Author's response to reviews

Title: Relationship of aerobic fitness and motor skills with memory and attention in preschoolers (Ballabeina): A cross-sectional and longitudinal study

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BMC Pediatrics Editorial Office
Jigisha Patel MRCP, PhD, Series Editor

Submission of a revision

Dear Editor, dear Editorial Board,

we would like to thank you for the thorough and helpful review of our paper “Relationship of aerobic fitness and motor skills with memory and attention in preschoolers: A cross-sectional and longitudinal study” (MS: 1613956967487532). Enclosed you find the revised version according to the reviewers comments with changes marked in yellow. The specific point-by-point responses to the reviewer’s comments are mentioned below. As outlined, we have carefully considered each suggestion.

Hoping that this revised version will now be acceptable for publication in the BMC Pediatrics, we thank you in advance for your consideration.

With kind regards on behalf of all the co-authors,

Iris Niederer
Reviewer I (Phillip Daniel Tomporowski)

General Comments
The authors provide a very interesting study that describes the relation between multiple measures of young children’s physical activity behaviors and two measures of cognitive function. The data were gathered as part of a larger study conducted with a relatively large number of children. The data obtained address an important but understudied topic. The methods employed were well described. The results of the study are important and support general assumptions about the role of children’s level of physical activity on mental function/development.

We thank the reviewer for his positive comments.

Discretionary comments:
The authors have been careful to select tests that provide reliable measures of young children’s physical activity. The reliability of the Attentional task is acceptable; however, the test-retest reliability of the spatial working memory task is quite low (0.48). The authors may want address this shortcoming in the discussion section.

The reviewer is right. We address this now in the discussion.

It might be helpful for the authors to describe in greater detail the procedures that were used to prepare children to perform both tests of physical fitness and cognitive function. For example, it was useful to know how the shuttle run was conducted. How were the tests of cognitive function administered? In what environment were the tests administered? Who administered the tests?

We thank the reviewer for this important comment. We added two new paragraphs with this information about the testing situation for the motor tests (aerobic fitness, agility and balance, page 8) and the cognitive tests (spatial working memory and attention, page 10).

It would probably assist the readership if the authors “streamlined” and condensed the Discussion section.

In response the reviewers comment, we shortened the discussion and made it more concise.

Major Compulsory Comments:
The authors state, “We therefore comprehensively assessed the cross sectional and longitudinal relationships of different measures of physical fitness (aerobic fitness, agility, dynamic balance)…”The term “Physical Fitness” is typically defined in terms of four components: cardio- respiratory function, muscular strength, muscular endurance, and flexibility. Only one of the tests employed by the authors (shuttle run) reflects a component of physical fitness. As acknowledged by the authors, performance on the agility test reflects the operations of both physical and cognitive components.
Balance is not considered a measure of physical fitness. The readership may be given the misguided impression that children’s physical fitness was measured in this study, when in fact only three measures of children’s physical activity behavior/performance were obtained. The authors may need to reconsider the use of their terminology and how the scores on the three tests are related to cognitive function.

We thank the reviewer for this helpful comment. Concerning the terminology, we focused on the study of Molnar and Livingstone [1]: “Physical fitness may be usefully conceived as ten separate components grouped into two broad categories: (1) skill-related aspects: agility, balance, co-ordination, power, reaction time and speed, (2) health-related aspects: cardiopulmonary fitness, muscular strength, muscular endurance, and flexibility.” But we think the reviewer is right, that our terminology might be misleading. We therefore changed our terminology and separated aerobic fitness and motor skills throughout the manuscript: We now use aerobic fitness for the results of the shuttle run and motor skills for agility and balance. This corresponds to the terminology we also used in another paper that has just been accepted in the International Journal of Obesity.

By doing so, we also changed the order of the results: We now present the results of aerobic fitness first and then mention the results for agility and balance. This has also been adjusted in the abstract, the methods, the results, the conclusion and the tables.

Indeed their hypotheses “was that higher fitness in young children is related to better memory and attention at baseline and will also be related to their improvements over 9 month. We also hypothesized that the relationship varies according to the investigated fitness measures.” How might measures of “agility” be expected to be related to memory and attention? Likewise, measures of balance?

This is an important point. We now explain more clearly how agility and balance might be related to cognitive performance in the background (page 6) and in the discussion (page 16).

Again, these are not traditional measures of physical fitness. Several reviewers have agreed that one of the reasons for the lack of agreement among studies in this field is probably due to task differences.

The reviewer is right and therefore we describe the assessment of the different measures now more clearly so that the reader can easily follow what has been assessed. Secondly we changed the terminology, so that it is hopefully no more misleading. We also mention the task differences as potential reasons for the lack of agreement among studies in the background.

Given the authors’ view that the result of the study are important for policy makers, it will be important for researchers to identify those activities that are most strongly related to cognitive performance. The general classification of “physical fitness” may not be useful.

We conclude in our study, that exercises involving specific mental processing including executive functions (like exercises involving agility) are probably most suitable to trigger global cognitive development in young children. As we now abandoned the use of physical fitness use as an umbrella term, we can better differentiate agility, balance and aerobic fitness.
Minor compulsory comment:

#1) The first line of the conclusion section may be a bit strong, i.e., “Based on our results, high physical fitness in preschoolers was related to improved spatial working memory and attention.” The study did not provide indices of absolute levels of aerobic fitness; therefore it may be inappropriate to suggest that “high” physical fitness is related to cognition.

We adapted the first sentence of the conclusion to the reviewer’s comment.
Reviewer II (Keita Kamijo)

General Comments
This study investigated the relationship between physical fitness (aerobic fitness, agility, and dynamic balance) and cognitive function (working memory and attention) in preschool children using cross-sectional and longitudinal analyses.

Results indicated that aerobic fitness and agility were positively associated with cognitive function in the cross-sectional analyses. Further, longitudinal analyses showed that greater aerobic fitness at baseline resulted in greater improvement in the attentional score, and superior dynamic balance at baseline resulted in greater improvement in the working memory score. Accordingly, the authors concluded that higher fitness is associated with improvements in working memory and attentional functions.

In general, this study is well designed and carried out. The authors’ effort to collect a large sample should be praised. Nevertheless, this reviewer has several concerns especially about the introduction.

We thank the reviewer for his positive comments. We tried to implement the reviewer’s comments in the study.

Major Compulsory Comments:
1. The authors stated that previous studies in children showed mixed results (Page 5). But the authors only described some limitations in previous studies (Page 6). The authors should review more details about the mixed findings in previous studies. That is, the authors should indicate why the mixed findings were observed. In doing so, the purpose and originality of the present study would become more clearly.

   The reviewer is completely right. We carefully reviewed the literature again and summarized the most likely reasons for the mixed findings in previous studies in the background section. As the reviewer had suggested, this helped to demonstrate more clearly the purpose and originality of the present study.

2. In this connection, the authors’ hypotheses are mere guesses (Page 6). This reviewer cannot follow why the authors made these hypotheses. Hypotheses should be made based on previous findings.

   As we now mention reasons for the mixed findings, we can lead the reader more directly to our hypothesis.

3. It is unclear why the authors focused on spatial working memory and attention. This should be described more clearly in the introduction.
We now state this more clearly in the background. In Switzerland, preschool children are encouraged through play and there are no assessments of academic achievement. In our (and others) opinion, attention and spatial working memory are important predictors of (later) academic achievement [2, 3]. In addition to the reasons mentioned in the background section of the manuscript, there were several practical reasons to choose these two tests: The tests had to be validated for preschoolers (i.e. no reading) and they had to be assessable in the preschool setting with over 250 children. As the tests were assessed in two different language regions and the population included many migrant children, they had to be independent of language skills. With all these restrictions, we selected two tests closely related with academic achievement.

4. The cognitive tasks should be explained in more details (Page 8-9). This reviewer cannot understand the cognitive tasks.

We thank the reviewer for this important comment. We added two new paragraphs with information about the cognitive tasks (spatial working memory and attention, page 10).

5. In several parts of the discussion, the authors merely indicated whether the current results are consonant with previous findings. The authors should focus on what are the important findings in the current study. It is difficult to follow the authors’ contentions.

The reviewer is completely right. We shortened the discussion and made it clearer and more concise. Additionally, we focused more on the important findings of the current study.

Minor compulsory comment:

Page 8-9, the working memory task should be described before the attention task.

We changed this.

Page 13, “by Hillman et al.” should be “by Hillman and his colleagues”.

We adapted this.

Tables, n (sample size) should be indicated in italics.

We corrected this.

References