Review of: "Hyperoxia improves repeated-sprint ability and the associated training load in athletes"

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The study aimed to investigate hyperoxic gas breathing on repeated sprint ability. The study is interesting with measurements that are thorough and in total a very nice experiment. The manuscript is clearly written and the rationale for doing the study is good.

However, my main concern is with the parts of the data analysis, the statistical methods and the interpretations of the outcome.

The endpoint of the sessions set at 15% performance decrement. This is fine and well described, but it allows for different number of sprints between conditions which is a major problem for interpretation. The authors state no meaningful difference is found between HYP and CON in work done in the common sprints, making it is surprising that HYP is able to complete more sprints. The increased number of sprints increases the total work which in turn is the reason for the increased training load and RPE in HYP. This can be partially amended by presenting more detailed data on individual sprints and focusing the conclusion on what is based on an equal number of sprints. That would mean the study cannot provide meaningful conclusions on the effect of HYP on TL, RPE and Wtot.

In the common sprints, the NIRS findings on TSI, HHb and tHb and the EMG are still of interest. However, specifically for the EMG results, they are now condensed into 2 bars. This is a lot of data not shown and the specifics of the different muscles are not addressed. I suggest presenting the EMG data for the sprints, how they change over time and the different muscles similar to the NIRS data. Increased details on normalization procedures must also be provided.

For the statistical analysis, there to a great extent is none. This must be improved and the details of the experiment makes it a good fit for a repeated measures ANOVA or a mixed models approach with the repeated sprints and the two conditions.

Some specific comments:

Abstract:

L20: You have not measured muscle recruitment. You have measured electrical activity on the skin.

L21: You cannot conclude this because of the different number of sprints caused by your way of ending the session.

Introduction

L29: I disagree. The effect is not dictated by the training load but by a sufficient training load in combination with other factors related to stimulus signalling and recovery and adaptation.

Methods:

L98: The experiment is making this statement illogical. Was the TL of the trial replicated every day? Or can you be more specific for the days between the trials.

L166: Could abbreviations be adjusted to avoid confusion with RPE? E.g. perceived limb discomfort: PLD?

L170: This is not how you calculate sRPEw which is durations times the overall RPE (according to the reference you also used). This must be changed to avoid confusion or you must use a different term.

L233: I cannot see how this is presented in both these ways?

L234: But how did you normalize`?

Statistics:

I suggest using Hedges g due to the low number of observations in each group.

L238: Do you mean that effect size is quantified using cohens d? Please specify your calculation if not and specify how you calculate the 90% CL on this value.

L240: ES thresholds should refer to Cohen 1988.

Results:

Overall this section contains a lot of numbers making it sometimes hard to follow (especially section 4.3.). I would suggest putting as much as possible in a table or adding more of this information to the figures.

How many participants reached 20 sprints?

Discussion:

L289: I recommend replacing "psycho-physiological" with "perceptual and physiological" (ref: Oxford Medical Dictionary).

L306: This is due to extra sprints, and not hyperoxia.

L310: No, extra work increases TL as you calculated it.

L313: This is unclear. What happened with number 13?

L322: 100%FiO2?

L324: Open loop as you state it seems to me to be largely influenced by the cut-of value of 15%. An alternative option would be to let the athletes go until the selected not to keep sprinting. I see that it would be difficult given the participants (I assume) not being very familiar with bike sprinting. But, regardless, you cannot conclude anything on this regard based on this study.

L326: Spelling?

L328: Check ref.

L335: In the context of adaptive signalling, do you think this could actually reduce the training stimulus? In other words, are you sure this is positive? (Retorical).

L350: You former statement is only one option. HYP could also allow for the increased recovery of anaerobic reserve and thus there might not be greater aerobic contribution during the sprints. You also touch on this in line 360, but you can reword this statement.

L371: Again, number of sprints increase TL, not HYP. HYP recovers more in the brakes, but the deoxygenation is similar. I don't think you separate the HYP from the sprints here. You should be less bombastic in your statements.

L374: This is for now hard to evaluate because of limitations in the methods section.

Conclusion

This conclusion does not fit with the findings of the study. The extended number of sprints increased the total work done and that increases the TL because you calculated it from work.