PROJECT INVICTUS

PROJECT INVICTUS ACROPOLI

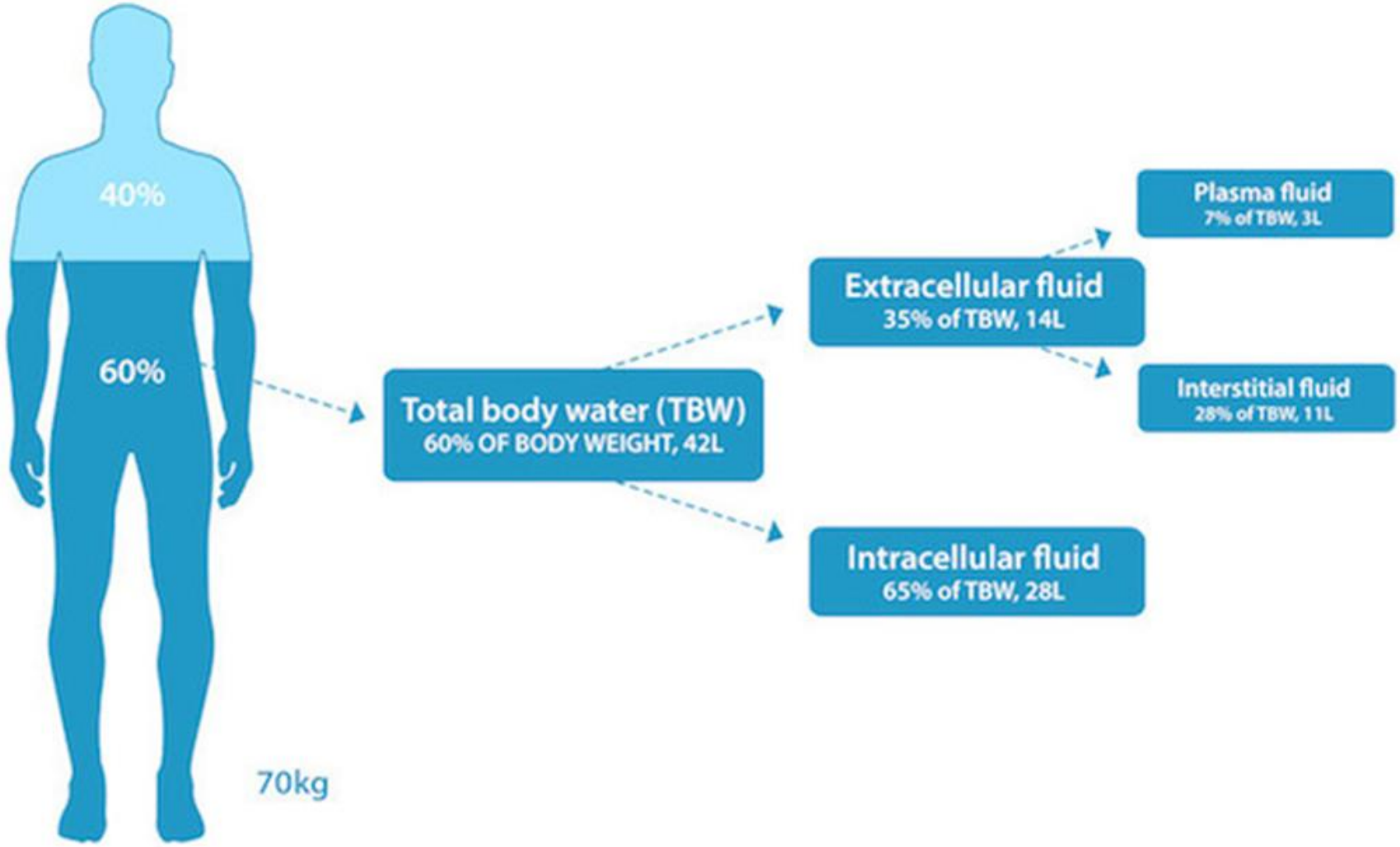
Con Alex Buoite Stella

Forza= muscoli + idratazione

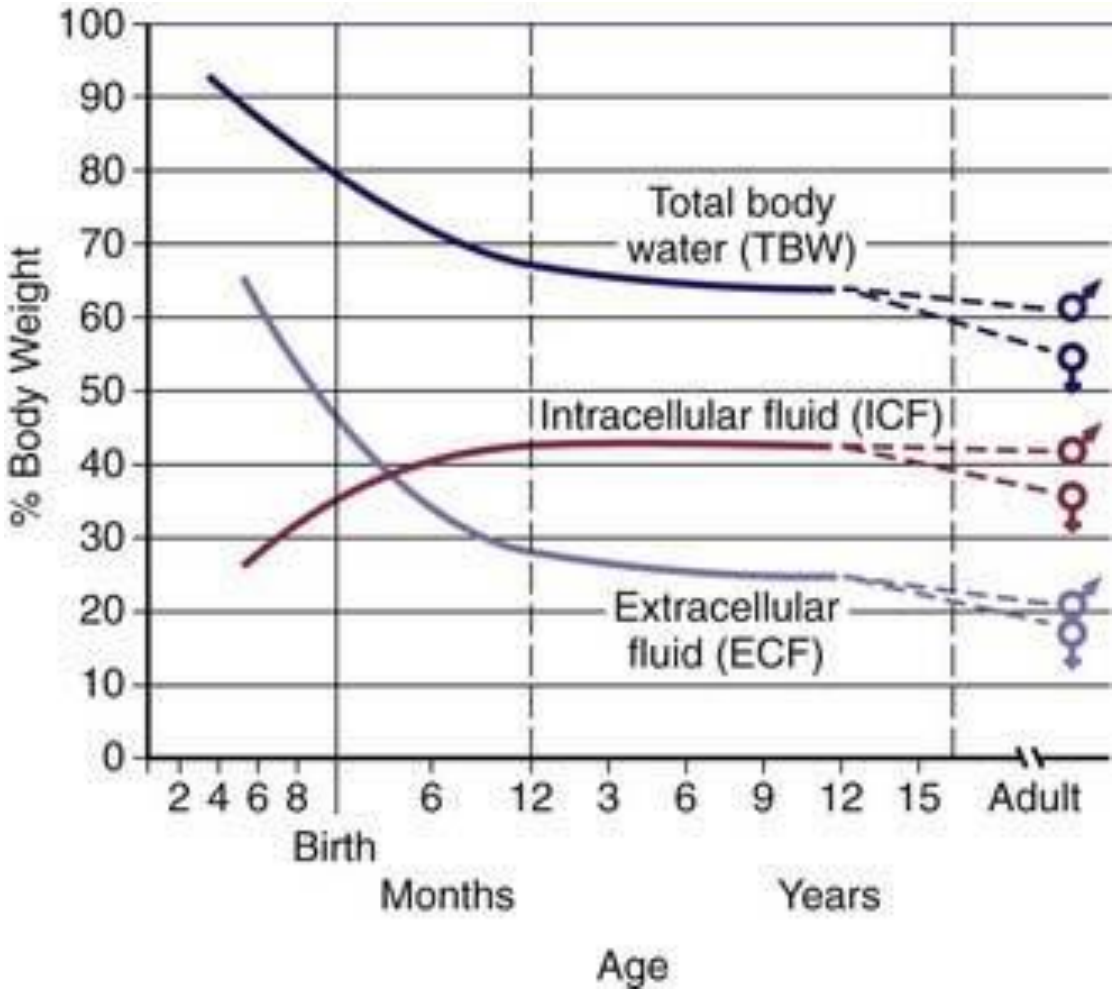
Il bilancio idroelettrolitico

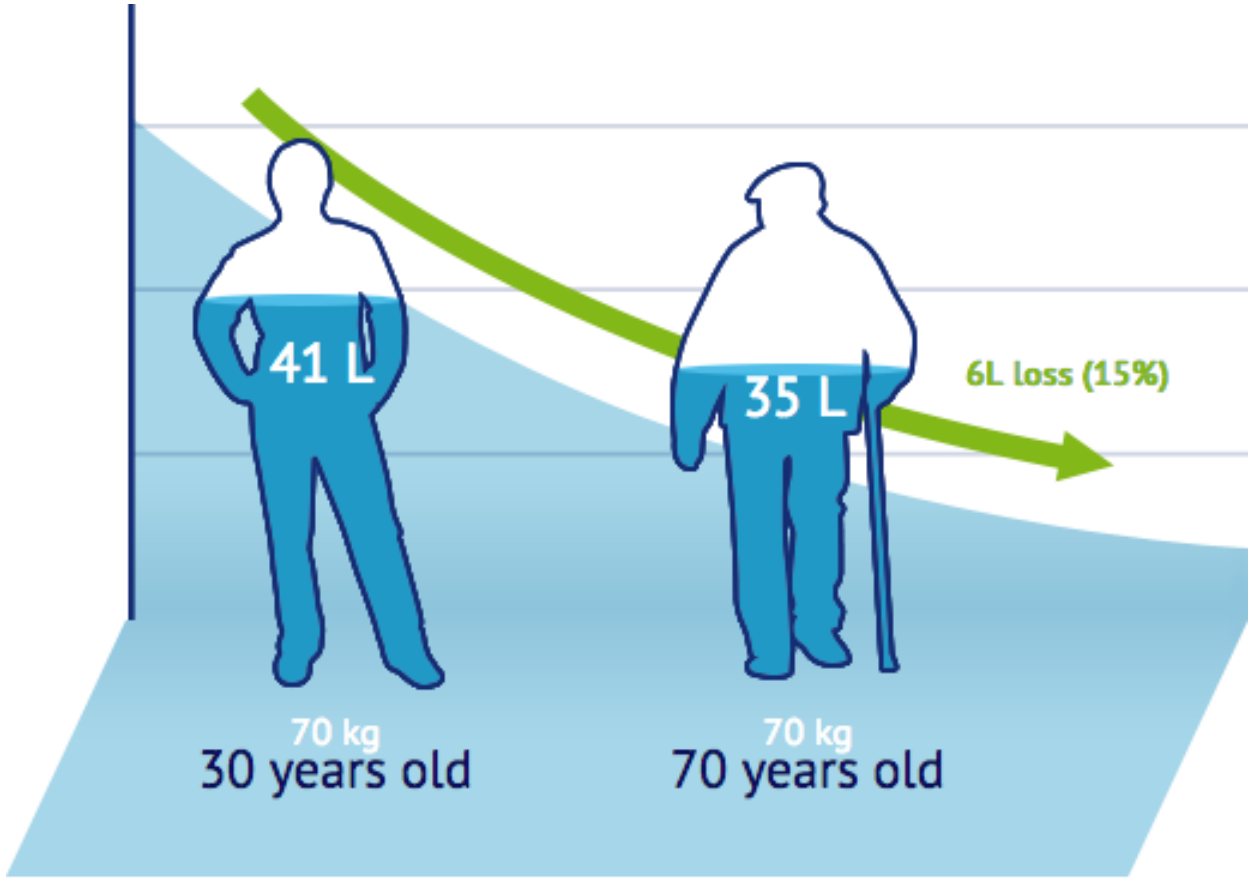
- Mantenimento del volume
- Mantenimento dell'osmolarità
- Concentrazione dei singoli ioni
- Mantenimento del pH
- Funzione termoregolatoria

Compartimenti Idrici



Compartimenti Idrici e Invecchiamento



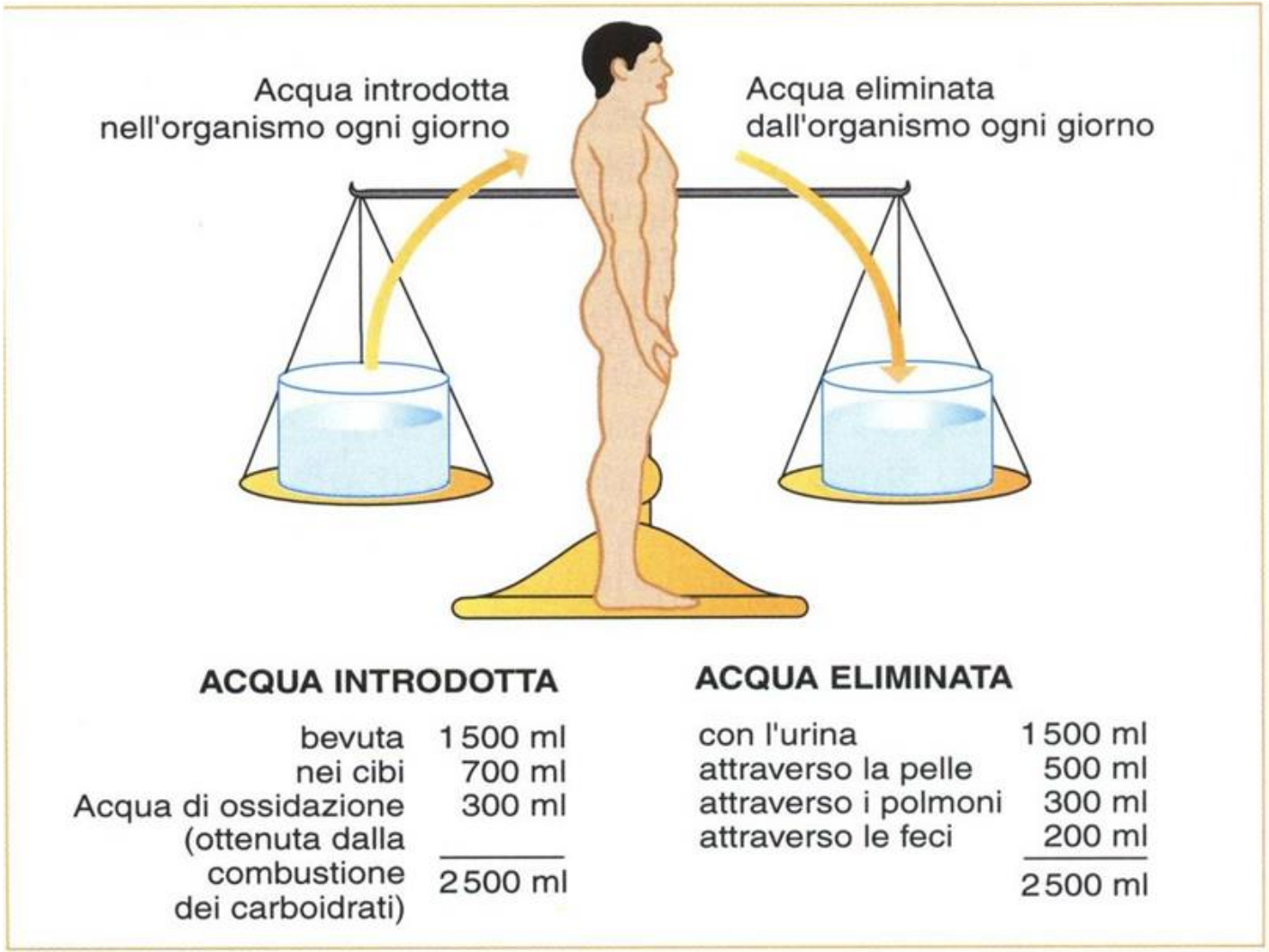


Data from Hébuterne et al. 2009

Elettroliti

Sostanza (mEq/L)	Liquido extracellulare	Liquido intracellulare
Na+	140	14
K+	4	120
Ca2+	2,5	10–4
Cl–	105	10
HCO3–	24	10
pH	7.4	7.1
Osmolarità (mOsm/L)	290	290

Bilancio Idrico



ACQUA INTRODOTTA	
bevuta	1 500 ml
nei cibi	700 ml
Acqua di ossidazione (ottenuta dalla combustione dei carboidrati)	300 ml
	2500 ml

ACQUA ELIMINATA	
con l'urina	1 500 ml
attraverso la pelle	500 ml
attraverso i polmoni	300 ml
attraverso le feci	200 ml
	2500 ml

Regolazione Ormonale

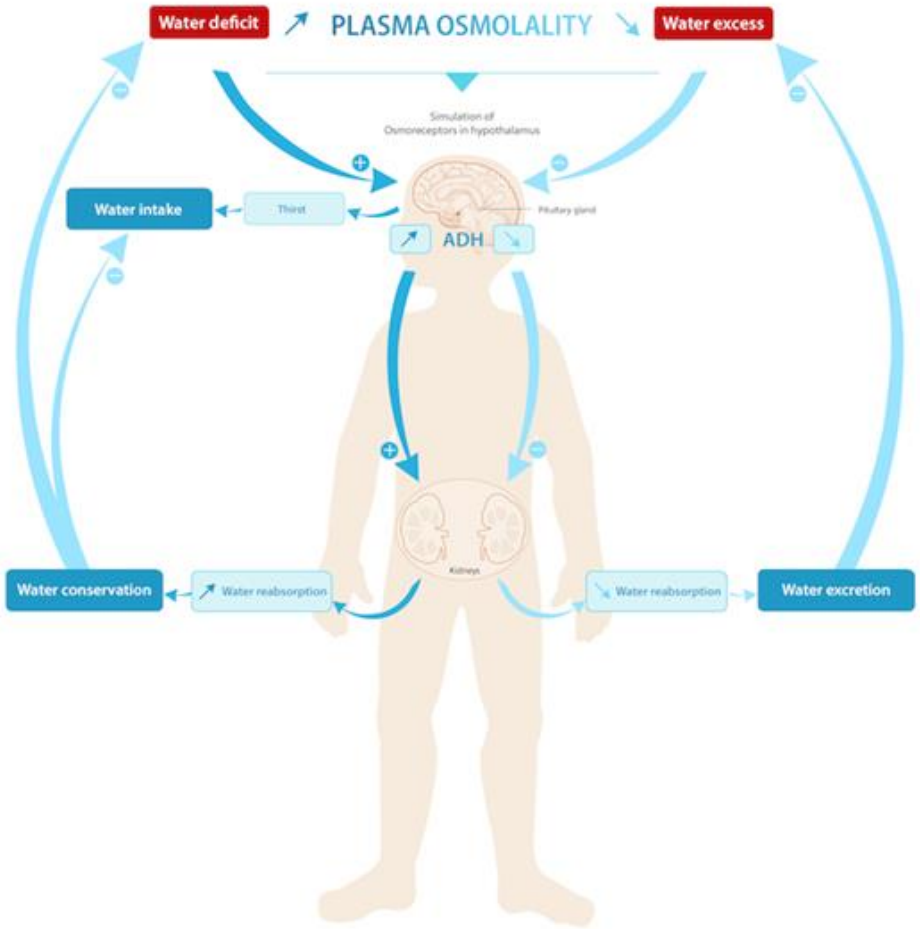
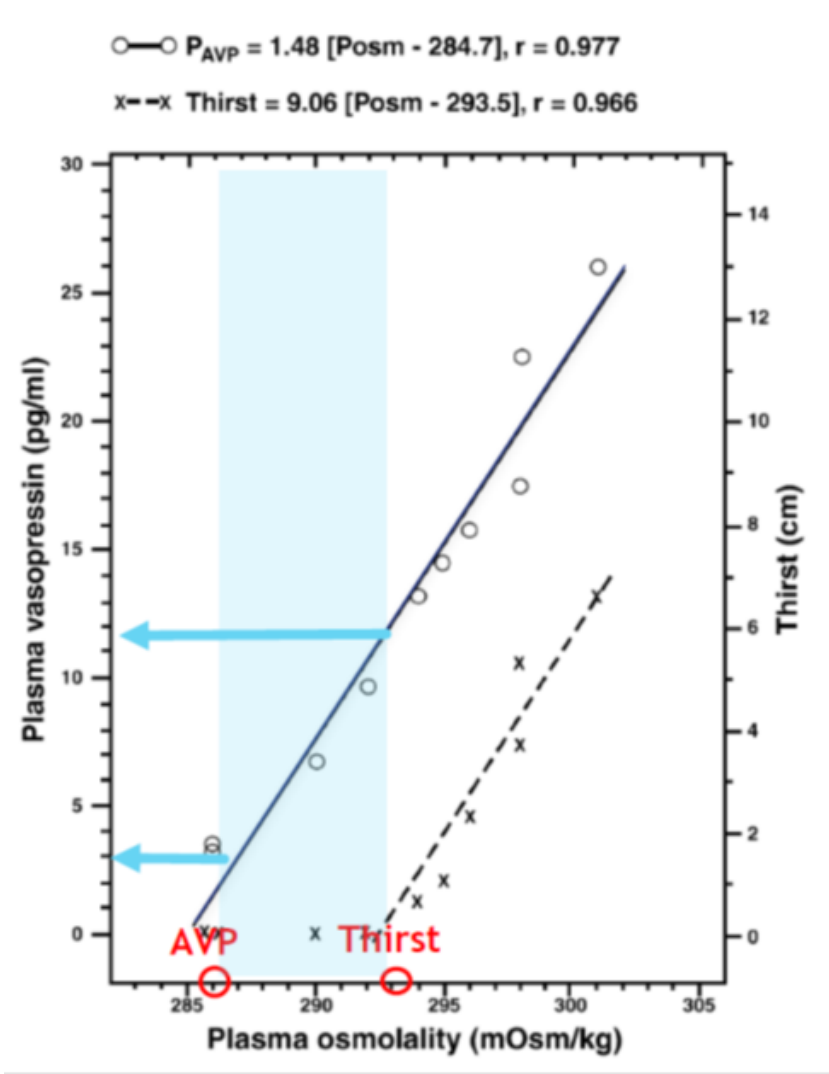
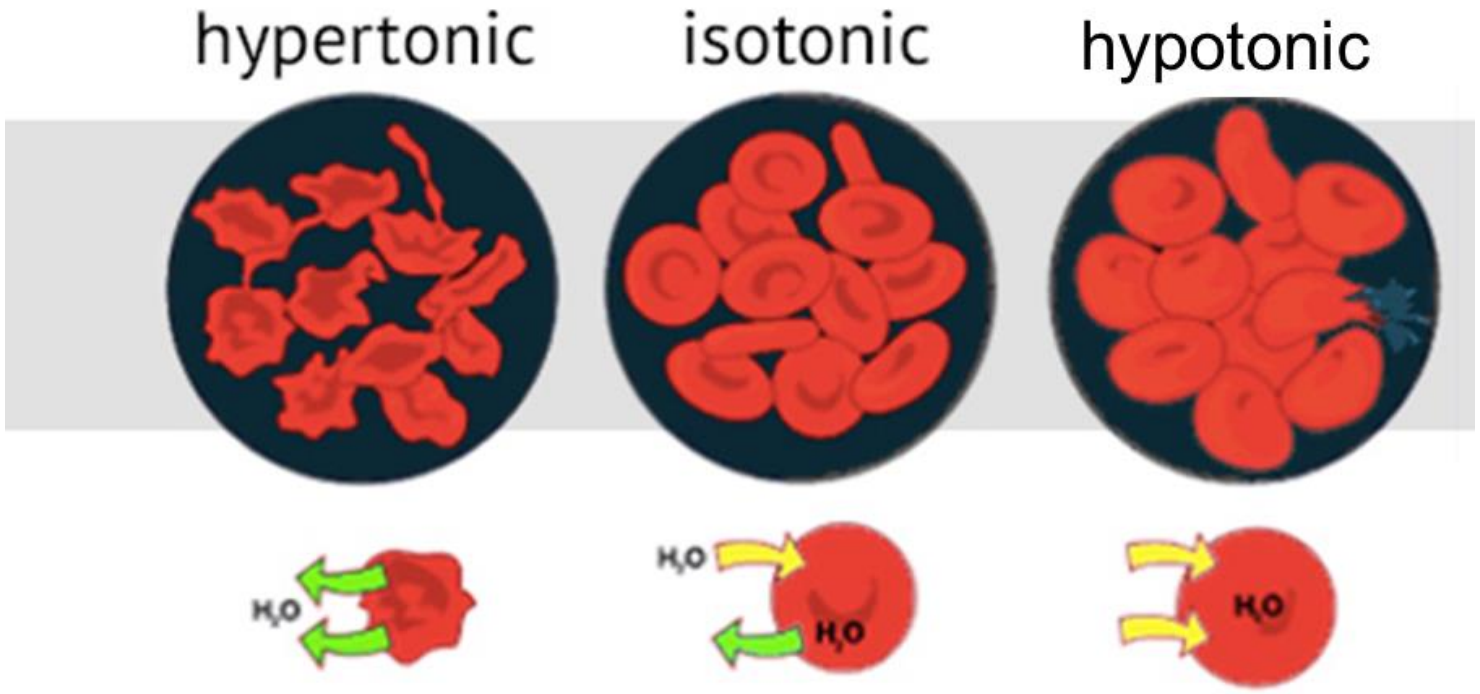


Figure 3. Regulation of body water balance by ADH and the kidney.



Tonicità

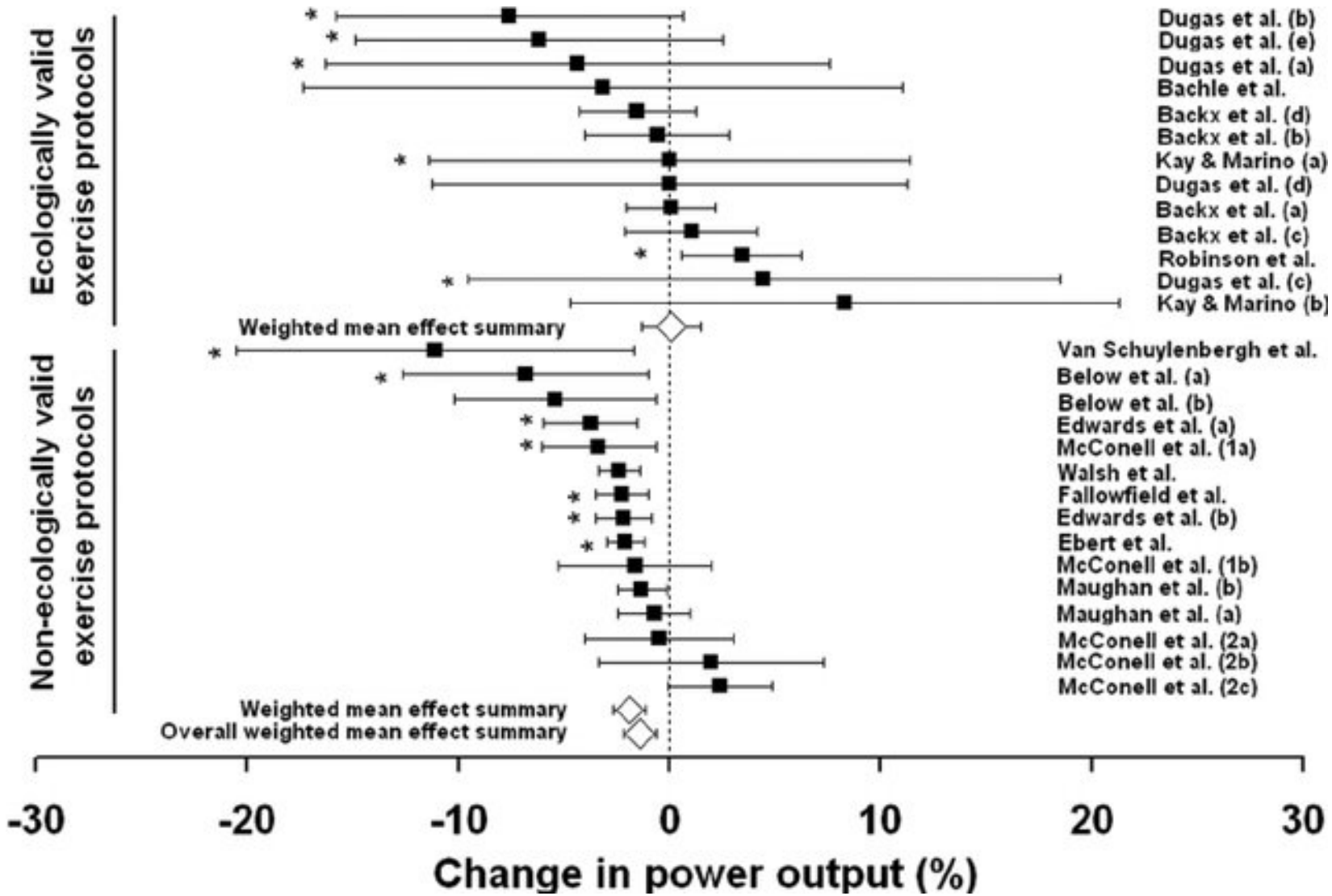

hypertonic
isotonic
hypotonic
H2O
H2O
H2O
H2O
animal cells

Effetti sulla Performance

Review Br J Sports Med. 2013 Jul;47(11):679-86. doi: 10.1136/bjsports-2012-090958.
Epub 2012 Jul 4.

Effect of Exercise-Induced Dehydration on Endurance Performance: Evaluating the Impact of Exercise Protocols on Outcomes Using a Meta-Analytic Procedure

Eric D B Goulet


Ecologically valid exercise protocols
Non-ecologically valid exercise protocols
Dugas et al. (b)
Dugas et al. (e)
Dugas et al. (a)
Bachle et al.
Backx et al. (d)
Backx et al. (b)
Kay & Marino (a)
Dugas et al. (d)
Backx et al. (a)
Backx et al. (c)
Robinson et al.
Dugas et al. (c)
Kay & Marino (b)
Weighted mean effect summary
Van Schuylenbergh et al.
Below et al. (a)
Below et al. (b)
Edwards et al. (a)
McConell et al. (1a)
Walsh et al.
Fallowfield et al.
Edwards et al. (b)
Ebert et al.
McConell et al. (1b)
Maughan et al. (b)
Maughan et al. (a)
McConell et al. (2a)
McConell et al. (2b)
McConell et al. (2c)
Weighted mean effect summary
Overall weighted mean effect summary
-30
-20
-10
0
10
20
30
Change in power output (%)

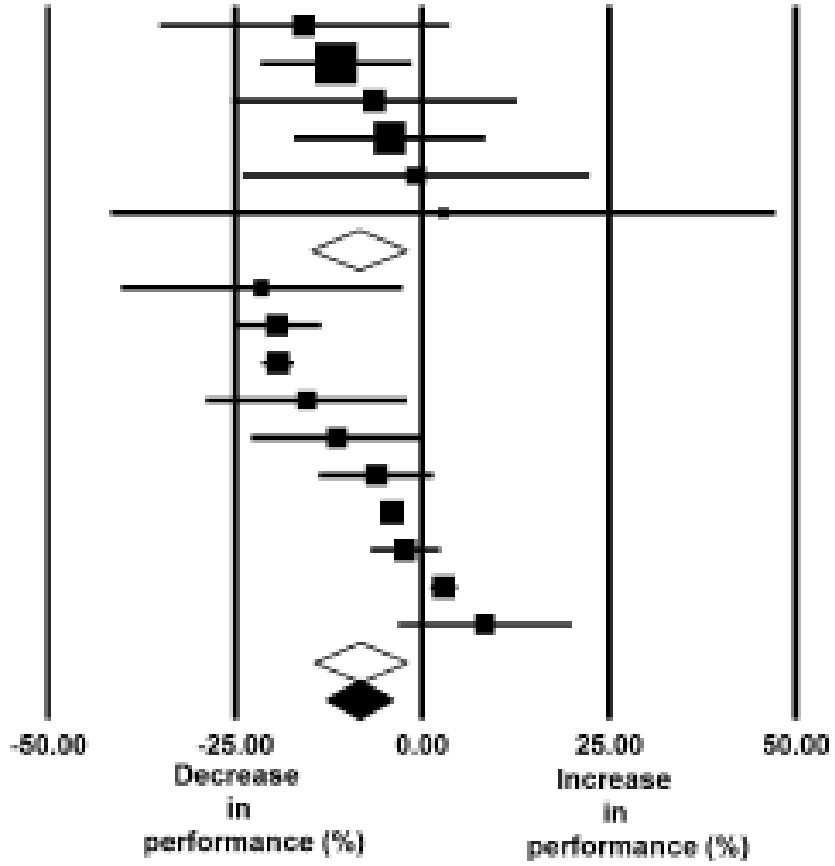
Meta-Analysis Sports Med. 2015 Aug;45(8):1207-27. doi: 10.1007/s40279-015-0349-0.

Effect of Hypohydration on Muscle Endurance, Strength, Anaerobic Power and Capacity and Vertical Jumping Ability: A Meta-Analysis

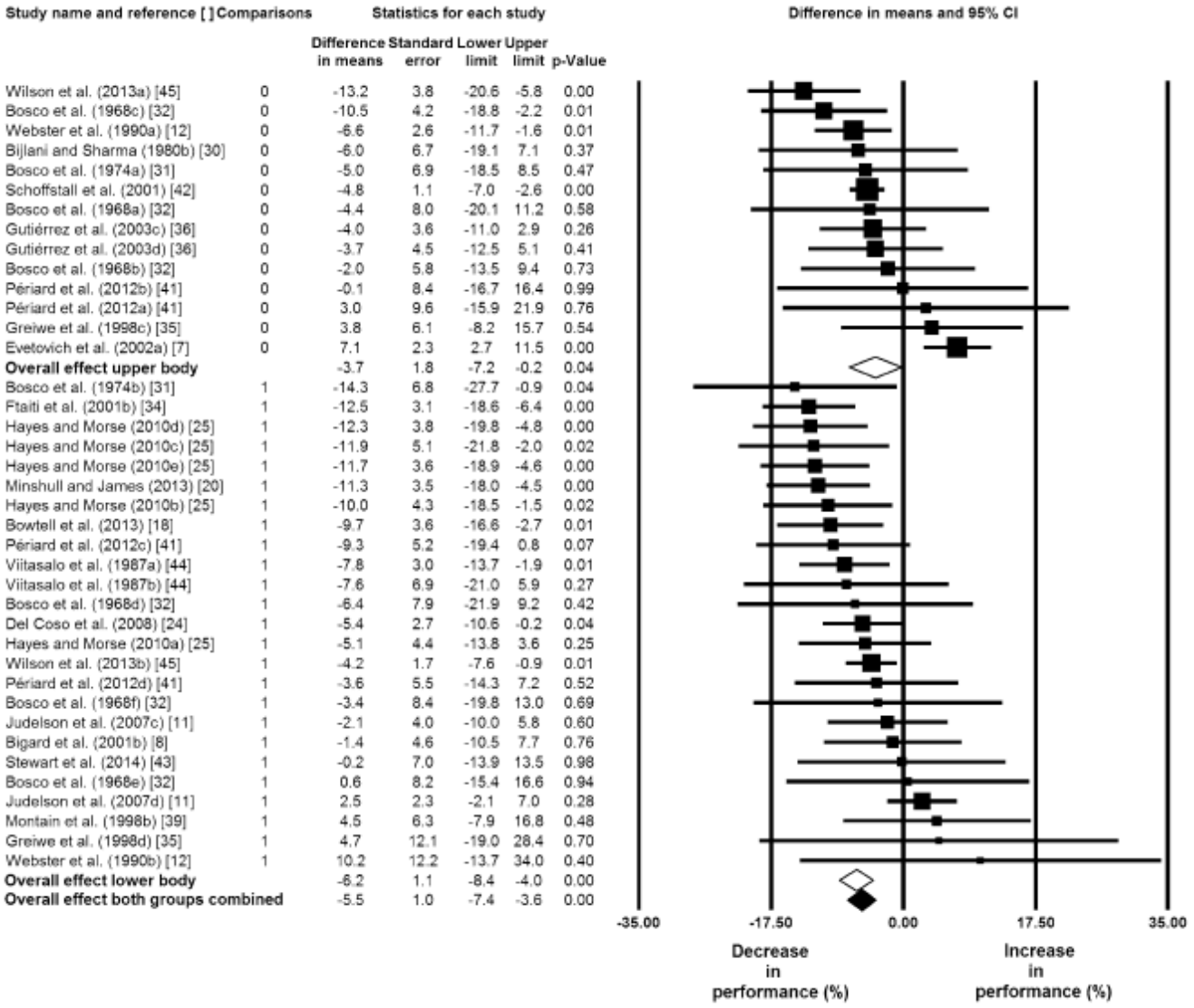
Félix-Antoine Savoie, Robert W Kenefick, Brett R Ely, Samuel N Cheuvront, Eric D B Goulet

Muscle Endurance

Study name and reference [ ]	Comparisons	Statistics for each study				
		Difference in means	Standard error	Lower limit	Upper limit	p-Value
Bijlani and Sharma (1980a) [30]	0	-15.8	9.9	-35.1	3.5	0.11
Kraft et al. (2010a) [38]	0	-11.5	5.1	-21.4	-1.6	0.02
Montain and Tharion (2010) [19]	0	-6.5	9.7	-25.4	12.5	0.51
Greiwe et al. (1998a) [35]	0	-4.4	6.5	-17.0	8.3	0.50
Gutiérrez et al. (2003a) [36]	0	-0.8	11.8	-23.9	22.3	0.95
Gutiérrez et al. (2003b) [36]	0	2.8	22.6	-41.6	47.2	0.90
Overall effect upper body		-8.4	3.3	-14.9	-2.0	0.01
Kraft et al. (2010b) [38]	1	-21.5	9.5	-40.2	-2.8	0.02
Caterisano et al. (1998a) [33]	1	-19.5	3.0	-25.3	-13.7	0.00
Caterisano et al. (1998c) [33]	1	-19.3	1.1	-21.4	-17.2	0.00
Montain et al. (1998a) [39]	1	-15.4	6.8	-28.8	-2.1	0.02
Bigard et al. (2001a) [8]	1	-11.4	5.8	-22.8	-0.1	0.05
Judelson et al. (2007b) [11]	1	-6.2	3.9	-13.7	1.4	0.11
Ftaiti et al. (2001a) [34]	1	-4.1	0.6	-5.2	-2.9	0.00
Judelson et al. (2007a) [11]	1	-2.3	2.3	-6.9	2.3	0.32
Caterisano et al. (1998b) [33]	1	2.9	0.9	1.2	4.6	0.00
Greiwe et al. (1998b) [35]	1	8.4	5.9	-3.2	19.9	0.16
Overall effect lower body		-8.2	3.2	-14.5	-2.0	0.01
Overall effect both groups combined		-8.3	2.3	-12.8	-3.9	0.00



Muscle Strength



Idratazione per il Resistance Training?

Capacità di Allenamento

Eur J Appl Physiol. 2010 May;109(2):259-67. doi: 10.1007/s00421-009-1348-3. Epub 2010 Jan 12.

Impact of Dehydration on a Full Body Resistance Exercise Protocol

Justin A Kraft, James M Green, Phillip A Bishop, Mark T Richardson, Yasmin H Neggers, James D Leeper

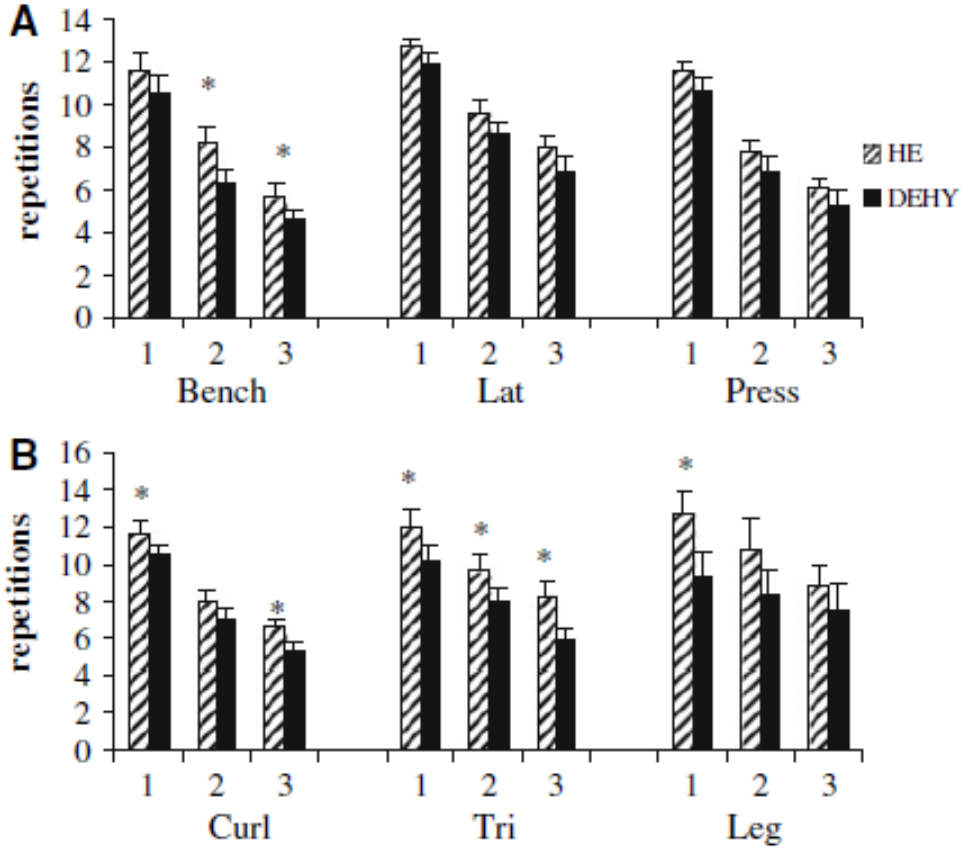


Fig. 1 Repetitions by set and exercise: bench press, lat pull down, overhead press, barbell curl, triceps press, and leg press. Values are means and standard errors (*$P \leq 0.05$ HE vs. DEHY)

Med Sci Sports Exerc. 2007 Oct;39(10):1817-24. doi: 10.1249/mss.0b013e3180de5f22.

Effect of Hydration State on Strength, Power, and Resistance Exercise Performance

Daniel A Judelson, Carl M Maresh, Mark J Farrell, Linda M Yamamoto, Lawrence E Armstrong, William J Kraemer, Jeff S Volek, Barry A Spiering, Douglas J Casa, Jeffrey M Anderson

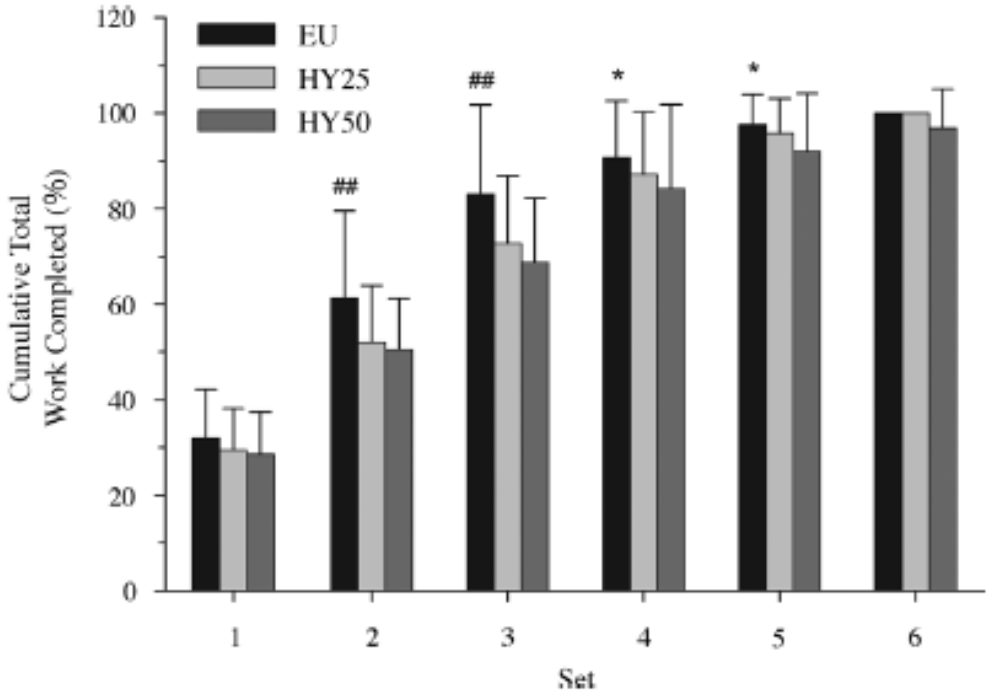
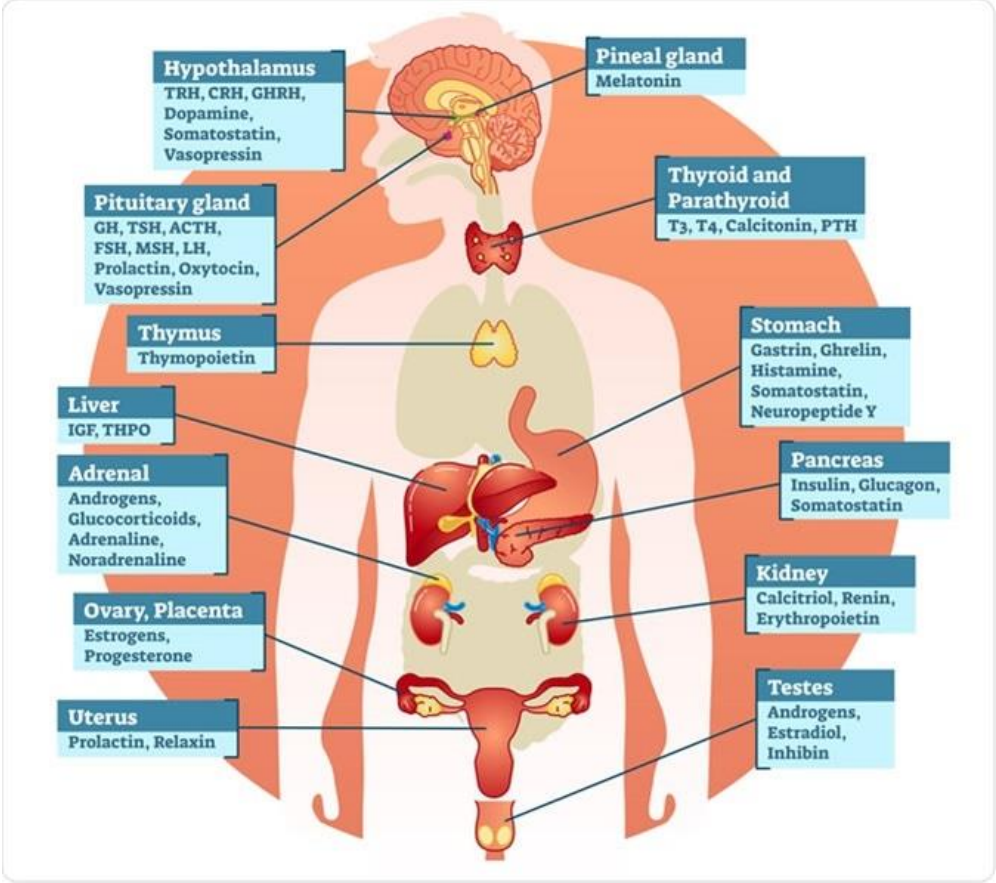


FIGURE 2—Cumulative total work completed (mean ± SD) after each set during the REC (for description of this calculation, please see Methods). EU, euhydrated; HY25, hypohydrated by approximately 2.5%; HY50, hypohydrated by approximately 5.0%. ## Significant difference between EU and both hypohydrated trials; * significant difference between EU and HY50.

REC= parallel back squat, 10 rep max, 80% 1 RM

Anabolismo e Catabolismo – Risposta Ormonale



J Strength Cond Res. 2008 Sep;22(5):1387-93. doi: 10.1519/JSC.0b013e3181739403.

Effects of Hydration State and Resistance Exercise on Markers of Muscle Damage

Linda M Yamamoto, Daniel A Judelson, Mark J Farrell, Elaine C Lee, Lawrence E Armstrong, Douglas J Casa, William J Kraemer, Jeff S Volek, Carl M Maresh

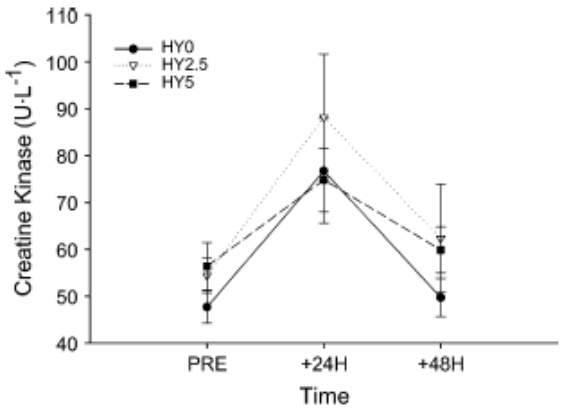


Figure 2. Creatine kinase response to resistance exercise in euhydrated and hypohydrated subjects. Values are mean ± SE. HY0, euhydrated; HY2.5, hypohydrated ~2.5%; HY5, hypohydrated ~5%; PRE, pre-exercise; IP, immediate post-exercise; +24H, 24 hours post-exercise; +48H, 48 hours post-exercise.

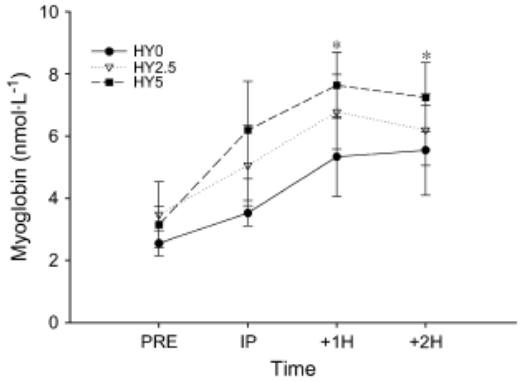


Figure 1. Myoglobin response to resistance exercise in euhydrated and hypohydrated subjects. Values are means ± SE. *Significant difference in all trials compared to corresponding pre-exercise values. HY0, euhydrated; HY2.5, hypohydrated ~2.5%; HY5, hypohydrated ~5%; PRE, pre-exercise; IP, immediate post-exercise; +1H, 1 hour post-exercise; +2H, 2 hours post-exercise.

6 sets back squat, 10 rep max, 80% 1 RM

Int J Sports Med. 2006 Oct;27(10):765-70. doi: 10.1055/s-2005-872932.

Effect of Hydration State on Testosteron and Cortisol Responses to Training-Intensity Exercise in Collegiate Runners

C M Maresh, M J Whittlesey, L E Armstrong, L M Yamamoto, D A Judelson, K E Fish, D J Casa, S A Kavouras, V D Castracane

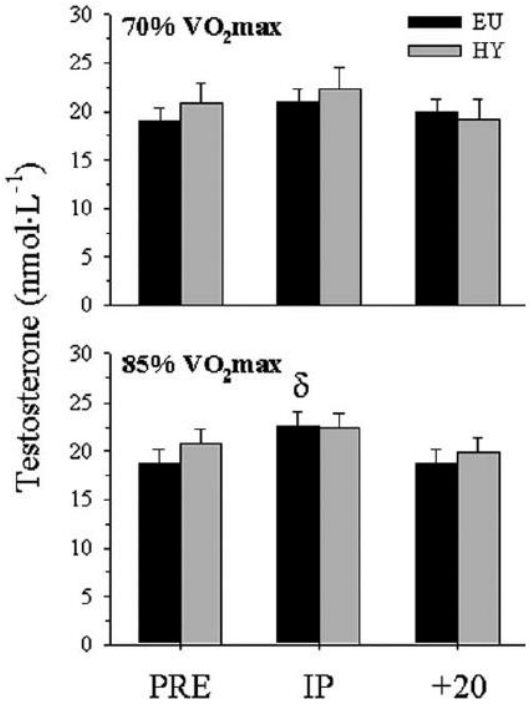


Fig. 1 T response to 10 min of running at 70% $\dot{V}O_{2max}$ (top panel) and 85% $\dot{V}O_{2max}$ (bottom panel) in euhydrated (black bars) and hypohydrated (gray bars) athletes. Values are means ± SE. δ indicates significant difference compared to all other time points within hydration status. Abbrevations: EU – euhydrated, HY – hypohydrated, PRE – pre-exercise, IP – immediate post-exercise, + 20 – 20 min post-exercise.

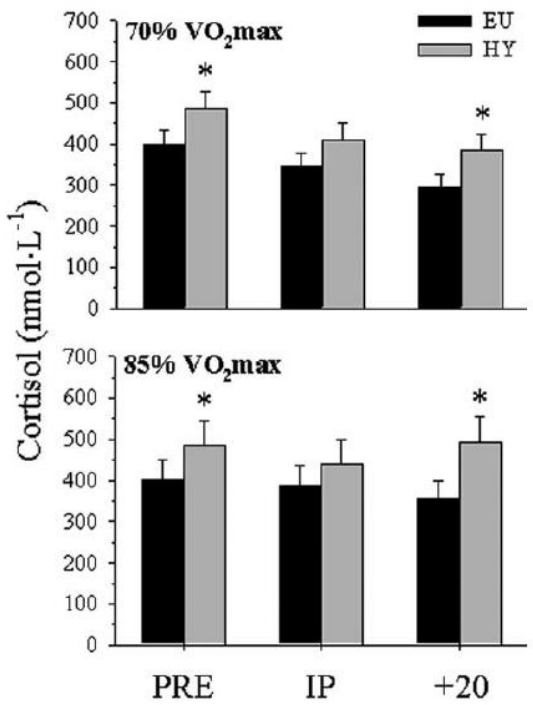


Fig. 2 C response to 10 min of running at 70% $\dot{V}O_{2max}$ (top panel) and 85% $\dot{V}O_{2max}$ (bottom panel) in euhydrated (black bars) and hypohydrated (gray bars) athletes. Values are means ± SE. * indicates significant difference between hydration status. Abbrevations: EU – euhydrated, HY – hypohydrated, PRE – pre-exercise, IP – immediate post-exercise, + 20 – 20 min post-exercise.

Int J Sports Med. 2006 Oct;27(10):765-70. doi: 10.1055/s-2005-872932.

Effect of Hydration State on Testosterone and Cortisol Responses to Training-Intensity Exercise in Collegiate Runners

C M Maresh, M J Whittlesey, L E Armstrong, L M Yamamoto, D A Judelson, K E Fish, D J Casa, S A Kavouras, V D Castracane

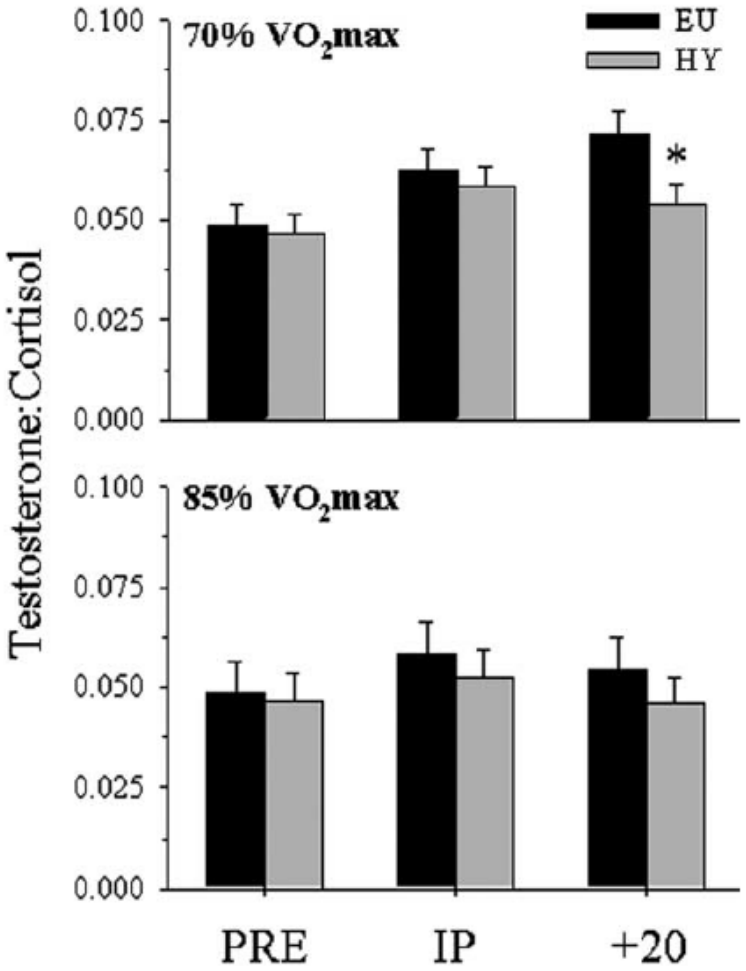
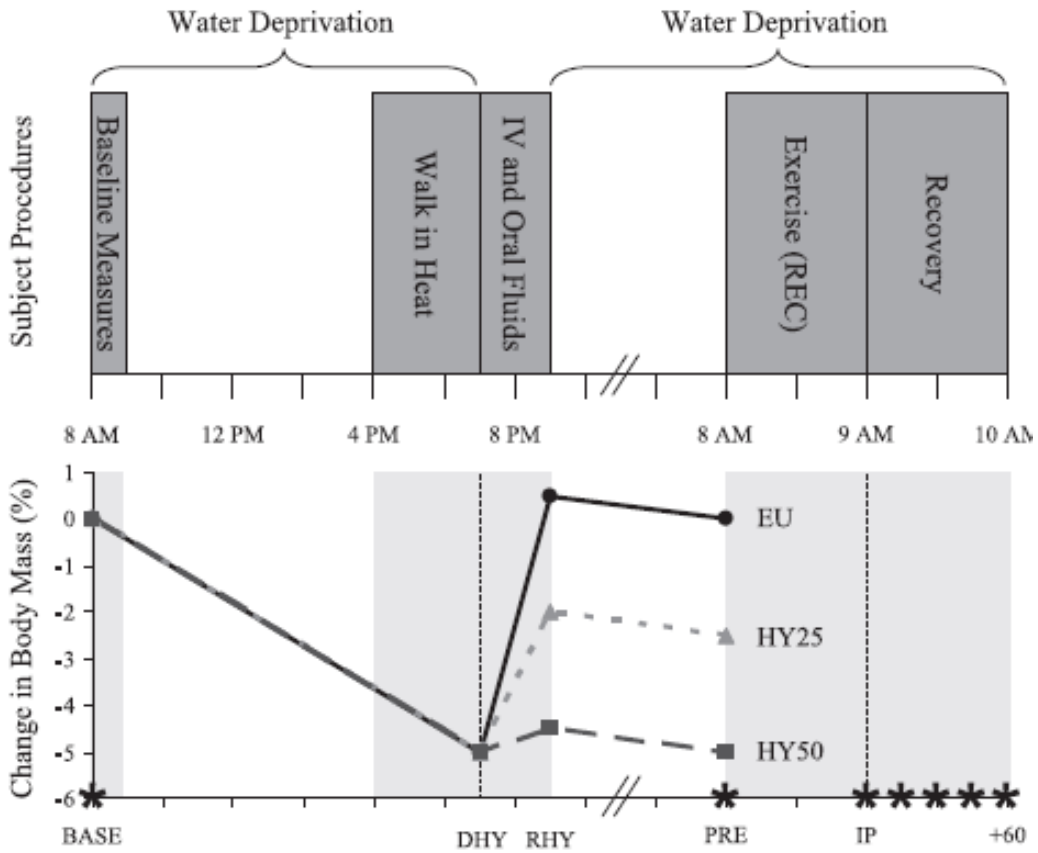


Fig. 3 T:C response to 10 min of running at 70% $\dot{V}O_{2max}$ (top panel) and 85% $\dot{V}O_{2max}$ (bottom panel) in euhydrated (black bars) and hypohydrated (gray bars) athletes. Values are means ± SE. * indicates significant difference between hydration status. Abbrevations: EU – euhydrated, HY – hypohydrated, PRE – pre-exercise, IP – immediate post-exercise, + 20 – 20 minutes post-exercise.

J Appl Physiol (1985). 2008 Sep;105(3):816-24. doi: 10.1152/japplphysiol.01010.2007. Epub 2008 Jul 10.

Effect of Hydration State on Resistance Exercise-Induced Endocrine Markers of Anabolism, Catabolism, and Metabolism

Daniel A Judelson, Carl M Maresh, Linda M Yamamoto, Mark J Farrell, Lawrence E Armstrong, William J Kraemer, Jeff S Volek, Barry A Spiering, Douglas J Casa, Jeffrey M Anderson



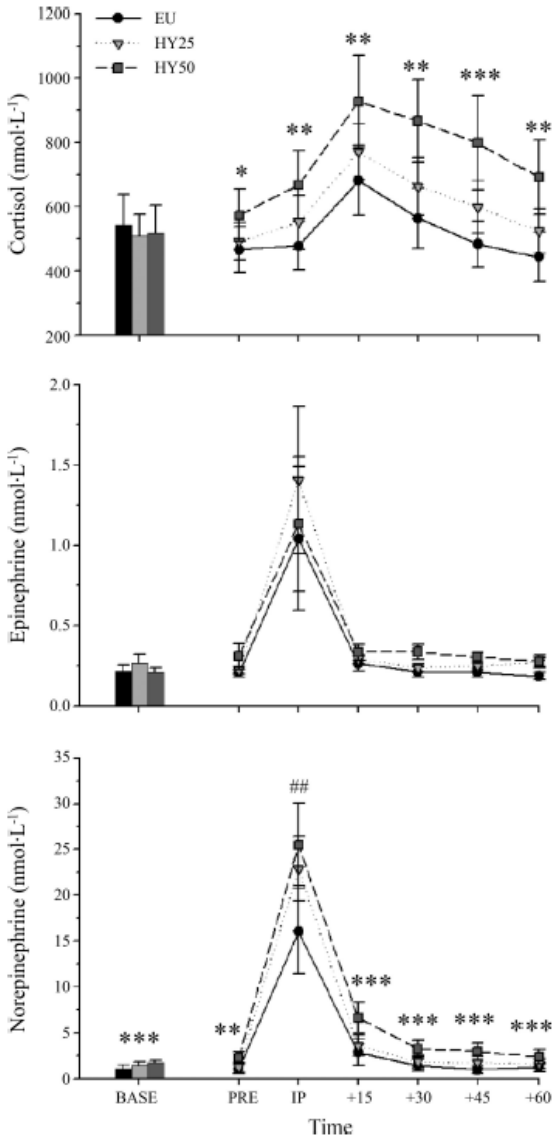


Fig. 2. Cortisol (*top*), epinephrine (*middle*), and norepinephrine (*bottom*) responses (means ± SE) to hypohydration and resistance exercise. Significant difference between *HY50 and EU; **HY50 and both EU and HY25; ##EU and both hypohydrated trials; and ***all trials at a given time: $P < 0.05$.

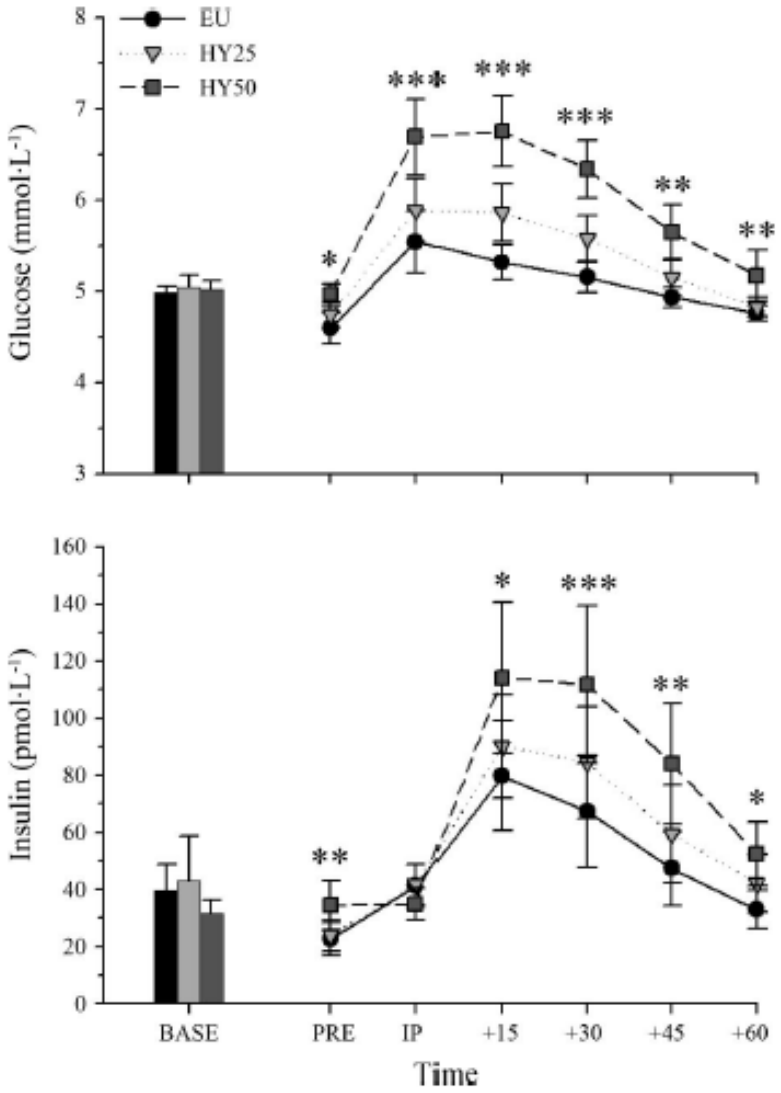


Fig. 3. Glucose (*top*) and insulin (*bottom*) responses (means ± SE) to hypohydration and resistance exercise. Significant difference between *HY50 and EU; **HY50 and both EU and HY25; and ***all trials at a given time: $P < 0.05$.

6 sets back squat, 10 rep max, 80% 1 RM

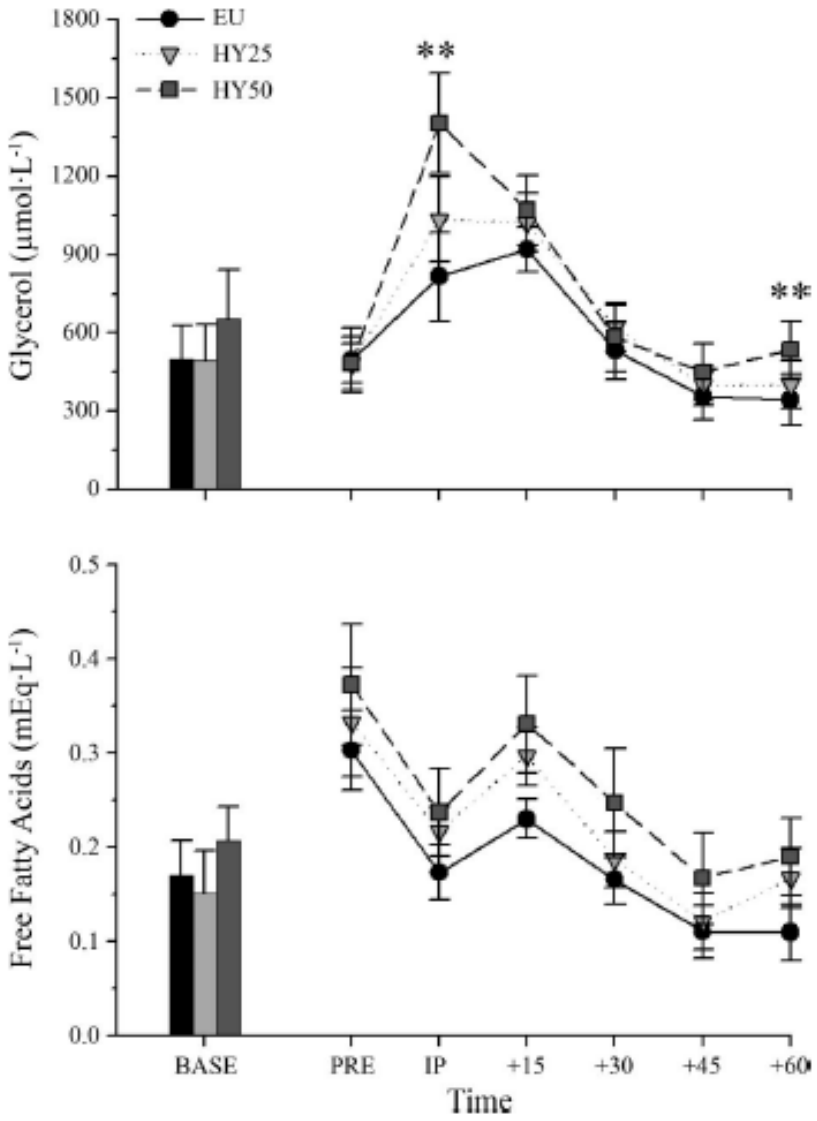


Fig. 4. Glycerol (*top*) and free fatty acid (*bottom*) responses (means ± SE) to hypohydration and resistance exercise. **Significant difference between HY50 and both EU and HY25, $P < 0.05$.

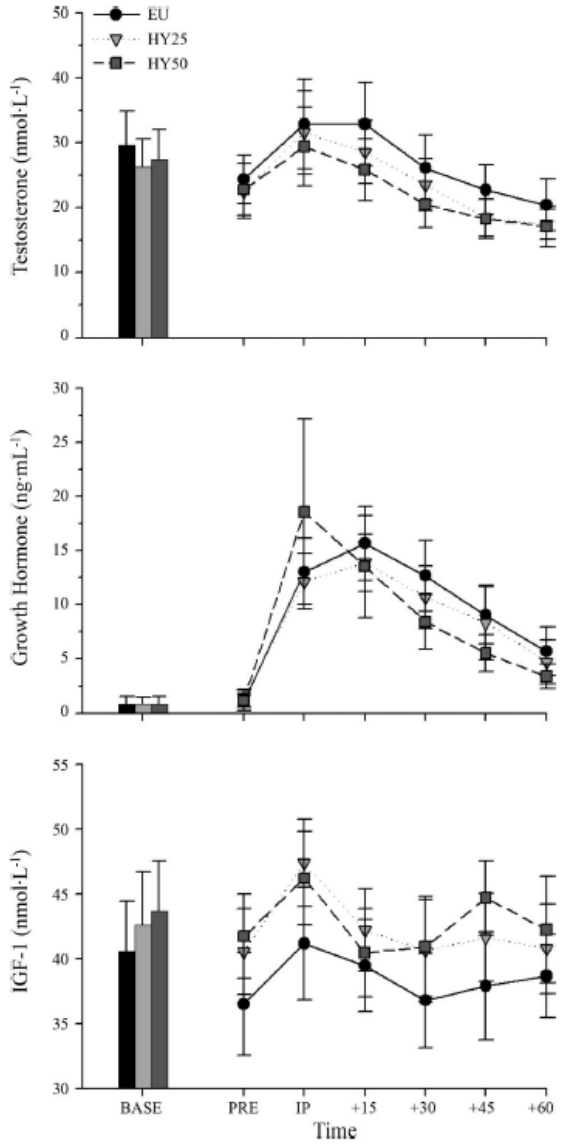
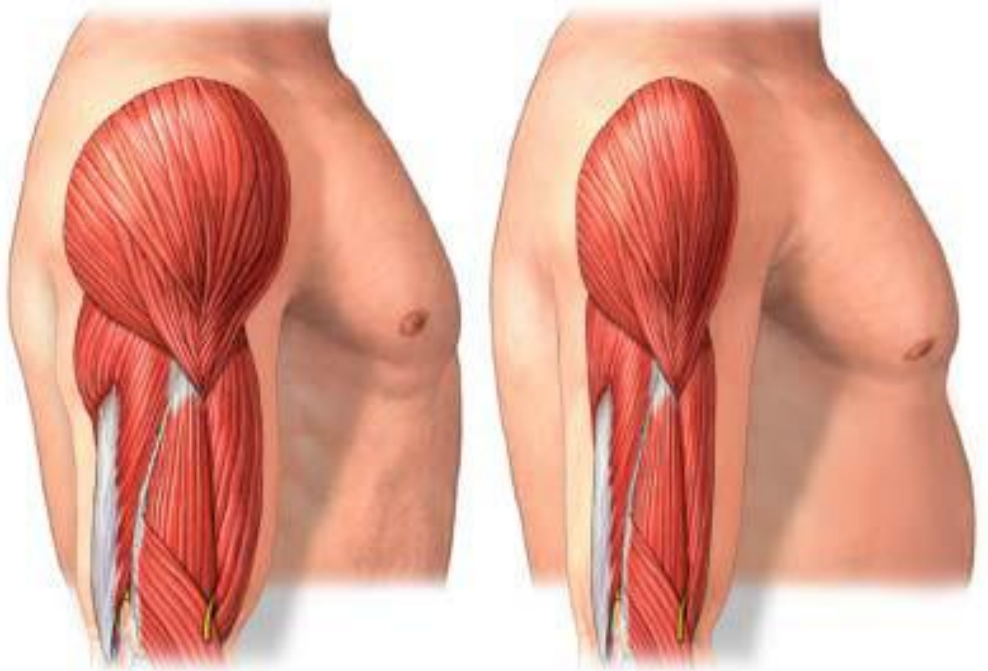


Fig. 5. Testosterone (*top*), growth hormone (*middle*), and insulin-like growth factor-I (IGF-I; *bottom*) responses (means ± SE) to hypohydration and resistance exercise. For testosterone, $n = 6$. No significant differences existed between trials at any point.

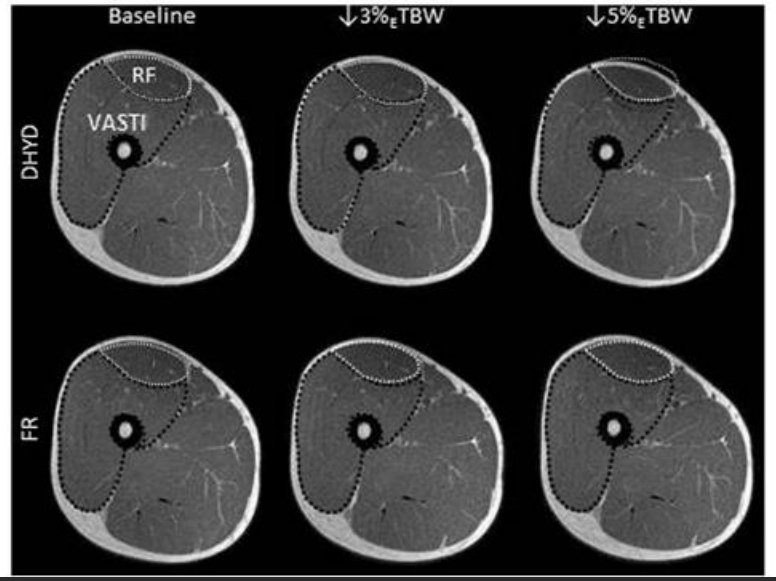
Volume Muscolare



J Appl Physiol (1985). 2008 Sep;105(3):816-24. doi: 10.1152/japplphysiol.01010.2007. Epub 2008 Jul 10.

Effect of Hydration State on Resistance Exercise-Induced Endocrine Markers of Anabolism, Catabolism, and Metabolism

Daniel A Judelson, Carl M Maresh, Linda M Yamamoto, Mark J Farrell, Lawrence E Armstrong, William J Kraemer, Jeff S Volek, Barry A Spiering, Douglas J Casa, Jeffrey M Anderson



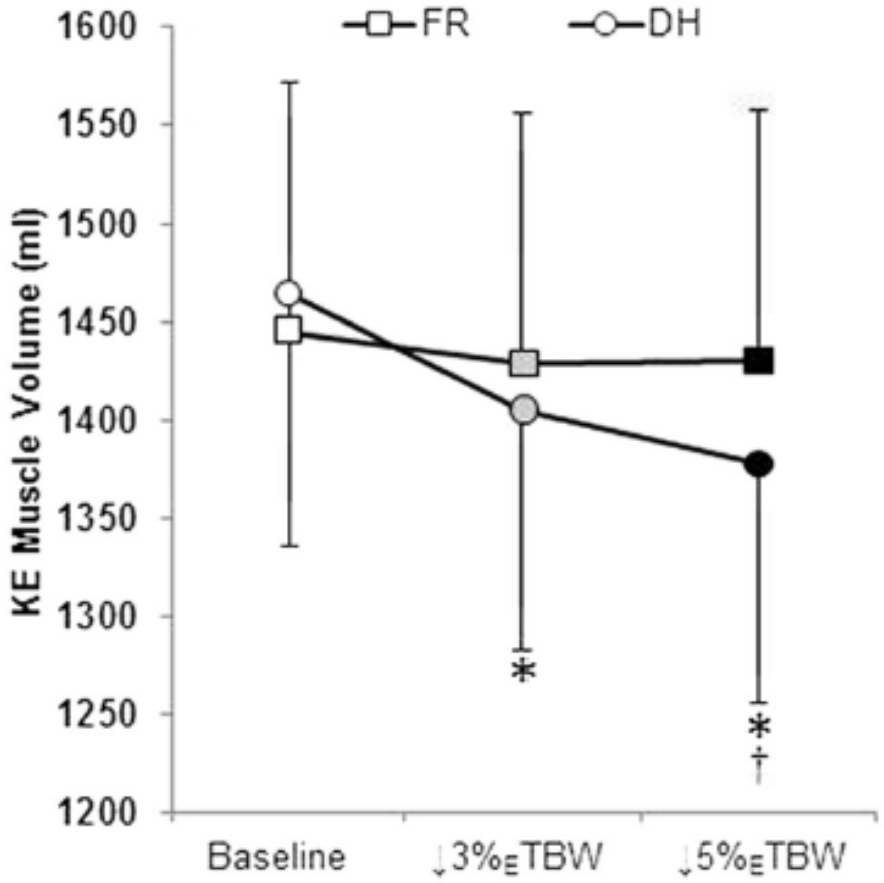


Figure 1 Knee extensor muscle volume (in milliliters) in DHYD and FR. *Significantly different from the baseline ($p < 0.05$); †significantly different from FR ($p < 0.05$). FR, *squares*; DHYD, *circles*; baseline, *white fill*; ↓3% ETBW, *gray fill*; ↓5% ETBW, *black fill*.

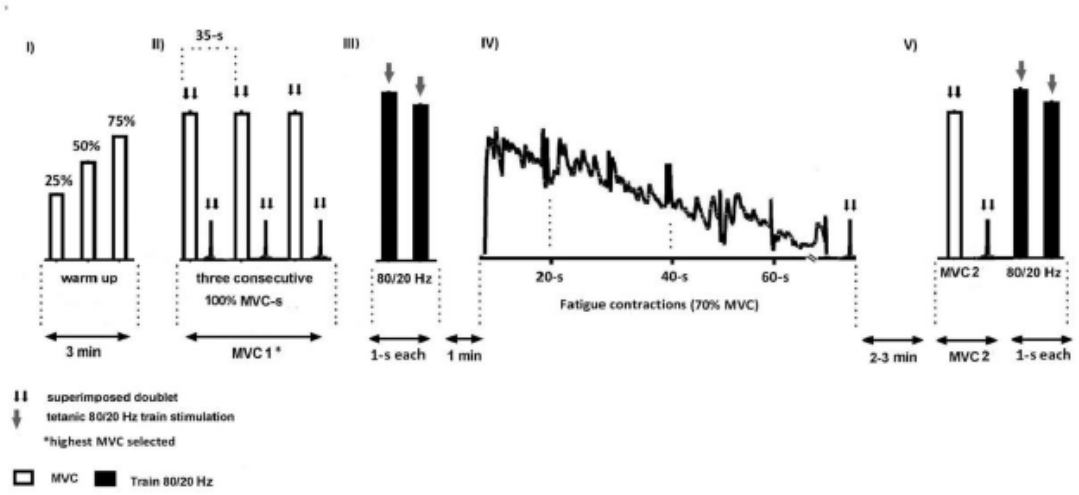
3 e 5% BML, allenamento al cicloergometro 38 °C, 32% RH, 13 km/h wind, MRI

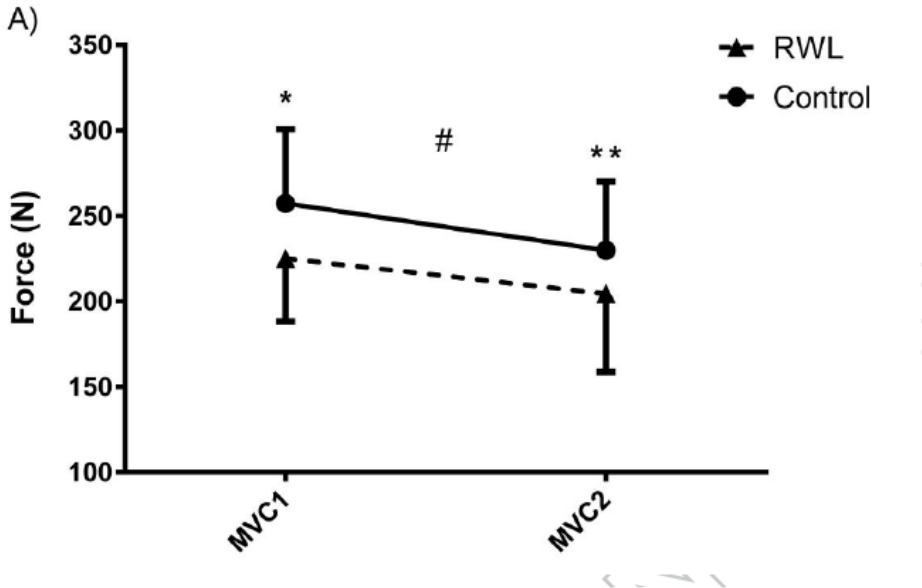
Effetti del Weight-Cutting

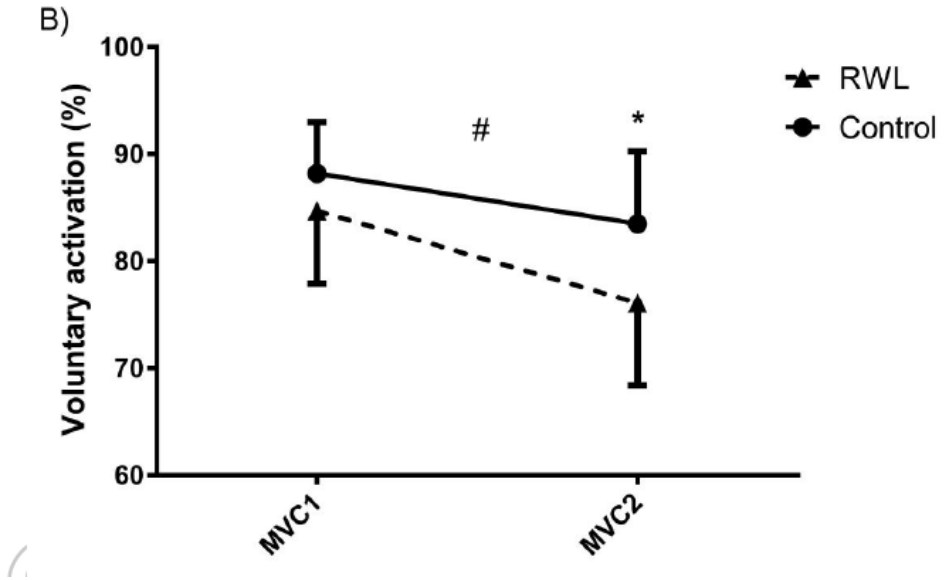
Eur J Sport Sci. 2019 Dec 2;1-10. doi: 10.1080/17461391.2019.1695954.
Online ahead of print.

Neuromuscular Performance After Rapid Weight Loss in Olympic-style Boxers

Damir Zubac, Boštjan Šimunič, Alex Buoite Stella, Shawnda A Morrison







Randomized Controlled Trial J Strength Cond Res. 2018 Sep;32(9):2555-2561.

Repeat Effort Performance Is Reduced 24 Hours After Acute Dehydration in Mixed Martial Arts Athletes

Oliver R Barley, Fiona Iredale, Dale W Chapman, Amanda Hopper, Chris R Abbiss

Table 2. Mean, *SD*s, 90% confidence intervals, and Hedges' *g* effect size of performance data from repeat sled push test (mean effort, peak effort, fatigue index, total test time, and runs completed), vertical jump test, handgrip test, and medicine ball chest throw.*†

Performance test	Exercise condition	Results of DHY and CONT		Difference between DHY and CONT	
		3 h after	24 h after	3 h after	24 h after
Mean effort (s)	DHY	6.68 ± 1.48	5.94 ± 1.42	(0.88 to 2.02), $p = 0.001$, 1.229	(0.42 to 1.18), $p = 0.012$, 0.671
	CONT	5.23 ± 0.66	5.15 ± 0.77		
Peak effort (s)	DHY	4.22 ± 0.58	4.18 ± 0.73	(0.06 to 0.36), $p = 0.1$, 0.362	(0.13 to 0.44), $p = 0.042$, 0.434
	CONT	4 ± 0.6	3.9 ± 0.5		
Fatigue index (s)	DHY	3 ± 2.21	1.4 ± 1.06	(0.8 to 3.01), $p = 0.075$, 1.112	(0.09 to 1.03), $p = 0.426$, 0.681
	CONT	1.1 ± 0.79	0.84 ± 0.39		
Total test time (s)	DHY	811 ± 62	788 ± 52‡	(27 to 77), $p = 0.028$, 1.068	(12 to 42), $p = 0.046$, 0.640
	CONT	759 ± 25	760 ± 30		
Runs completed	DHY	27 ± 6	29 ± 3	(−4.57 to −0.57), $p = 0.188$, 0.550	(−0.19 to 0.05), $p = 0.336$, 0.028
	CONT	29 ± 3	29 + 3		
Vertical jump (cm)	DHY	48 ± 8	48 ± 9	(−2.46 to −0.36), $p =$ NA, 0.171	(−2.46 to 0.46), $p =$ NA, 0.115
	CONT	49 ± 8	49 ± 7		
Handgrip (kg)	DHY	51 ± 8	54 ± 9	(−4.05 to −0.66), $p = 0.044$, 0.243	(−2.03 to −0.12), $p = 0.102$, 0.105
	CONT	53 ± 8	56 ± 10		
Medicine ball chest throw (cm)	DHY	454 ± 46	449 ± 44	(−0.23 to −0.01), $p = 0.276$, 0.245	(−0.36 to −0.13), $p = 0.016$, 0.253
	CONT	466 ± 49	474 ± 52		

*NA = not applicable because no main effects were observed.
†Differences are displayed as 90% CI (LL, UL), *p* value, and Hedges' *g* effect size.
‡$p \leq 0.05$ when 24 hours compared with 3 hours after DHY/CONT during the same condition.

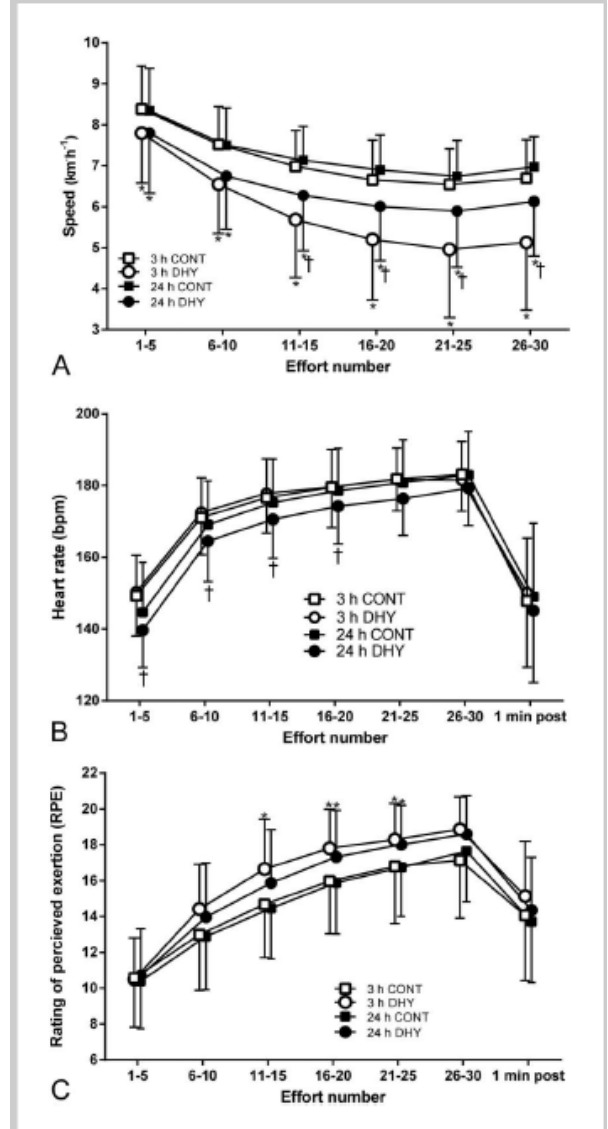


Figure 1. Sled push speed (A), heart rate (B), and RPE (C) (mean ± *SD*) of the repeat sled push test 3 hours and 24 hours after DHY/CONT for both control and intervention conditions. *$p \leq 0.05$ compared with the control condition at the same time, †$p \leq 0.05$ when 24 hours compared with 3 hours after DHY/CONT during the same condition.

Int J Sports Physiol Perform. 2018 Nov 18;1-7. doi: 10.1123/ijspp.2018-0089.
Online ahead of print.

Effects of Rapid Weight Loss on Balance and Reaction Time in Elite Judo Athletes

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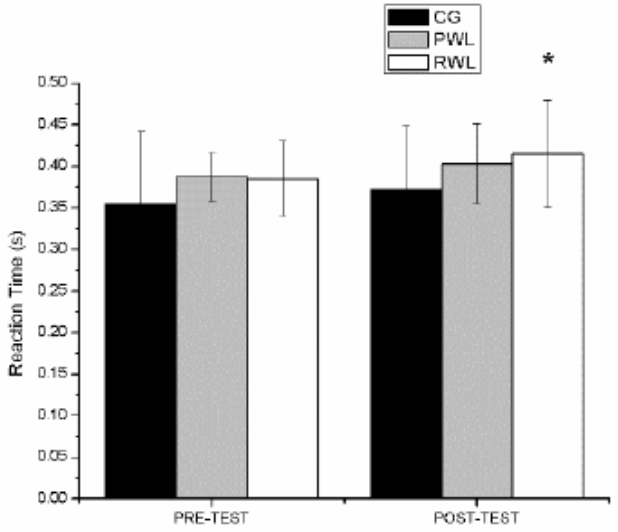
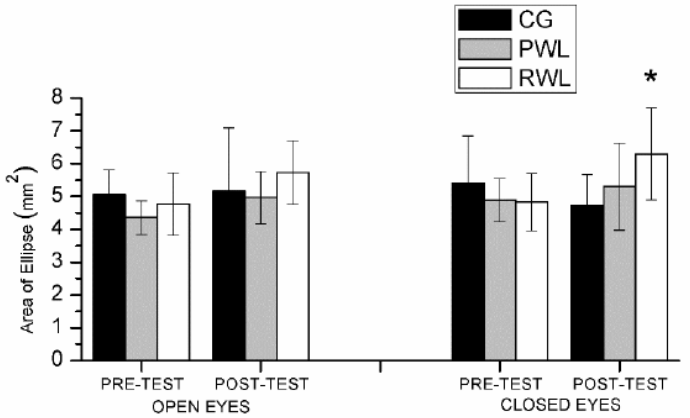
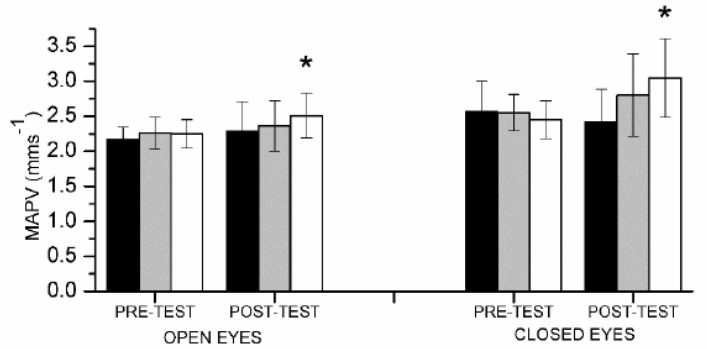
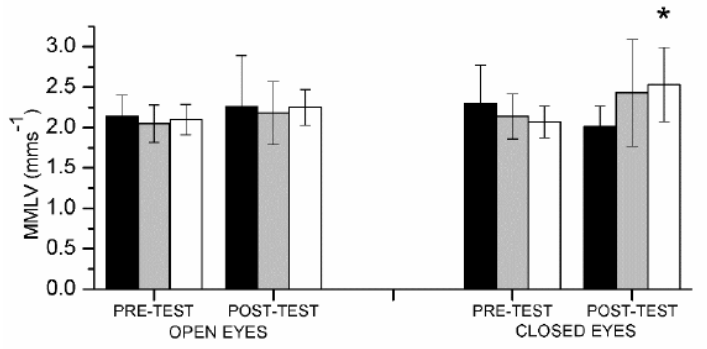




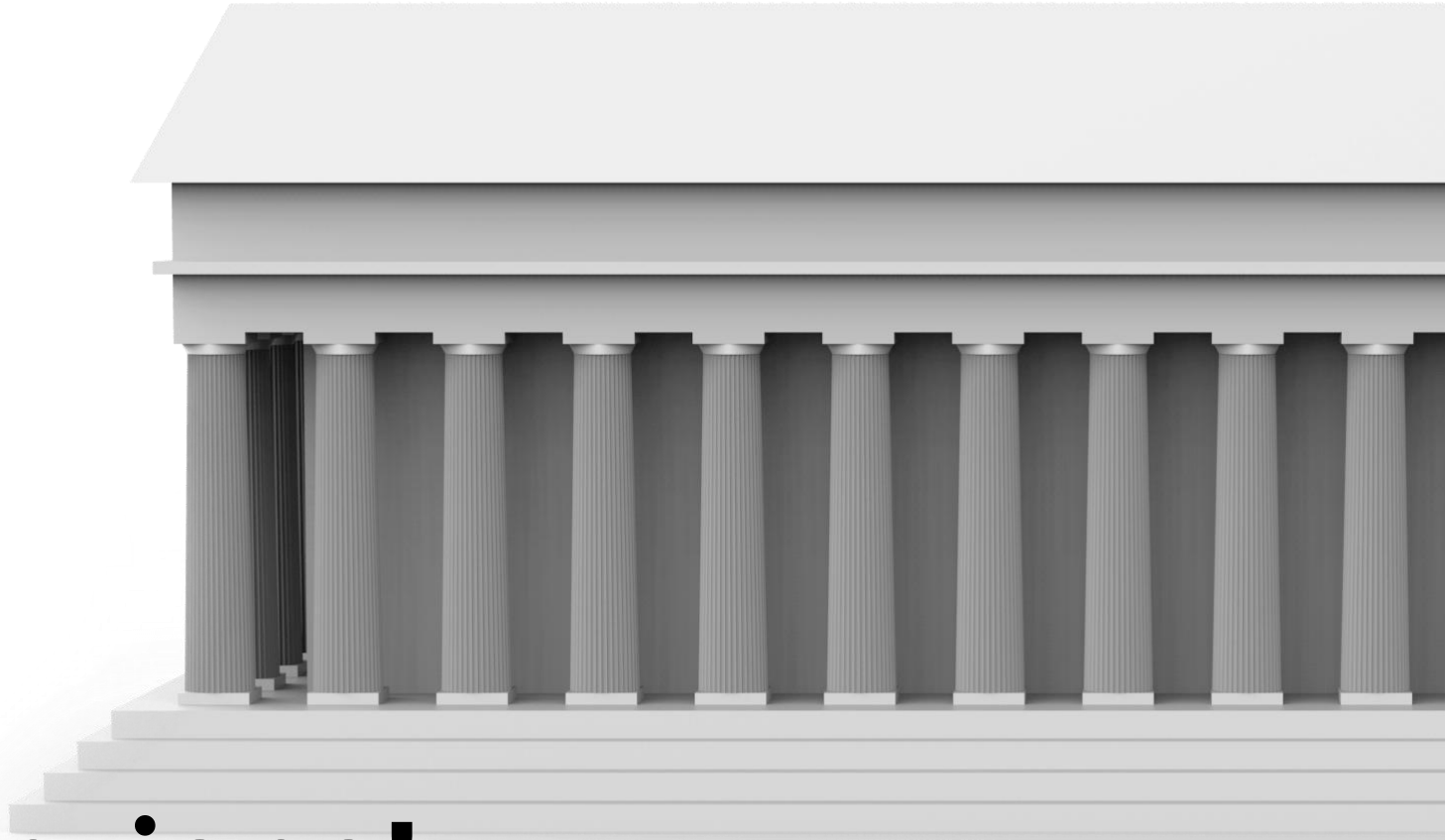




3% BML, PWL: Progressive Weight Loss < 3% BML, RWL: Rapid Weight Loss > 3% BML

Jet Lag e Viaggi di Lunga Durata

Fine del Viaggio



Grazie per l’attenzione!