

## PEER REVIEW HISTORY

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### ARTICLE DETAILS

<b>TITLE (PROVISIONAL)</b>	Are physiological attributes of jockeys predictors of falls?: A controlled Tasmanian pilot study.
<b>AUTHORS</b>	Hitchens, Peta; Blizzard, Leigh; Jones, Graeme; Day, Lesley; Fell, James

### VERSION 1 - REVIEW

<b>REVIEWER</b>	<b><i>Professor Stephen Lord</i></b> Senior principal Research fellow Neuroscience Research Australia Australia  I have no competing interests with regard to the submitted article.
<b>REVIEW RETURNED</b>	29-Apr-2011

<b>THE STUDY</b>	The pilot nature of the study do not provide definitive results.
<b>RESULTS &amp; CONCLUSIONS</b>	As above, the pilot nature of the study do not provide definitive results.
<b>GENERAL COMMENTS</b>	<p>Falls in jockeys and track-work riders are significant issues and this paper reports novel findings in this difficult study area. It is clear considerable effort was made in terms of recruiting a representative sample, administering rigorous assessments of physiological assessments and implementing a best practice for the follow-up of falls and associated injuries. Despite these efforts, only a small sample was recruited (n=28) and the findings are limited by missing data for some variables (DEXA) and limited fall event recording. Accordingly, the study results could be seen as being of only a pilot nature. The small study numbers, with the resulting increased chances of type 1 errors, may have contributed to the mix of study findings indicating some physiological attributes (i.e. fitness) reduced falls risk whereas others (i.e. strength) increased risk. Sufficient acknowledgement of these limitations is made in the discussion. I have a few issues for consideration.</p> <ol style="list-style-type: none"> <li>1. No need to include reference to Tasmania in the title.</li> <li>2. Include subject numbers for the subset who had falls and injury data in the abstract.</li> <li>3. In keywords replace "horse" with "horse riding".</li> <li>4. The analyses between the fallers and non-fallers are appropriately adjusted for age and gender (particularly given the age and gender differences between the jockeys and track-work riders). The strength measures could also be adjusted for body size (i.e. weight).</li> <li>5. The stirrup foot position was determined by a one-off questionnaire item, and not verified in any way. This limitation needs acknowledgement as a study limitation.</li> <li>6. An explanation for why 13 of the 20 track work riders did not have falls data is provided, but no explanation as to why 1 of the 8 jockey did not have falls data.</li> <li>7. The text indicating that if sample were bigger, significant findings</li> </ol>

	would have resulted (in results and discussion) is not helpful and should be deleted.
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<b>REVIEWER</b>	<b><i>Dr Giles Warrington</i></b> School of Health and Human Performance Dublin City University Dublin 9 Ireland
<b>REVIEW RETURNED</b>	01-May-2011

<b>THE STUDY</b>	Sample size is small and the data set is incomplete. Not all the physiological data for the variables measured are presented for the subjects. The sample of jockeys as indicated may be more representative of average rather than elite jockeys.
<b>RESULTS &amp; CONCLUSIONS</b>	Some of the results would appear to be counter-intuitive which may be a reflection of the small sample size.
<b>GENERAL COMMENTS</b>	<p>The authors have attempted to address a number of the issues highlighted in the first review and have emphasised that this is a pilot study which will serve as the basis for a large-scale study of the physiological attributes of jockeys and their relationship with falls risk.</p> <p>Notwithstanding this, there are still a number of inherent limitations within the study design which dilute its impact, as highlighted in the first review, many of these limitations are indicated in the manuscript. These primarily relate to the small sample size as well as gaps within the data set reported. These limitations make data analysis problematical and thereby reduce the validity and therefore the impact of the relationships reported between the various physiological variable measured and falls risk.</p> <p>As the authors point out in the discussion the inverse associations with muscular strength and power reported may be due to chance findings. This is probably in part due to the small sample size and as acknowledged by the authors a reflection that they did not use more sensitive physiological testing equipment and more specific test protocols that may provide more accurate valid test results on which to draw comparison. It is also inferred that more experienced riders possess greater strength and power, however there appears to be no basis for this assumption as rider experience is not reported or analysed. Furthermore the authors acknowledge that there are only a few inexperienced riders involved in the subject group investigated which again is a reflection of the small number of participants.</p> <p>There is no doubt of the importance and value of conducting such research in this dangerous and high risk sport and the authors should be applauded for their endeavours to date. I would therefore encourage the authors undertake a large-scale study of physiological attributes of jockeys, taking into account the recommendations of the reviewers and the limitations highlighted in this manuscript.</p>

**VERSION 1 – AUTHOR RESPONSE**

## Response to Editor Comments

*The limitations section of the 'strengths and limitations' should be strengthened, particularly to acknowledge that some findings may be down to chance. This can be at the expense of the text about the % of Tasmanian riders participating, although the small study size limitation should remain.*

We have replaced the following text in the limitations section of the Discussion:

Due to difficulties in recruitment, we obtained only a small number of participants, but our sample comprised 44% of the jockey population and 24% of the track-work rider population licensed in Tasmania. Other studies involving jockeys have also reported low response proportions,[3, 27] and this is probably due to the working life of jockeys that necessitates considerable travel.

with:

Our sample of 8 jockeys and track-work riders was small, and some of our findings – including the results for muscular strength and power – may be a play of chance. Our sample comprised 44% of the jockey population and 24% of the track-work rider population licensed in Tasmania. Other studies involving jockeys have also reported low response proportions,[3, 27] and this is probably due to the demanding working lives of those in this profession.

*Please also provide justification for the sample size.*

To clarify the reasons for our sample size, we have replaced the following text in the Methods:

All jockeys (n=18; 6 apprentice, 12 full-licensed) and track-work riders (n=85) licensed to ride in Tasmania, the island state of Australia, were invited to participate. Reasons for non-participation included riders not currently or regularly riding, injury or illness, living interstate or being ineligible by reason of age (we excluded riders older than 50 years). The final study group consisted of 8 jockeys (2 female full-licensed, 4 male apprentice, 1 male full-licensed and 1 male full-licensed jumps jockey) and 20 track-work riders (14 female, 6 male). This represents 44% of the jockey population and 24% of the track-work rider population in Tasmania.

with:

We invited the participation of every jockey (n=18; 6 apprentice, 12 full-licensed) and track-work rider (n=85) who was licensed to ride in Tasmania, the island state of Australia. Reasons for non-participation included riders not currently or regularly riding, injury or illness, living interstate or being ineligible by reason of age (we excluded riders older than 50 years). The final study group consisted of all of those who made themselves available: 8 jockeys (2 female full-licensed, 4 male apprentice, 1 male full-licensed and 1 male full-licensed jumps jockey) and 20 track-work riders (14 female, 6 male). This represents 44% of the jockey population and 24% of the track-work rider population in Tasmania.

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## Response to Reviewer Comments

Reviewer #1:

Reviewer: Professor Stephen Lord  
Senior Principal Research Fellow  
Neuroscience Research Australia

*I have a few issues for consideration.*

*1. No need to include reference to Tasmania in the title.*

We agree and have amended the title:

"Are physiological attributes of jockeys predictors of falls?: A controlled Tasmanian pilot study."

to:

"Are physiological attributes of jockeys predictors of falls?: A controlled pilot study."

*2. Include subject numbers for the subset who had falls and injury data in the abstract.*

We have replaced the following text in the abstract:

For a subset of participants, we obtained information on falls and injuries.

with:

For a subset of participants (n=14), we obtained information on falls and injuries.

*3. In keywords replace "horse" with "horse riding".*

We have made this change as suggested.

*4. The analyses between the fallers and non-fallers are appropriately adjusted for age and gender (particularly given the age and gender differences between the jockeys and track-work riders). The strength measures could also be adjusted for body size (i.e. weight).*

It is reasonable to adjust strength for weight. Our preference is to adjust for lean body mass and, not having a measurement of this for all subjects, we made no adjustment. We have now added to the Supplementary Tables measurements of strength adjusted for weight, and have adjusted the strength measures for weight in the analyses of falls presented in Table 2. Because falls by track-work riders were more common than falls by jockeys, and track-work riders are taller and heavier than jockeys, this has the effect of reducing the estimated effect of strength on the rate of falls. In consequence, only pull strength among the strength measures remains significantly (in the statistical context) associated with risk of falls. For this reason, we have revised the text of Results and Discussion. In Results, we have replaced:

Greater shoulder pull strength and greater leg and back strength were also associated with a higher incidence of falls (Table 2). Other measures of muscular strength differed by licence type. Table 3 shows that jockeys who had lower grip strength or higher peak alactic power had a higher fall incidence than other jockeys, with the opposite being the case for track-work riders.

with:

Greater shoulder pull strength was also associated with a higher incidence of falls (Table 2). The effect of some measures of body composition and muscular power differed by licence type. Table 3 shows that jockeys with higher peak alactic power had a higher fall incidence than other jockeys, with the opposite being the case for track-work riders.

In Discussion, we have replaced:

Paradoxically, we found that higher muscular strength and power were positively associated with falls.

This was seen for shoulder pull strength and leg and back strength, for peak alactic power in jockeys, and for grip strength in track-work riders. This may be due to riders with greater strength and power being placed on difficult or fractious horses because it is generally industry practice to, where possible, not assign this task to less experienced riders. Possibly consistent with this finding, industrial workers with greater isometric strength have been reported to be at greater risk of back problems.[26] On the other hand, opposite results were found for grip strength of jockeys and for peak alactic power of track-work riders in our study and, in view of the inconsistencies, we can not discount the possibility that the inverse associations with muscular strength and power are chance findings.

with:

There was some evidence that higher muscular strength and power were positively associated with falls. This was seen for shoulder pull strength, and for peak alactic power in jockeys. This may be due to riders with greater strength and power being placed on difficult or fractious horses because it is industry practice, where possible, to assign this task to the most capable riders. Possibly consistent with this finding, industrial workers with greater isometric strength have been reported to be at greater risk of back problems.[26] On the other hand, opposite results were found for peak alactic power of track-work riders in our study. This may reflect a true difference between jockeys and track-work riders, but we can not discount the possibility that the associations with muscular strength and power are chance findings due to the small sample size.

*5. The stirrup foot position was determined by a one-off questionnaire item, and not verified in any way. This limitation needs acknowledgement as a study limitation.*

We agree that an acknowledgement of this limitation is required and have added the following text to the limitations in the Discussion:

Additionally, we had only self-reports of stirrup foot position. Ideally, assessment of this factor would be made by a trained, independent observer.

*6. An explanation for why 13 of the 20 track work riders did not have falls data is provided, but no explanation as to why 1 of the 8 jockey did not have falls data.*

We have replaced the following text in the Methods:

None of the jockeys returned their track-work diaries. However, we did obtain incident data on falls by the 7 licensed flat racing jockeys at race meetings.

with:

None of the jockeys returned their track-work diaries. However, we did obtain incident data on falls at race meetings by the 7 licensed flat racing jockeys. The one jumps jockey did not have any race rides recorded during the study period.

*7. The text indicating that if sample were bigger, significant findings would have resulted (in results and discussion) is not helpful and should be deleted.*

We have deleted the following text from the Results:

The associations of measures of anaerobic fitness were not statistically significant but, became significant when we expanded the dataset from n=14 to n=28 (peak power per kg of body mass, fatigue index) or to n=42 (mean power per kg of body mass) by duplicating observations.

We have also added the following text to the Methods:

To make an assessment of the possible significance of anaerobic fitness factors in a fully powered main study, we expanded the dataset from n=14 to n=28 (to assess the effects of peak power per kg of body mass and fatigue index) and to n=42 (to assess the effect of mean power per kg of body mass) by duplicating observations.

and replaced the following text in the Discussion:

Only the association with aerobic fitness was statistically significant but, if our participants are representative of jockeys and track-work riders in general, the association with measures of anaerobic fitness would have been statistically significant for peak power per kg of body mass and for fatigue index if the dataset had been just two times greater and significant for mean power per kg of body mass if the dataset had been three times greater.

with:

Only the association with aerobic fitness was statistically significant but, if our participants are representative of jockeys and track-work riders in general, the association with measures of anaerobic fitness would have been statistically significant for peak and mean power per kg of body mass and for fatigue index had the sample size been just one or two times greater (data not shown).

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Reviewer #2:

Reviewer: Dr Giles Warrington PhD, FACSM  
School of Health and Human Performance  
Dublin City University, Dublin 9, Ireland

*Sample size is small and the data set is incomplete.*

*Not all the physiological data for the variables measured are presented for the subjects.*

*The sample of jockeys as indicated may be more representative of average rather than elite jockeys. Some of the results would appear to be counter-intuitive which may be a reflection of the small sample size.*

*The authors have attempted to address a number of the issues highlighted in the first review and have emphasised that this is a pilot study which will serve as the basis for a large-scale study of the physiological attributes of jockeys and their relationship with falls risk.*

*Notwithstanding this, there are still a number of inherent limitations within the study design which dilute its impact, as highlighted in the first review, many of these limitations are indicated in the manuscript. These primarily relate to the small sample size as well as gaps within the data set reported. These limitations make data analysis problematical and thereby reduce the validity and therefore the impact of the relationships reported between the various physiological variable measured and falls risk.*

In this particular comment, the reviewer focuses on the small size of the sample. We think that more credit should be given for the novel information provided. For example, we think the information provided on measurements of physiological attributes of jockeys and track-work riders that is presented in the Supplementary Tables is of critical importance and value. We believe that this information will be of major benefit to industry participants and to researchers who, like ourselves, are planning future studies.

To clarify this point, we have replaced the following text to the Results:

Detailed results are available in a Supplementary Appendix.

with:

Detailed results in relation to the physiological attributes of jockeys and track-work riders are available in a Supplementary Appendix.

In addition, we have replaced the following text of Discussion:

This study adds to the limited information available on the physiological attributes of jockeys, and is the first study to report comprehensively on the physiological characteristics of track-work riders. A strength of this study was the comprehensive range of tests that was implemented.

with:

This study adds to the limited information available on the physiological attributes of jockeys, and is the first study to report comprehensively on the physiological characteristics of track-work riders. A strength of this study was the comprehensive range of tests that was implemented. For the benefit of industry participants and researchers, these results have been made available in a Supplementary Appendix.

*As the authors point out in the discussion the inverse associations with muscular strength and power reported may be due to chance findings. This is probably in part due to the small sample size and as acknowledged by the authors a reflection that they did not use more sensitive physiological testing equipment and more specific test protocols that may provide more accurate valid test results on which to draw comparison. It is also inferred that more experienced riders possess greater strength and power, however there appears to be no basis for this assumption as rider experience is not reported or analysed. Furthermore the authors acknowledge that there are only a few inexperienced riders involved in the subject group investigated which again is a reflection of the small number of participants.*

We have adjusted the strength measures for weight in the analyses of falls presented in Table 2, as per a suggestion by Reviewer #1 (point 4 above). Additionally, we think it likely that the positive associations of muscular strength and power with falls may be due to stronger riders being placed on difficult or more fractious horses. To make this point clearer, and to remove the inference that more experienced riders possess greater strength and power, we have replaced the following sentence in the Discussion:

This may be due to riders with greater strength and power being placed on difficult or fractious horses because it is generally industry practice to, where possible, not assign this task to less experienced riders.

with:

This may be due to riders with greater strength and power being placed on difficult or fractious horses because it is industry practice, where possible, to assign this task to the most capable riders.

*There is no doubt of the importance and value of conducting such research in this dangerous and high risk sport and the authors should be applauded for their endeavours to date. I would therefore encourage the authors undertake a large-scale study of physiological attributes of jockeys, taking into account the recommendations of the reviewers and the limitations highlighted in this manuscript.*

We agree that research of this type is critical and has been dangerously neglected in the past. Our intention is to seek funding to undertake a large-scale study. Publication of these results will assist greatly in that respect.

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The authors hope that these amendments satisfactorily address the editor and reviewers concerns and suggestions.

**VERSION 2 - REVIEW**

<b>REVIEWER</b>	<b><i>Stephen Lord</i></b>
<b>REVIEW RETURNED</b>	14-May-2011

<b>THE STUDY</b>	The study is limited by the small sample size which reduces its impact and generalisability. None-the-less, given the dearth of findings in this area the study makes a useful contribution to the literature.
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