Inland Norway University of Applied Sciences

Heavy strength training increases cycling performance in well-trained cyclists

Prof. Bent Rønnestad

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Effects of heavy strength training on cycling performance variables

Vikmoen et al. 2016, Vikmoen et al. 2017, Rønnestad et al. 2011, Rønnestad et al. 2015, Aagaard et al. 2011, Sunde et al. 2010, Rønnestad et al. 2010, Koninckx et al. 2010, Psilander et al. 2015, Bishop et al. 1999, Beattie et al. 2017, Gil-Cabrera et al. 2021, Montalvo-Perez et al. 2021.
reviews: Aagaard P, Andersen 2010, SJMSS, 20, 39-47; Beattie et al. 2014, Sports Med, 44:845-65; Mujika et al. 2016, IJSPP, 11:283-9; Rønnestad & Mujika 2014, SJMSS, 24:603-12; Yamamoto et al. 2010, JSCR, 24:560-6, Vikmoen & Rønnestad 2021

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Baseline characteristics

	Strength (n=13)	Control (n=11)	P
Males (n)	6	7	
Females (n)	7	4	
Age (yrs)	21.0 ± 4.8	20.3 ± 3,8	0.68
Body mass (kg)	67.9 ± 7.0	66.6 ± 7,2	0.77
Body height (cm)	176 ± 7.6	176 ± 7,4	0.94
VO_{2max} (mL·min^{-1})	4706 ± 788	4687 ± 771	0.95
VO_{2max} (mL·min^{-1}·kg^{-1})	70.2 ± 11.7	71.0 ± 12,7	0.87
W_{max} (W)	393 ± 70	385 ± 67	0.78
W_{max} (W·kg^{-1})	5.9 ± 1.1	5.8 ± 1,1	0.95

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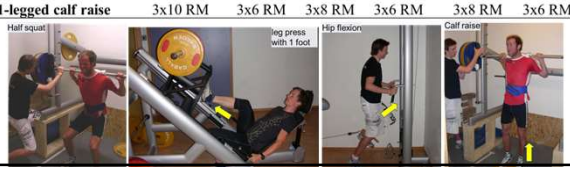
Heavy strength training protocol

	Week -2 - 2		Week 3 - 6		Week 7 - 10	
	1. session	2. session	1. session	2. session	1. session	2. session
Squat	3x10 RM	3x6 RM	3x8 RM	3x5 RM	3x6 RM	3x4 RM
1-legged leg-press	3x10 RM	3x6 RM	3x8 RM	3x5 RM	3x6 RM	3x4 RM
1-legged hip-flexion	3x10 RM	3x6 RM	3x8 RM	3x6 RM	3x8 RM	3x6 RM
1-legged calf raise	3x10 RM	3x6 RM	3x8 RM	3x6 RM	3x8 RM	3x6 RM



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1-legged calf raise	3x10 RM	3x6 RM	3x8 RM	3x6 RM	3x8 RM	3x6 RM

Training load development

Squat	71 ± 18	79 ± 20	93 ± 21	90 ± 20	105 ± 20	106 ± 20
1-legged leg-press	84 ± 18	90 ± 17	105 ± 20	114 ± 20	133 ± 21	116 ± 31
1-legged hip-flexion	17 ± 4	18 ± 5	20 ± 6	21 ± 6	27 ± 8	31 ± 9
1-legged calf raise	95 ± 28	103 ± 26	114 ± 31	117 ± 25	118 ± 22	121 ± 22

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	Strength	Control	p
Zone 1 (tt:mm)	05:39 ± 04:08	06:10 ± 01:58	0.73
Zone 2 (tt:mm)	03:18 ± 01:57	04:11 ± 02:29	0.38
Zone 3 (tt:mm)	01:12 ± 00:26	01:22 ± 00:50	0.60
Zone 4 (tt:mm)	00:54 ± 00:17	00:48 ± 00:19	0.50
Zone 5 (tt:mm)	00:19 ± 00:11	00:19 ± 00:10	0.50
Heavy strength training (tt:mm)*	01:39 ± 00:11	00:00 ± 00:00	< 0.01
Core training (tt:mm)	00:28 ± 00:31	00:28 ± 00:35	0.99
Total traning duration (tt:mm)	13:10 ± 03:41	13:16 ± 03:35	0.95

Similar weekly training volume

Zone 1: < 55% of FTP / < 68 % of HR@FTP
Zone 2: 56-75% of FTP / 69-83% of HR@FTP
Zone 3: 76-90% of FTP / 84-94% of HR@FTP
Zone 4: 91-105% of FTP / 95-105% of HR@FTP
Zone 5: > 106% of FTP / > 106% of HR@FTP

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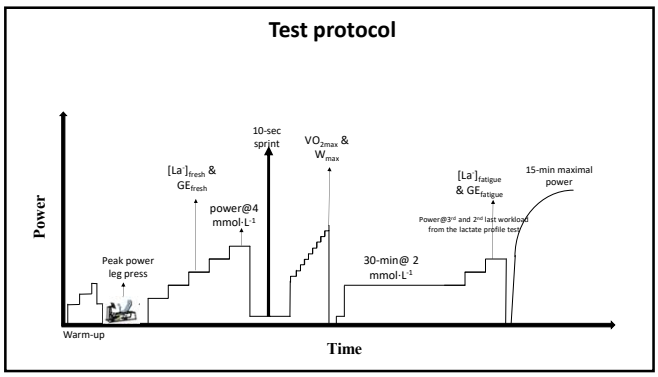

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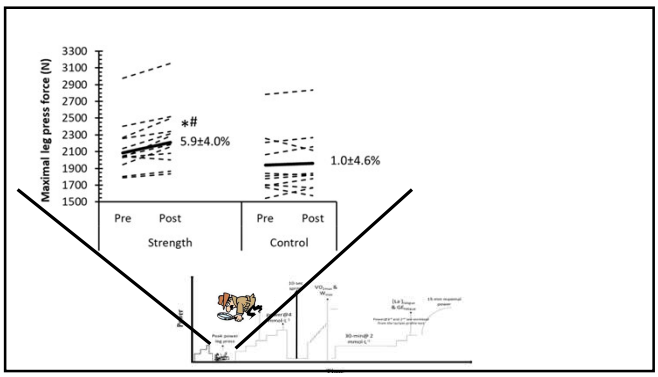

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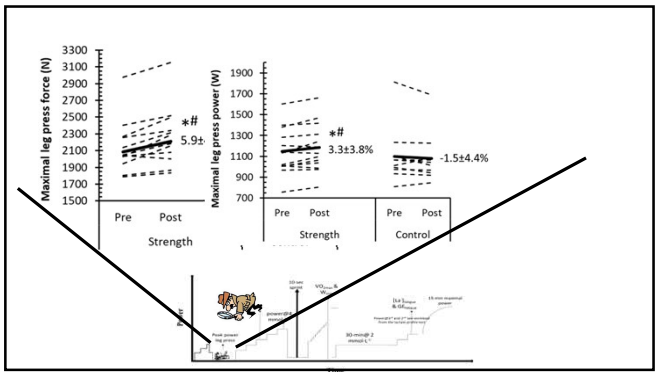

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Gross efficiency in the fresh state

	Pre	Post
Strength	19.61±1.29	19.86±1.04
Control	19.80±0.82	19.51±0.99

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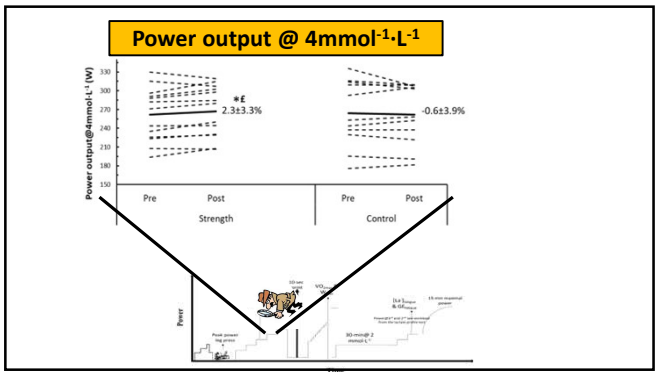

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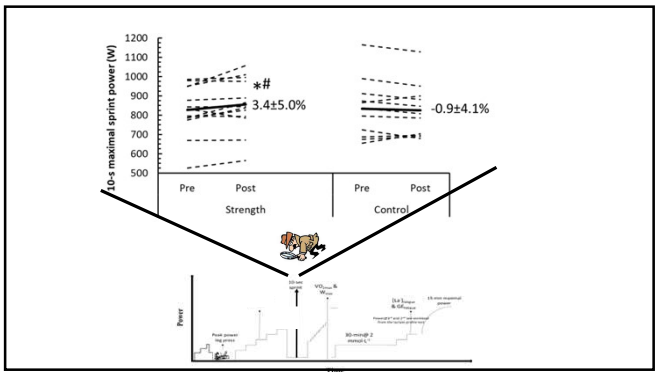

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	Strength		Control		
	Pre	Post	Pre	Post	p
Body mass (kg)	67.4 ± 7.2	67.9 ± 7.6	66.6 ± 7.2	66.8 ± 7.2	0.77
VO_{2max} (mL·min^{-1}·kg^{-1})	70.2 ± 11.7	71.3 ± 13.3	71.0 ± 12.8	71.5 ± 14.4	0.58
VO_{2max} (mL·min^{-1})	4706 ± 788	4800 ± 871	4687 ± 771	4743 ± 897	0.66

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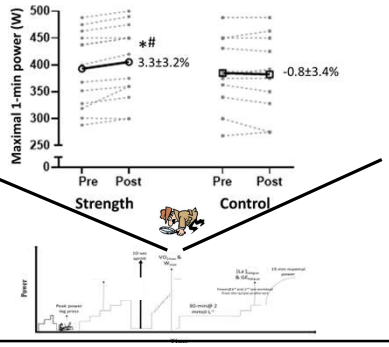

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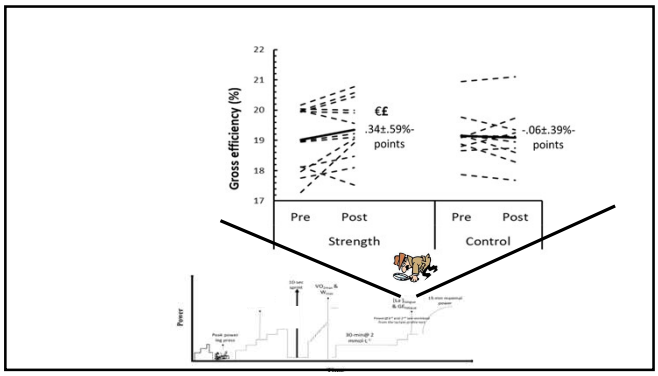

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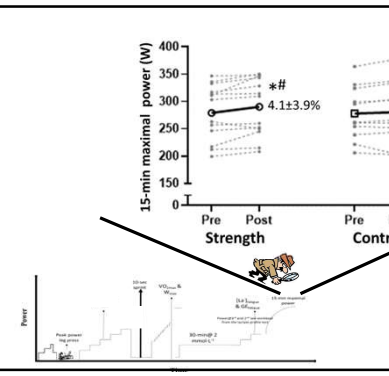

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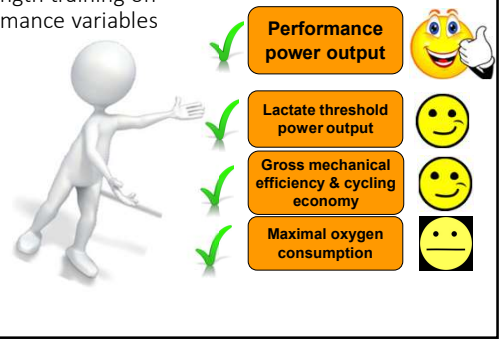
Effects of strength training on cycling performance variables



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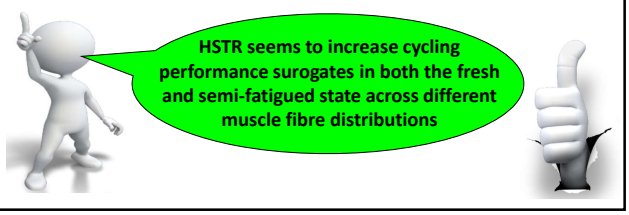

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Thanks for the attention!

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