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May 8, 2021

Dr. Farshid Guilak

Editor-in-Chief, Journal of Biomechanics

[em@editorialmanager.com](mailto:em@editorialmanager.com)

**RE: BM-D-21-00131**

Dear Dr. Guilak,

Thank you for the opportunity to revise our manuscript and the reviewer for their insightful comments. Attached, please find our revised manuscript titled: “The influence of bicycle lean on maximal power output during sprint cycling” that we hope you will find acceptable for publication in the *Journal of Biomechanics*.

In the following pages we have addressed all of the reviewer comments on a point-by-point basis and also indicated altered parts of the manuscript text as follows:

* italicized text refers to new text that has been included within the manuscript and,
* strikethrough text refers to old text that has now been omitted.

Thank you in advance for your time and effort in reviewing our response.

Sincerely,

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| Ross Wilkinson, Ph.D.  Post-doctoral Researcher  Integrative Physiology Dept.  University of Colorado Boulder  ross.wilkinson@colorado.edu | Rodger Kram, Ph.D. Associate Professor, Emeritus Integrative Physiology Dept. University of Colorado Boulder rodger.kram@colorado.edu |

Response to Reviewer

General

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| **Comment** | This manuscript submitted at Journal of Biomechanics focuses on the maximal output power during sprint cycling with or without lean. For this study, nineteen recreational cyclists performed 5-seconds sprints against variable resistance until they reach their maximal output power. The main result obtained in this study is that the maximum power is identical between the ad-lib condition and the locked condition.  The manuscript is clear and well written. |
| **Response** | We thank the reviewer for their concise summary and positive feedback. |
| **Comment** | This study is an incremental study (see Wilkinson et al. 2020. http://dx.doi.org/10.31236/osf.io/hj9gp). It is surprising to note that this manuscript quotes previous unpublished studies by the same author. The reviewer thinks that these data should first be peer-reviewed before being cited. Moreover, this first study on the same topic leads to very close results as the authors stated "[…] and peak instantaneous crank power in the Unconstrained condition were greater than Self-Restricted but similar to in the Trainer". Thus, what is different between these previous results and the new ones? Moreover, the authors have changed the names of the different conditions: ad-libitum (unconstrained), locked (trainer) and minimal lean (self-restricted). The reviewer believes that the authors should use the same name for the same condition. |
| **Response** | We thank the reviewer for taking the time to review and compare this study to the pre-print by Wilkinson et al. (2020). We apologize for not being more explicit that it remains a pre-print, however our understanding is that citing pre-print material is an acceptable practice when necessary. The pre-print is under review at another journal.  We have edited the in-text referencing to the pre-print as (Wilkinson et al., 2020 *PREPRINT*)  We contend that nearly all studies and the overall practice of science are incremental. After completing the more detailed biomechanical analysis of submaximal roller cycling (Wilkinson et al., 2020), it became clear that maximal sprint cycling was the next logical step. However, sprinting on rollers is not safe and it does not prevent lean. Thus, the present authors invented and built the device described in the present manuscript.  The two most important differences between these two studies are that Wilkinson et al. (2020 PREPRINT) was at a submaximal power output and it was done on rollers rather than a stationary ergometer as stated on line 37:  “Further, the question of whether minimizing lean affects maximal power remains open. Wilkinson et al. (2020 *PREPRINT*) compared rider biomechanics on rollers, but only at a submaximal power output (5 W kg–1).” Thus, the difference in peak instantaneous crank power­­ (measured at 100 Hz) merely indicates a difference in the pattern of crank power production rather than an increase in maximal power output.  We have renamed the conditions in Wilkinson et al. (2020 PREPRINT) to be consistent with the current submission as we feel the new terminology is clearer. |
| **Comment** | On page 5, line 47-51, the assumptions were probably made after the results were obtained. Indeed, no results from the literature (except the ones published by the main author) can lead to such precise hypotheses. The hypotheses should be reformulated more broadly. |
| **Response** | We do not understand how/why the Reviewer might consider a null hypothesis to be overly precise and post-hoc. By its very nature, a null hypothesis is neutral and really the only option when there is insufficient *a priori* evidence in the literature. Hypothesis 2 is based upon the findings in the aforementioned preprint. We concede that Hypothesis 3 was slightly artificial in that we simply hoped our ergometer would foster the same style of cycling as overground riding. In pilot testing, it seemed that the coordination pattern was the same as overground riding. However, stating it as a hypothesis allowed us to test it statistically. |
| **Comment** | The method is unclear. Indeed, the authors used a crank-mounted sensor (Garmin Ltd, Olathe, KA, USA) with 1 Hz resolution. This was followed by three to five short (5-s) maximal sprints in a non-seated posture under the ad-lib lean condition, each separated by 3-min of rest. Finally, the authors recorded the maximal instantaneous 1-second crank power. The reviewer doesn't understand how the authors can measured the instantaneous cadence with such low frequency. Indeed, the authors obtained a mean cadence around 110 rpm. Thus, they measured the cadence every two rotations. This seems too low to measure the maximal instantaneous power. |
| **Response** | We are sorry for the confusion. The Quarq system samples both crank angular velocity and torque at 65 Hz but it averages over 1 second periods and transmits those 1-sec averages to the Garmin head unit. It is not possible to obtain the instantaneous crank power values from the Quarq unit.  We have modified the text at Line 71 to avoid any confusion:  “The power meter ~~creates a 1-second average from data measured~~ *samples crank angular velocity and torque* at 65 Hz *and then transmits a 1-second average of cadence and power to the Garmin head unit.”* |
| **Comment** | The authors mention the dynamic balance of the cyclists (page 12, line 186). How they define this concept? The balance is usually a static concept. How the authors can measure a good or a bad dynamic balance during a pedaling task? |
| **Response** | Animals are said to be dynamically stable when the extrapolated centre of mass (xCoM) projection is within the edges of support (Hof, Gazendum, and Sinke, 2005). xCoM takes into account the velocity of the CoM. For example, during cycling a vertical projection of the rider’s center of mass can be (and is) positioned outside of the bicycle’s base of support and yet the rider does not fall. Something similar occurs in human walking.  For the readers’ interests, we now include the following in-text citation at Line 186: “...dynamic balance *(Hof, Gazendam, and Sinke, 2005)*.”  Hof, A. L., M. G J Gazendam, and W. E. Sinke. 2005. “The condition for dynamic stability.” *Journal of Biomechanics* 38 (1): 1–8. <https://doi.org/10.1016/j.jbiomech.2004.03.025>.  We did not measure center of mass position or dynamic balance in the present study. |
| **Comment** | The authors provide no results regarding the joint torques and joint powers. Thus, it is unclear for the reader if the same output crank power observed with the ad-lib and the locked conditions necessitates the same power developed by the cyclists. The authors should briefly discuss this issue. |
| **Response** | We have added the following paragraph at Line 240 to discuss this topic:  “*We did not collect motion capture or three-dimensional pedal force data and thus cannot provide any insight into individual joint kinematics or kinetics. Although net total crank power is equal to net total joint power over a complete crank cycle, it is certainly possible that the contribution of power across individual joints differed between the three conditions.*” |
| **Comment** | On page 13 at line 224, the authors use non-standard units. Please modify it. |
| **Response** | We have modified the units at Line 224: “*18.0 m s–1* (65 km hr–1)”. We parenthetically provide the more colloquial 65 km hr-1 that cyclists are more familiar with. |

End of response to Reviewer.