

## PEER REVIEW HISTORY

BMJ Paediatrics Open publishes all reviews undertaken for accepted manuscripts. Reviewers are asked to complete a checklist review form and are provided with free text boxes to elaborate on their assessment. These free text comments are reproduced below.

### ARTICLE DETAILS

<b>TITLE (PROVISIONAL)</b>	The Swim Drink study: A randomised controlled trial of during-exercise rehydration and swimming performance
<b>AUTHORS</b>	Briars, Graham; Gordon, Gillian; Lawrence, Andrew; Turner, Andrew; Perry, Sharon; Pillbrow, Dan; Walston, Florence; Molyneux, Paul

### VERSION 1 - REVIEW

<b>REVIEWER</b>	Shaw, Dominick E. University of Nottingham Competing interests: None
<b>REVIEW RETURNED</b>	20-Jun-2017

<b>GENERAL COMMENTS</b>	<p>this is a well written and well designed study, looking to answer an important physiological/sports medicine question.</p> <p>the authors take great care over the study design and interpretation, and conclude that sports drinks (or water) do not improve performance.</p> <p>although the study is well designed there is a potential flaw that the authors needs to address; the athletes never reached a state of dehydration that could have led to a worse performance.</p> <p>I was confused by the fact that "At each, subjects completed 75 minutes training, with 18 free access to their designated session drink". Do they know how much drink was measured?</p> <p>I understand ethically why this was allowed, but surely this biases the study interpretation, as this presumably effected the dehydration rates and therefore influenced any effect on performance.</p> <p>This needs consideration and justification.</p> <p>otherwise there are no major comments. The way the CIs are expressed in the abstract is confusing and may lead some readers to believe there was a difference- perhaps quote the p value too or stick to + and - rather than faster/slower.</p> <p>did the swimmers feel better/faster with the different drink combinations?</p> <p>what total volume did they consume during the study?</p> <p>lastly, alluding to the point above, were they heavier pre drink assignment once they knew there were receiving nothing (ie once knowing they were randomised to nothing, did they preload with fluid prior to their session?)</p>
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<b>REVIEWER</b>	Phillips, Bob CRD, University of York
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	Competing interests: None. Well. I don't like swimming much.
<b>REVIEW RETURNED</b>	04-Jul-2017

<b>GENERAL COMMENTS</b>	<p>I found this detailed and well written summary of a non-health-outcome RCT fascinating and well explored in nearly every aspect.</p> <p>The only area which I could have seen improvement in would be reference to undertaking a mini-review of previous 'sports drink' and performance trials within the commentary / discussion section, but this is a very minor element.</p>
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<b>REVIEWER</b>	Harron, Katie LSHTM, UK Competing interests: no competing interests
<b>REVIEW RETURNED</b>	31-Jul-2017

<b>GENERAL COMMENTS</b>	<p>This study reports a randomized controlled trial of water and sports drink versus no drinking during swimming. Overall the study seems well reported. I have a few points for clarification.</p> <ol style="list-style-type: none"> <li>1. The abstract should state that the sessions were at one week intervals.</li> <li>2. The abstract should also include average absolute times (as well as differences) for each group.</li> <li>3. It is not appropriate to call this a double blind study – both the participants and the study team knew which drink (or not) was being used. This point should be included in the discussion as a limitation. The sentence in the discussion saying “every effort to reduce bias by blinding the subjects to their drink allocation” should be removed.</li> <li>4. Catch up sessions are described in the methods but not the results – were any of these needed?</li> <li>5. The questionnaires are described in the methods but no results are provided.</li> <li>6. It is not clear why only 8 or 4 of the 12 sessions were selected for analysis. This decision should be justified.</li> <li>7. Methods should state whether this was an intention to treat or per protocol analysis.</li> <li>8. Please provide more information on the Bonferroni correction, as it is not clear what this means when “<math>p &lt; 0.05</math>” is also stated.</li> <li>9. More details need to be provided so that the sample size calculation can be replicated, i.e. sd and mean</li> <li>10. More information should be given about the regression model building. What exactly was the outcome variable? How did you decide which variables to include in the final model? How did you deal with repeated measurements for the same participant? Coefficients with 95% CIs should be given for the regression model results, and I would suggest these are presented in the main paper rather than the appendix. In the statistical notes – what is the justification for including the coefficient of variation of swimmer times in the regression?</li> <li>11. Supplemental tables 1 and 2 – p-values cannot be 0 or 0.000. For very small p values, ranges should be presented.</li> <li>12. Table 1: the hydration status at session end should be presented separately from the baseline characteristics – not in the same table. Table 1 appears to show statistics for 19 individuals, yet</li> </ol>
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	<p>Figure 1 suggests 16 were included in the analysis. The median age should be presented. It would be helpful to present some of the variables by session type (training distance, pool temperature, dehydration), to show any differences according to drink / water / sports drink.</p> <p>13. Table 2 – where differences are presented, absolute values should also be presented, e.g. for thirst.</p> <p>14. I found the flow diagram a little difficult to follow. It would be helpful to include the number of swims for each participant.</p> <p>15. The protocol mentioned measuring pre-session intake, but I can't see any results for this.</p> <p>Minor points:</p> <p>The abstract mentions both 75 minutes training sessions and 105 minutes of sustained effort – this is confusing.</p> <p>I couldn't see titles / captions for the tables.</p> <p>SEM should be given in full the first time it is used.</p> <p>It is not clear how helpful presenting BMI for this age group is.</p>
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### VERSION 1 – AUTHOR RESPONSE

Reviewer: 1

#### Comments to the Author

this is a well written and well designed study, looking to answer an important physiological/sports medicine question.

the authors take great care over the study design and interpretation, and conclude that sports drinks (or water) do not improve performance.

although the study is well designed there is a potential flaw that the authors needs to address; the athletes never reached a state of dehydration that could have led to a worse performance.

I was confused by the fact that "At each, subjects completed 75 minutes training, with 18 free access to their designated session drink".

**Amendment made referring to designated drink regime over the full 105 minutes.**

Do they know how much drink was measured?

**Swimmers drank to thirst and could have as much as their thirst dictated, volumes taken by each participant at each session are now available in supplementary data and are summarized in table 2**

I understand ethically why this was allowed, but surely this biases the study interpretation, as this presumably effected the dehydration rates and therefore influenced any effect on performance.

This needs consideration and justification. otherwise there are no major comments.

**It was because of the possibility that swimmers randomized to a drink may choose to drink none of it, that the regression analyses were included so that volume of drink rather than just category of drink**

could be considered.

The way the CIs are expressed in the abstract is confusing and may lead some readers to believe there was a difference- perhaps quote the p value too or stick to + and - rather than faster/slower.

Mean times and p values inserted.

did the swimmers feel better/faster with the different drink combinations?

Neither their pre study prediction nor their post study perception in the questionnaires predicted their performance.

what total volume did they consume during the study?

See table 2

lastly, alluding to the point above, were they heavier pre drink assignment once they knew there were receiving nothing (ie once knowing they were randomised to nothing, did they preload with fluid prior to their session?)

Insertion: They were then under continuous supervision until the start of training and did not have an opportunity to drink anything other than their designated drink.

Reviewer: 2

#### Comments to the Author

I found this detailed and well written summary of a non-health-outcome RCT fascinating and well explored in nearly every aspect.

The only area which I could have seen improvement in would be reference to undertaking a mini-review of previous 'sports drink' and performance trials within the commentary / discussion section, but this is a very minor element.

This has been added to the discussion

Reviewer: 3

#### Comments to the Author

This study reports a randomized controlled trial of water and sports drink versus no drinking during swimming. Overall the study seems well reported. I have a few points for clarification.

1. The abstract should state that the sessions were at one week intervals.

*In the main results section we report that the sessions were conducted over 23 weeks. The original plan was to conduct the study in the Autumn with weekly sessions. This was delayed to the spring to satisfy ethical committee recommendations. This resulted in some of the planned weekly sessions clashing with public holidays and with swimmer unavailability due to competition commitments.*

2. The abstract should also include average absolute times (as well as differences) for each group.

Mean times and p values inserted.

3. It is not appropriate to call this a double blind study – both the participants and the study team knew which drink (or not) was being used. This point should be included in the discussion as a limitation. The sentence in the discussion saying “every effort to reduce bias by blinding the subjects to their drink allocation” should be removed.

This has been amended

4. Catch up sessions are described in the methods but not the results – were any of these needed?

18 individual catch up sessions were performed by 14 subjects.

5. The questionnaires are described in the methods but no results are provided.

These data are used as planned in the regression models, which are now given fuller description.

6. It is not clear why only 8 or 4 of the 12 sessions were selected for analysis. This decision should be justified.

There were three reasons for this:

- 1) Participants remained at liberty to attend or fail to attend any of the sessions. From previous experience of swimmer's attendance at training sessions, a plan to capture data from 8 as indicated from the power calculation would be most likely to succeed if an extra 50% sessions were available. As a safeguard against a swimmer having a shortfall of a particular type of session the two catch up sessions were offered. This limited the number of occasions that the pool had to be set up in competition mode to 14. Despite this safeguard two participants did not produce a set of fully analyzable data due to a shortage of their water drinking and no drinking sessions respectively.
- 2) It is not possible to blind observers to the drink allocation as study data is collected, however a degree of masking was achieved by the study team not knowing which subset of swims would be selected for analysis, reducing the opportunity to wittingly or unwittingly influence the result.
- 3) Whilst the primary paired t-test analysis tested whether swimmers performance was improved a by a particular drink allocation, any failure to demonstrate benefit would have been open to the interpretation that the subjects had just not taken enough of the drink for an effect. This was the principal reason for conducting regression analyses. Splitting the collected data was performed to allow development of regression models on the 8 session data, and to test its generalizability on the remaining un-selected 4 sessions data. In the end no relationship between volume consumed and performance was detected.

7. Methods should state whether this was an intention to treat or per protocol analysis.

These terms, used to describe parallel group clinical trials with one study outcome per participant are not ideal to describe the current study. On the one hand it was per protocol because subjects were analysed according to the drink regime they had taken, and on the other hand it was intention to treat because no subject changed from one intervention to another for a particular outcome assessment. In the primary drink versus no drink analysis, a participant with a full data set would have had 40

outcomes contributing to the result.

8. Please provide more information on the Bonferroni correction, as it is not clear what this means when “ $p < 0.05$ ” is also stated.

- 1) Answering the third study question “Are there idiosyncratic differences in response between individual athletes?” requires that analyses are individually conducted on all 16 subjects with analyzable data and the participant who was excluded from the pooled analysis for use of a pull bouy because of his leg injury. With 17 tests at an overall threshold of  $p < .05$  the critical p value was calculated at .003. This is described in the legend for figure 2.

9. More details need to be provided so that the sample size calculation can be replicated, i.e. sd and mean

This has been included in the modified manuscript

10. More information should be given about the regression model building. What exactly was the outcome variable? How did you decide which variables to include in the final model? How did you deal with repeated measurements for the same participant? Coefficients with 95% CIs should be given for the regression model results, and I would suggest these are presented in the main paper rather than the appendix.

Insertions have been made into the main paper and data on the regression model expanded.

In the statistical notes – what is the justification for including the coefficient of variation of swimmer times in the regression?

We predicted that subjects undergoing a training session that they found intense may exhibit greater variation in their sprint times for that session.

11. Supplemental tables 1 and 2 – p-values cannot be 0 or 0.000. For very small p values, ranges should be presented.

12. Table 1: the hydration status at session end should be presented separately from the baseline characteristics – not in the same table.

Baseline data now integrated in text Table 1 appears to show statistics for 19 individuals, yet Figure 1 suggests 16 were included in the analysis.

The median age should be presented.

Done

It would be helpful to present some of the variables by session type (training distance, pool temperature, dehydration), to show any differences according to drink / water / sports drink.

13. Table 2 – where differences are presented, absolute values should also be presented, e.g. for thirst.

Done

14. I found the flow diagram a little difficult to follow. It would be helpful to include the number of swims for each participant.

The number of pairs of swims for each participant are shown in the supplementary tables.

15. The protocol mentioned measuring pre-session intake, but I can't see any results for this.

This was the intention at the outset, but it was not done. In preparatory work for the performing the pool session tasks, it became clear that there was insufficient time at the start of the pool session to conduct the weigh in, administer the pre-session questionnaires, distribute the drinks and supervise the participants effectively in addition to performing the 24hr dietary recall that would have been required for this data collection. As the participants were blind to their drink allocation prior to the weigh in, it was felt the failure to collect these data would not be detrimental to the prosecution of the study.

Minor points:

The abstract mentions both 75 minutes training sessions and 105 minutes of sustained effort – this is confusing.

This has been clarified

I couldn't see titles / captions for the tables.

Table titles are shown in the first two rows of each table

SEM should be given in full the first time it is used.

Done

It is not clear how helpful presenting BMI for this age group is.

The use of BMI in this age group has been a subject of debate. It is presented here solely to describe the characteristics of the study group.

## VERSION 2 – REVIEW

<b>REVIEWER</b>	Shaw, Dominick E. University of Nottingham Competing interests: none
<b>REVIEW RETURNED</b>	13-Sep-2017

<b>GENERAL COMMENTS</b>	<p>most comments have been answered satisfactorily.</p> <p>but</p> <p>it is still the case that the dehydration percentage was v. small, and less than a tenth (0.42%) of the 2% recommended by sports guidelines before rehydration is suggested.</p> <p>this is mentioned in the conclusion, but unless the reader takes care they will not appreciate the subtleties of the message; its not sports drinks don't improve performance, rather sports drinks don't improve performance in non-dehydrated athletes.</p>
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<b>REVIEWER</b>	Harron, Katie LSHTM, UK Competing interests: no competing interests
<b>REVIEW RETURNED</b>	18-Sep-2017

<b>GENERAL COMMENTS</b>	<p>The authors have responded to my previous comments. I think the regression results would be better presented as a table in the main text, rather than in the text itself. The authors didn't take into account that there were repeated measurements for the same individual, within the regression model. This should be discussed/justified or changed.</p>
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## VERSION 2 – AUTHOR RESPONSE

Regression results are placed in a new table 3 as requested.

Discussion relating to the choice not to employ a repeated measures technique in the regression analyses is included. I hope I have successfully balanced these comments so that the statistically minded and the general reader are equally catered for.