
Post	42.8 (11.3)	1.6 (1.6)	3.9 (3.3)	31.0 (11.7)	12.1 (7.0)*	8.6 (6.1)*	912 (542)
INT REP							
Pre	38.6 (9.3)	0.5 (0.6)	0.5 (0.8)	33.1 (7.7)	6.1 (4.1)	21.2 (9.0)	953 (463)
Post	40.7 (9.9)	1.8 (2.1)	1.6 (1.3)	34.1 (11.8)	11.3 (2.8)*	10.5 (9.8)*	885 (471)
HIGH REP							
Pre	34.9 (13.3)	0.7 (1.1)	2.4 (4.8)	28.5 (10.5)	5.8 (5.1)	27.7 (15.8)	1110 (561)
Post	40.4 (6.0)	1.8 (3.6)	3.0 (2.8)	32.2 (9.5)	12.0 (6.1)*	10.6 (5.8)*	1342 (549)

*Significantly different from corresponding pre-training value

Table 3. Muscle fiber type percentages determined using myofibrillar adenosine triphosphatase histochemical methods. Values given are mean (SD). (*n* Mean number of fibers per biopsy sample)

Campos; Luecke; Wendeln, *et all.*, 2002 (Eur. J. Appl. Physiol.)

Resultados

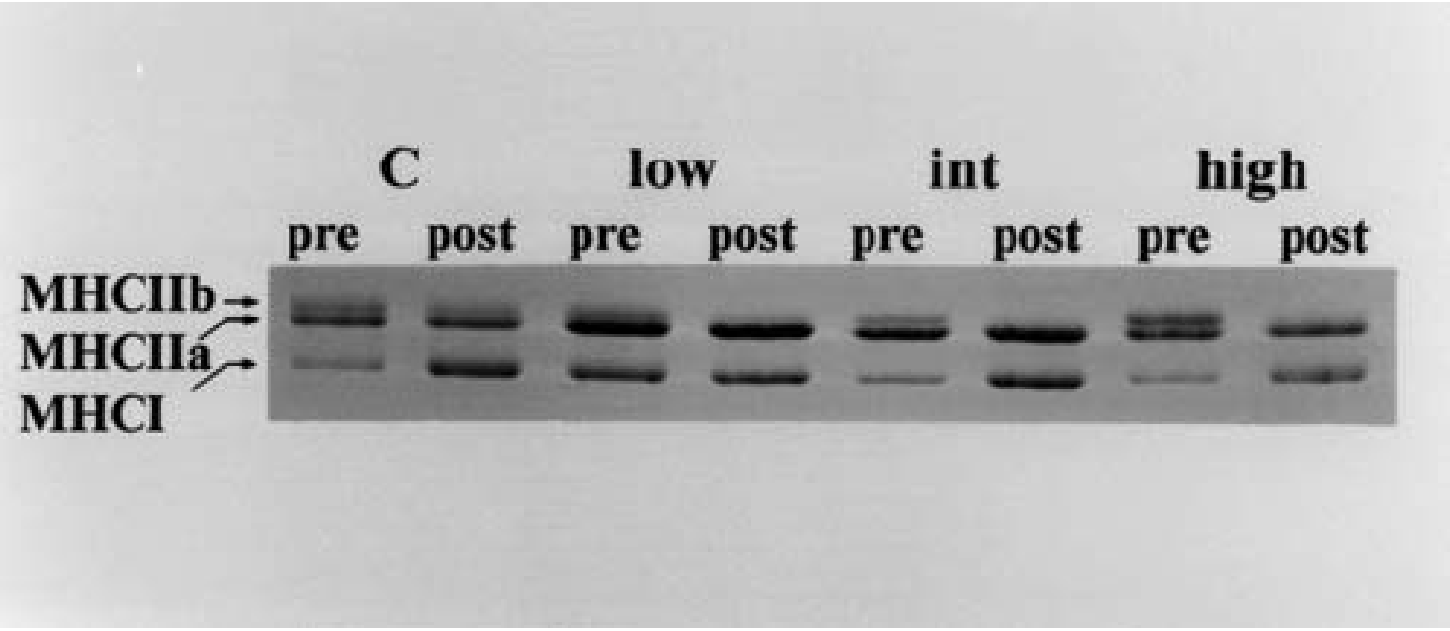


Fig. 2. Myosin heavy chain (MHC) analysis of muscle biopsy samples obtained from a representative subject in each of the four groups (*C* control, *low* low repetition, *int* intermediate repetition, *high* high repetition) at the beginning (*pre*) and end (*post*) of the study. Note the decrease in the band corresponding to MHCIIb from pre to post for the training subjects. (*MHCIIb* Myosin heavy chain IIb, *MHCIIa* myosin heavy chain IIa, *MHCI* myosin heavy chain I)

Campos; Luecke; Wendeln, *et all.*, 2002 (Eur. J. Appl. Physiol.)

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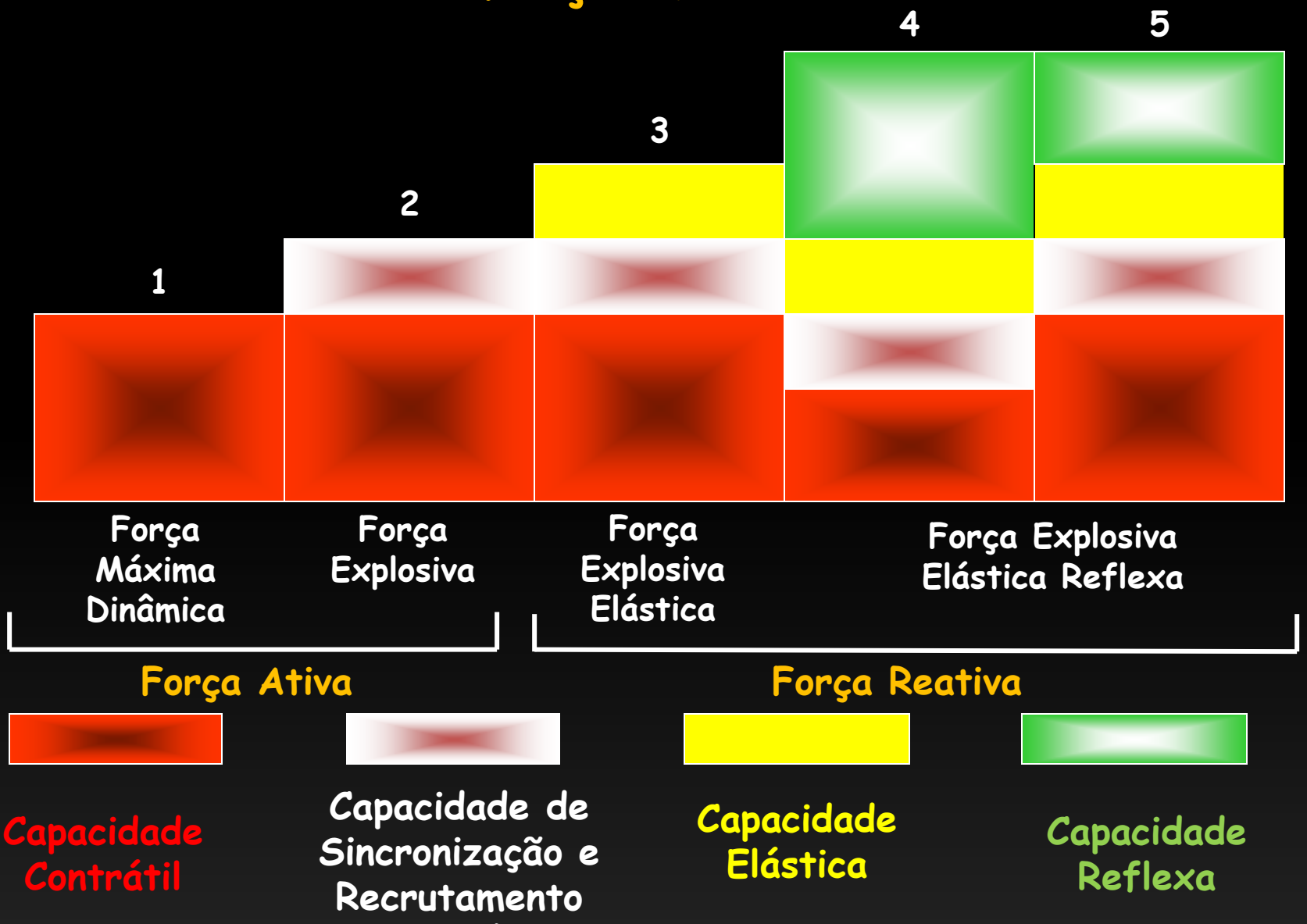
Table 4. Relative myosin heavy chain isoform percentages from homogenate muscle samples determined using sodium dodecylsulfate-polyacrylamide gel electrophoresis. Values given are mean (SD). (*MHCI* Myosin heavy chain I, *MHCIIa* myosin heavy chain IIa, *MHCIIb* myosin heavy chain IIb)

Training condition	MHCI	MHCIIa	MHCIIb
CONTROL			
Pre	34.4 (14.0)	41.4 (11.1)	23.2 (4.9)
Post	36.9 (12.0)	40.7 (8.7)	22.4 (5.0)
LOW REP			
Pre	32.8 (8.2)	44.6 (6.7)	22.6 (5.6)
Post	35.3 (11.3)	55.4 (9.3)*	9.3 (2.9)*
INT REP			
Pre	28.6 (7.9)	47.1 (6.9)	24.3 (8.4)
Post	31.6 (8.0)	57.6 (6.6)*	10.8 (3.7)*
HIGH REP			
Pre	30.1 (10.2)	42.4 (4.7)	27.5 (11.6)
Post	33.2 (6.3)	53.9 (5.3)*	12.9 (3.5)*

*Significantly different from pre-training values

Campos; Luecke; Wendeln, *et all.*, 2002 (Eur. J. Appl. Physiol.)

Fatores Determinantes das Diversas Expressões da Força Motora



Barbanti, 2010

Fatores Determinantes das Diversas Expressões da Força Motora

Barbanti, 2010

Fatores Determinantes Das Diversas Expressões Da Força Motora

Barbanti, 2010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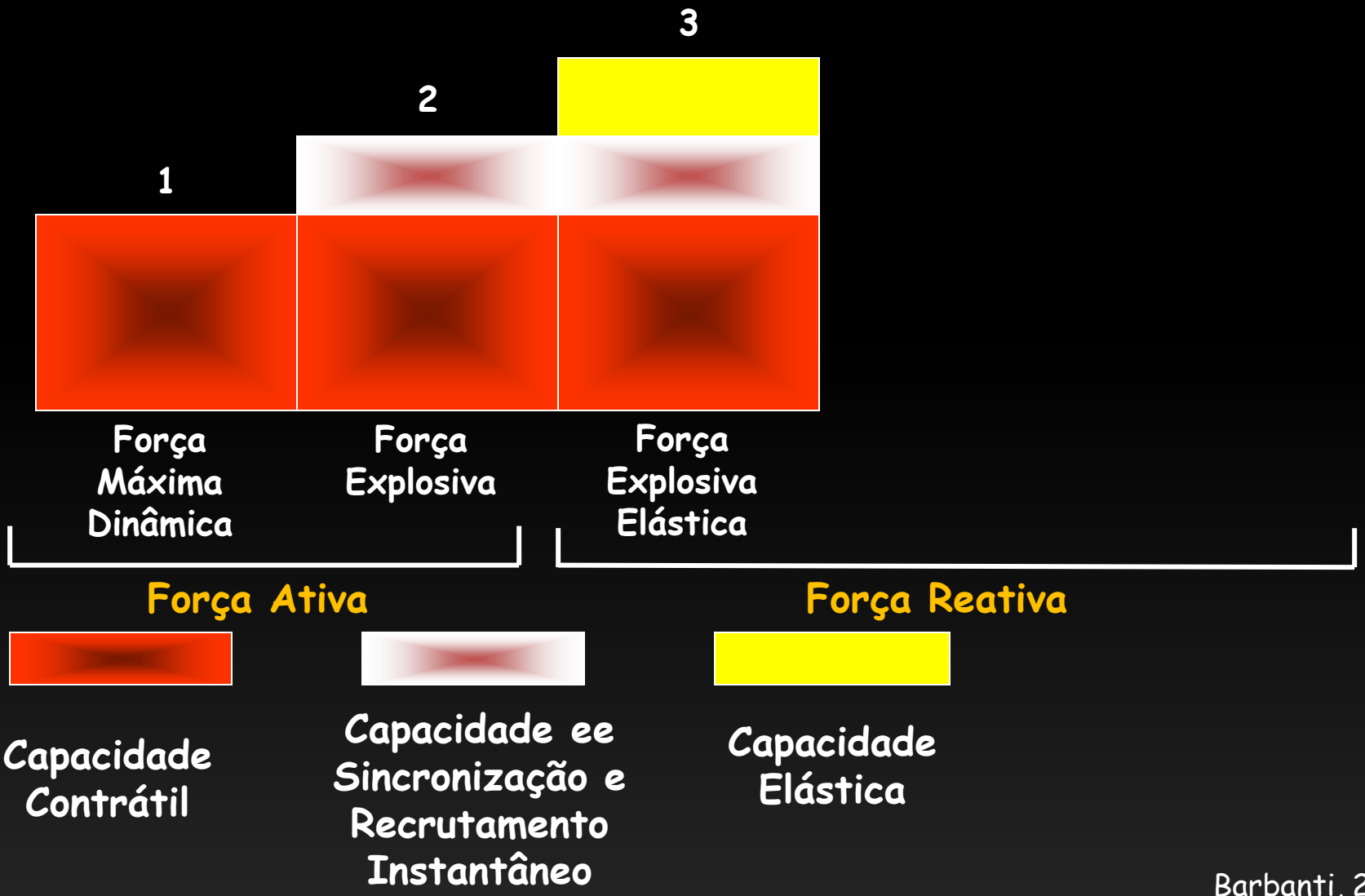
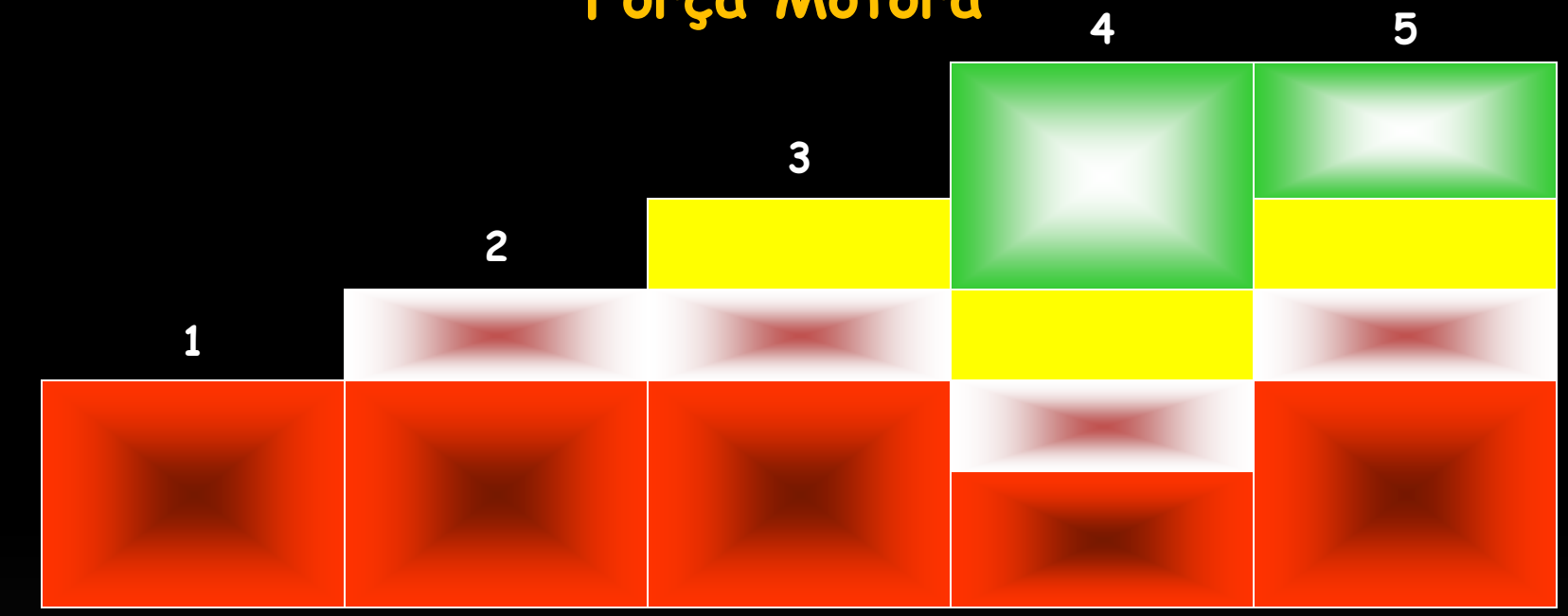
Fatores Determinantes Das Diversas Expressões Da Força Motora



Barbanti, 2010

Fatores Determinantes Das Diversas Expressões Da Força Motora



Barbanti, 2010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Força no Esporte

Força de Lançamento

- Dardo
- Disco
- Martelo
- Peso
- Handebol
- Beisebol
- Polo-Aquático
- Futebol
- Basquetebol

Força de Salto

- Vertical
- Horizontal

- Salto em altura
- Salto em distância
- Salto triplo
- Voleibol
- Basquetebol
- Handebol
- Futebol

Força de Sprint

- 100m rasos
- 200m rasos
- 400m rasos
- 800m rasos
- 100m s/ barreiras
- 110m s/ barreiras
- 400m s/ barreiras
- Futebol
- Basquetebol
- Handebol
- Futsal
- Rugbi
- Beisebol

Força Resistente

- Todas as modalidades esportivas

Barbanti, 2010