



Relation between maximal power output during isokinetic workout on a cycling ergometer and maximal strength

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Introduction



Strength & Endurance

- traditional strength training definitions based on sport
- definitions of “strength endurance” vary from sport to sport as well as from discipline to discipline
- traditional forms of strength endurance training hardly verified
- modern definitions on strength endurance not commonly known
- traditional forms of specific strength training preferred

Introduction



strength endurance characterization

- wide range of intensity and duration
- wide range of physiological training goals
- apart from dimensional analysis based structure hardly empirical knowledge exists

	Scientific knowledge based strength endurance definitions: (Schmidtbleicher 2003)	Therapeutic /Fitness related strength endurance training (Seidenspinner 2005)	Strength endurance in Cycling / Triathlon (Lindner, 2005; Neumann et al., 2005)
Sets / Repetition	3 – 5 / 20 – 30 reps	2 – 4 / 15 – 20 reps	1 – 3 / 50 – 60 rpm for 10 – 50 min
Energy / max. Duration	anaerobic / within 2 min	aerobic / 30 reps	aerobic / 50 minutes
Intensity	moderate intensity	moderate/ low intensity	low intensity

Introduction



strength training within cycling

- Seldom weight based strength training in off-season
- Specific strength training on a bike
- „Aerobic strength training“
- Long term sets in between 10 – 50 minutes on a bike with low cadence 50 – 60 rpm



Method

purpose of this study:

- explorative study
 - to examine the relationship between power output and maximal strength
 - to get further information about strength and power relationship

primary objective:

- Preparing further research concerning
 - effects of weight based strength training in endurance sports
 - adaptations through strength training in endurance sports
 - effects of specific strength endurance training method

Method

cross section study to determine power output and maximal strength

sample: Hessen Cycling Federation junior cyclists
(n=8; 16,4 years old; weight: 63,2kg)

–isokinetic measurement:

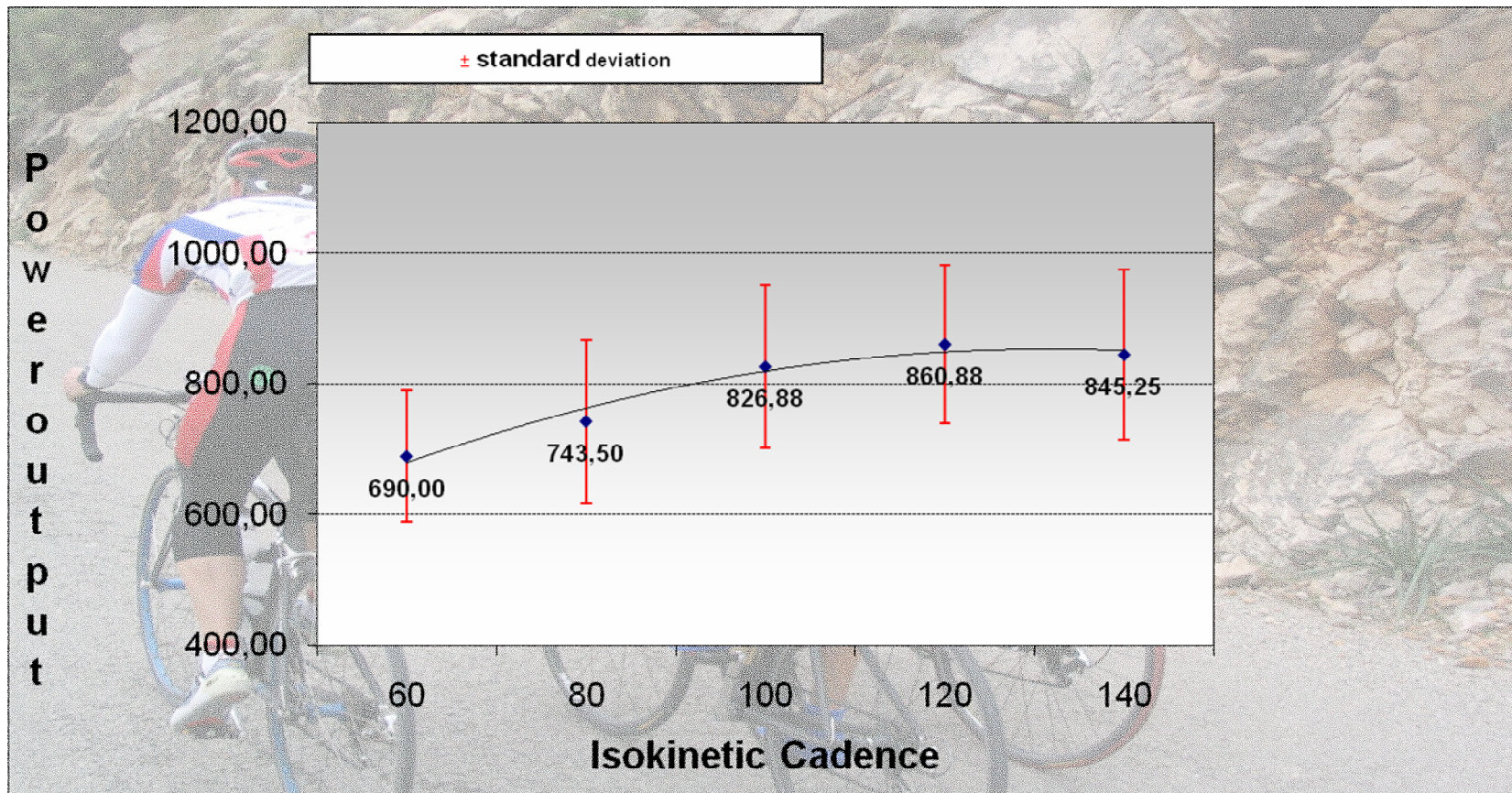
- SRM Ergometer
- 60 – 80 – 100 – 120 – 140 RPM
- Maximum power /10s.
- Mean PO

–isometric maximal strength (BAG)

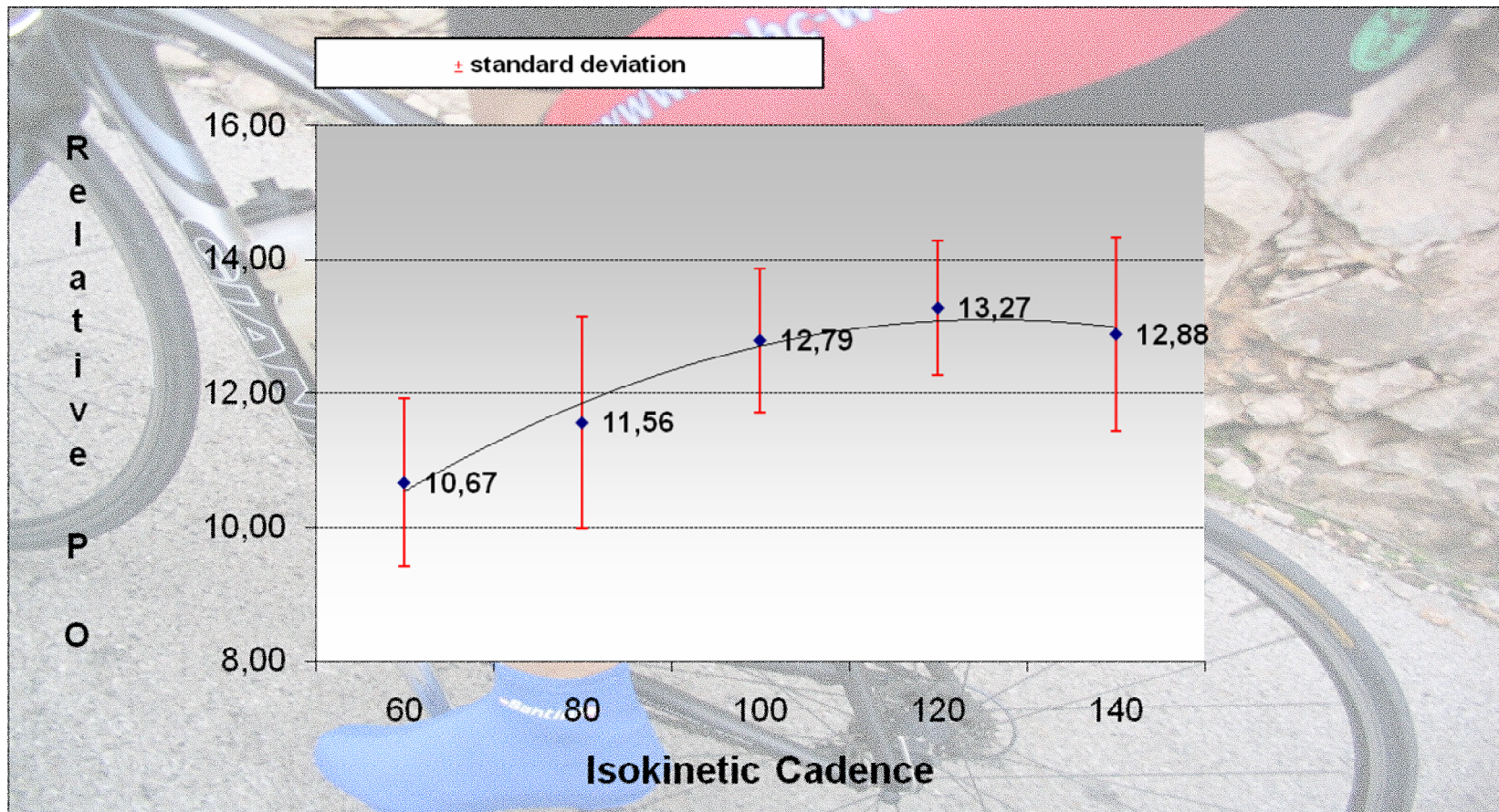
- 110°



Results



Results



Results



	60 rpm	80 rpm	100 rpm	120 rpm	140 rpm
mean max. p o (Watts)	690,0	743,5	826,9	860,9	845,3
relative p o (Watt/kg)	10,7	11,6	12,8	13,3	12,9
correlation	0,35	0,65*	0,83**	0,78*	0,35

* P < 0.05; ** p < 0.01

Discussion

- no correlation between max power output at 60 and 140 rpm
- strong correlation between max power output at 80, 100 and 120 rpm
- contraction speed seems to be important
- “specific strength trainings” movement speed to slow to improve cycling performance?
- race specific movement needs effort in specific contraction force?
- specific strength training on a bike has to be questioned
- improvements in maximum strength could enhance performance in short term efforts (sprint/ attack on mountain)

Conclusion



- adaptations are highly specific in strength training as well as in endurance training
- fast movement requires fast ankle speed in strength training as well as in endurance training

further proposals:

- evaluation of specific strength training and the recommendations from practice
- studies are necessary to proof adaptation, effects and impacts of specific strength training
- indications of superior effects of maximum strength training in endurance sports have to be proofed
- evaluation and studies concerning strength endurance are required

Thank you very much for your attention!

Vielen Dank für Ihre
Aufmerksamkeit!

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Literatur beim Verfasser