Prime physiological determinants associated with peak power and endurance cycling performance

Published: 16-06-2014 Last updated: 21-04-2024

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Ethical review	Approved WMO
Status	Recruitment stopped
Health condition type	Other condition
Study type	Observational invasive

Summary

ID

NL-OMON42016

Source ToetsingOnline

Brief title Physiology of cycling performance

Condition

• Other condition

Synonym

Health condition

geen aandoeningen

Research involving

Human

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Sponsors and support

Primary sponsor: Vrije Universiteit **Source(s) of monetary or material Support:** STW (NWO),Artenis Medical Systems,b-Cat High Altitude,Koninklijke Nederlandse Wielren Unie (KNWU),NOC*NSF,Tulipmed

Intervention

Keyword: Cycling, Endurance, Peak power, Physiology

Outcome measures

Primary outcome

The primary outcome of this study is the peak power and endurance cycling performance of the cyclist (POpeak during Wingate and VO2-max). These two outcome measures will be related to muscle contractile characteristics (i.e. mitochondrial density, myoglobin concentration, capillary density, muscle fiber size and fiber type).

Secondary outcome

The secondary outcome parameter of this study is peak power and endurance of the cyclist (POpeak during a vertical jump and POmean during a 15,000m time trial). These two outcome measures will be related to muscle contractile characteristics (i.e. mitochondrial density, myoglobin concentration, capillary density, muscle fiber size and fiber type).

The next secondary outcome measure are the non-invasive measurements of muscle oxidative metabolism (i.e. TSI, O2Hb and HHb, as measured by Near Infrared Spectroscopy) and muscle architecture (muscle cross-sectional area as measured by ultra-sound). These outcome variables are compared to invasive measurements of oxidative metabolism (i.e. mitochondrial density, myoglobin concentration,

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capillary density) and muscle architecture (i.e. fiber size).

The last secondary outcome measure is the remaining parameters of peak power and endurance performance of the cyclist (POpeak, POmean, time-to-peak and fatigue index during Wingate, and POpeak, POmean and jump height during vertical jump, P-VO2-max, POmean and finish time 15,000m time trial). These outcome measures are related to mechanical gross efficiency, maximal voluntary knee extension torque and anthropometric, cardio-respiratory, hematological and endocrine parameters.

Study description

Background summary

A major and challenging objective in sports and clinical exercise training is to improve peak power and endurance capacity concurrently. This applies to many sports, such as cycling, rowing and speed skating. Since skeletal muscles are the actuators of movement, sports performance is largely determined by muscle peak power and maximal sustainable power. However, muscle fiber size, which is a major determinant of muscle peak power, and muscle fiber oxidative capacity, which is associated with endurance performance, are generally inversely related. In addition, the adaptations of these variables are mutually exclusive. We hypothesize that a high oxygen supply to the core of the muscle fiber (i.e. high capillary density, myoglobin concentration and/or hematocrit) are requisite for concurrent increases in muscle fiber size and oxidative capacity and that performance of elite athletes is related to differences in these variables. Knowledge of the status of key determinants of muscle peak power and endurance capacity and knowledge of how these variables can be measured non-invasively are requisite and important for talent identification and development of successful training strategies.

Study objective

The aims of the proposed study are (1) to obtain insight in the relationship between muscle contractile characteristics (i.e. muscular oxidative capacity, muscle fiber size and fiber type) and peak power and endurance performance of trained sprint and endurance cyclists, (2) to assess the relationship between invasive and non-invasive measurements of muscular oxidative capacity and muscle fiber size and (3) to determine the relationships between cycling performance and mechanical gross efficiency, maximal knee extension torque and anthropometrical, cardio-respiratory, hematological and endocrine parameters.

Study design

An observational cross-sectional study in trained cyclists (of different cycling disciplines) will be performed to assess muscle physiological parameters (muscular oxidative capacity, muscle fiber size and fiber type) associated with peak power and endurance performance by invasive as well as non-invasive measurements. Multiple regression analyses will be performed to determine the contribution of prime physiological parameters to peak power and endurance performance.

Study burden and risks

Trained cyclists will be subjected to physical (exercise) tests, harvesting a muscle biopsy (1 sample) and blood sampling (2 x 8 ml). The burden of harvesting muscle biopsies and blood sampling is low, as these procedures are quickly performed with little discomfort afterwards. The risks of the physical (exercise) measurements are negligible. Burden for the participants is mainly related to their time investment, since participants are required to visit the laboratory on four occasions for a total amount of approximately 8 hours. This outcome of the research project is expected to provide insight in the critical physiological determinants of peak power and/or endurance cycling performance and to assess to what extent these determinants can be measured noninvasively.

Contacts

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Trial sites

Listed location countries

Netherlands

Eligibility criteria

Age Adults (18-64 years) Elderly (65 years and older)

Inclusion criteria

Male, age 18-45 year Trained track or road cyclists (VO2-max > 55ml/kg/min) Low risk / healthy: based on the outcome of the anamnesis form

Exclusion criteria

Allergic to local anesthetic Female Age < 18 or > 45 year VO2-max < 55 ml/kg/min Risk: based on the outcome of the anamnesis form

Study design

Design

Study type: Observational invasiveMasking:Open (masking not used)Control:UncontrolledPrimary purpose:Other

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Recruitment

NL	
Recruitment status:	Recruitment stopped
Start date (anticipated):	28-10-2014
Enrollment:	30
Туре:	Actual

Ethics review

Approved WMO Date:	16-06-2014
Application type:	First submission
Review commission:	METC Amsterdam UMC
Approved WMO Date:	15-01-2015
Application type:	Amendment
Review commission:	METC Amsterdam UMC

Study registrations

Followed up by the following (possibly more current) registration

No registrations found.

Other (possibly less up-to-date) registrations in this register

No registrations found.

In other registers

Register CCMO **ID** NL49060.029.14