Protocol: Systematic Review

# Review title

Are Cycling Power Meters Accurate: A qualitative review of the methodologies in power meter accuracy and precision studies.

# Review question

Power Meters are used in cycling for training, competition and research to objectively measure physical expenditure. Power meter companies claim high levels of accuracy with their devices, but without clearly defined testing protocols. Literature has attempted to validate the levels of claimed accuracies by conducting comparative studies between multiple power meters. However, due to the high number of influential variables in these studies, the results cannot be analogously compared. Therefore, the focus of this review is to summarise and review the methods used in existing powermeter research to aid the development of higher quality literature in this field.

# Searches

The search will not be constrained to a particular publication period. The same combination of relevant keywords will be used to identify literature on Scopus, Web of Science and SPORTDiscus. In addition, relevant literature sourced in reviewed papers will be included in the review process. The search procedure will begin on the 24th January 2020.

# 17. URL to search strategy

ALL FIELDS: (bike OR bicycl\* OR cycling OR cyclist OR cycle) AND TITLE: (power OR powermeter\* OR "power meter\*" OR "power measur\*") AND TITLE: (validity OR reliability or accuracy OR precision or agreement) NOT ALL FIELDS: (wind or electr\* or therm\*)

# Domain being studied

The study is focussed on highlighting the complexity of proving the validity, accuracy, precision or reliability of bicycling power meters. By highlighting the complexity, the number of variables that influence the measurement of power will be more clearly understood and can be effectively controlled in future research.

# Problem

The study will focus on the tools used to measure power during cycling. Currently data from different power measuring devices cannot be confidently compared as the accuracy of the devices is not definitively known.

The study will have practical implications for any person who may use a powermeter – sports physiologists, cyclists, coaches and cycle ergometer users. By reviewing the methodologies currently employed in research, future researchers can take steps to ensure the data gathered in their study is robust and reliable. The review will the summarise the methods from existing literature, highlighting areas for further research and allowing power meter users to make informed choices on which device will suit their application.

# Intervention

The focus of the study is to critically review the methodologies of research reporting on the accuracy, validity or reliability of bicycling power measurement.

# Types of study to be included.

Studies will not be included/excluded based on their use (or not) of human participants. Additionally, studies will not be included/excluded based on the number of participants used.

### Inclusion

Only studies reporting on the accuracy, validity or reliability of bicycling power and torque measurement will be included for review. Studies will only be included if the methodology involves comparing a method of power measurement in cycling against a reference device - a gold standard, for example. Studies using differing terminology from *accuracy, validity or reliability* but with the same aim will be included.

### Exclusion

Magazine articles, expert opinions and book chapters will be excluded. Studies concerning physiological (critical power, functional threshold power, v02 max etc) and biomechanical variables will not be included.

# Main outcome

A summative review of the existing knowledge on measuring power output in cycling. This will lead to an improved understanding of the best practices for measurement of human power in cycling.

# Data extraction

The titles of potentially relevant literature will be screened independently by three reviewers. Disagreement between the three reviewers will be resolved through review of abstracts and discussion until a consensus is reached for all included literature.

# Risk of bias (quality) assessment.

Bias will be eliminated by publishing the systematic review protocol prior to commencement of the review process.

Data extraction will be done independently by three reviewers. Difference in screened literature will be reviewed and discussed until a consensus is reached between all three researchers.

# Strategy for data synthesis.

Due to the large number of variables present in existing studies, powermeter data cannot be quantitatively synthesized. Therefore, a narrative synthesis will be used to review the methodologies in existing studies.