Author's response to reviews

Title: Effect of living area and sports club participation on physical fitness in children: A 4 year longitudinal study

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Author's response to reviews: see over
Revised Manuscript [MS: 9317640631205412 - Effect of living area and sports club participation on physical fitness in children: A 4 year longitudinal study]

Dear Editor and Reviewers´
Thank you for your patience and your helpful comments regarding our manuscript. We tried hard to improve the coherence of the manuscript by integrating your comments in the revised version of our manuscript. Below you will find our point-by-point statements to the editor’s and reviewers’ comments (editor: changes highlighted in blue, referee #1: changes highlighted in yellow, referee #2: changes highlighted in grey).

We hope that our manuscript is now suitable for publication in BMC Public Health.

Kind regards

Kathleen Golle, Urs Granacher, Martin Hoffmann, Ditmar Wick, Thomas Muehlbauer

Editor’s comments: highlighted changes in blue

Comment: 1.) Please provide the specific name of the ethics committee which approved your study in the manuscript.

Statement: The specific name of the ethics committee was added to the revised version of this manuscript. That is: “The study was approved by the Ministry of Education, Youth and Sport of the federal state Brandenburg. Parents or legal representatives of each child provided written informed consent”.

**Response to Referee #1: highlighted changes in yellow**

**Comment:** Reviewer's report: Major Compulsory Revisions

1. According to method section: The authors must clarify the exact meaning of “grade” and why they divided from grade three to six and not from one to six. It is unclear whether this grade is in relation to fitness levels or any other criteria. On the other hand, it would be interesting explain better when the whole sample was selected, during the first year or along of the 4 years.

**Statement:** The reviewer is right that the term “grade” is not clear enough in terms of its relation to fitness levels. The term “grade” is not in relation to fitness levels. We therefore changed the term “grade” to “class” (throughout the revised manuscript). This should be more specific and suitable because it refers to a group of pupils learning at school.

Pupils from class three to six and not from one to six were investigated because one major goal of this study was talent identification. Programs for talent identification (i.e., age to begin practicing the sport) usually start between the ages of 9-10 [1] which again equals the age range of third graders. Another goal was to see whether development of physical fitness is differentially affected by living area and sports club participation area in children (was investigated in the present study) as compared to adolescents (will be investigated in a follow-up project). For example, muscular strength increases quite linearly during childhood, however, a marked acceleration in strength can be observed during adolescence (i.e., puberty), especially in boys [2]. Given these maturational characteristics, differences in the effects of living area and sports club participation on physical fitness development in adolescents as compared to children might be possible.

The sample was tested for the first time as pupils attended the third class and from thereon once a year for the next three years (i.e., during classes 4, 5, 6). However, of the initially recruited 341 children, informed consent and valid data were obtained from 172 children (69 girls, 103 boys) over the four-year period. This data set was used for the present manuscript. All these information were added to the Methods section of the revised manuscript.
Comment: 2. Results: When the authors write about the numbers of participants in a sports club in the first paragraph, they show that “49 children participated in a sports club at least once a week and 17 did not participated...” However, what happen with rest of subjects (106)? Participated or not?

Statement: The reviewer is right that incomplete information were provided. For clarification, we added information on our sample size in the Methods section (see Questionnaire). To find out whether living area and/or sports club participation has an effect on physical fitness development in children, “Only children that did not change their residential status (N=172) over the 4-year study period were included for further analyses. Sixty-six out of 172 children either continuously participated (n=49) or did not participate (n=17) in a sports club at all”.

Comment: On other hand, when compared urban and participated in a sports club vs rural and not participated in a sports club, those children who do not participated and live in a rural area presented lower levels of physical fitness. However, it would be interesting know whether the results obtained by rural and no participated children could be treated as low levels of physical fitness if it is compared with standards values for their age and sex. In addition, it should be analyze other variables like sedentary habits to know a possible effect of life style in both zones.

Statement: Due to the fact that chi-square test showed statistically significant associations between living area and sports club participation with a higher likelihood of not participating in a sports club when living in rural areas, we adjusted our statistical model for these potential confounders. More specifically, when analyzing the effect of sports club participation on physical fitness development, the factor living area was included as a covariate. However, we observed that irrespective of living area, children participating in sports clubs showed better physical fitness development than their non-participating peers. This information was added to the Results section (see Effect of sports club participation on physical fitness development).

The reviewer is right that a comparison of physical fitness in children living in rural areas and not participating in sports clubs with age- and sex-specific normative values would be interesting. Unfortunately, age- and sex-specific normative values
for the selected physical fitness tests (i.e., star coordination run, 9-min run, stand-and-reach, 50-m sprint, triple hop, 1-kg ball push) are not available in the literature. There is however normative data for the 50-m sprint provided by the German Olympic Sports Confederation ('Deutscher Olympischer Sportbund', DOSB: 8-9 years (boys: 10.3 s girls: 10.4 s), 10-11 years (boys: 9.9 s, girls: 10.0 s), and 12 years (boys: 9.2 s, girls: 9.5 s). When comparing these values with findings from our study, children living in rural areas and not participating in sports clubs fulfilled the normative criteria or even performed better (class 3 [boys: 9.8 s, girls: 10.0 s], class 4 [boys: 9.1 s, girls: 9.9 s], class 5 [boys: 9.5 s, girls: 8.9 s], and class 6 [boys: 9.1 s, girls: 8.8 s]). In other words, children living in rural areas and not participating in sports clubs were not classified as low fit in term of speed performance. Due to a void in the literature regarding age- and sex-specific normative values (i.e., data are available in 1 out of 6 fitness test items only), we decided not to include these information in the present manuscript. However, if the reviewer finds that stating these data is fundamental for the interpretation of our findings, we could add it.

In terms of other variables like sedentary habits, we were restricted to questions on living area (rural or urban) and sports club participation (Yes or No option) by the Ministry of Education, Youth and Sport of the federal state Brandenburg. However, the reviewer is right that variables like time spent watching TV or playing computer games could also have an impact on level and/or development of physical fitness in children. Therefore, we stated this aspect as a limitation of the present study (see Discussion section). That is: “However, it should be noted that additional factors (e.g., time spent watching TV or playing computer games) that were not included in this study may also have an impact on physical fitness development and should therefore be targeted in future studies”.

Comment: Finally, the results of table 3 must be also adjusted by participate in a sport club to avoid any confounding factor.

Statement: In the present study, Chi-square test showed statistically significant associations between living area and sports club participation with a higher likelihood of not participating in a sports club when living in rural areas. Due to the fact that residential status compared to sports participation was a relatively stable factor over time, we adjusted our statistical mode for living area as confounding factor when
analyzing the effects of sports club participation on physical fitness development but not vice versa (i.e., adjustment for sports club participation as confounding factor when analyzing the effect of living area on physical fitness development). In addition, only 66 children of our study sample (N=172) continuously participated (n=49) or did not participate (n=17) in a sports club over the four-year period. The remaining children (n=106) changed their status of sports club participation (from YES to NO or vice versa) over the four-year period which is why they were not included in the analyses. In other words, the effect of sports club participation as a confounding factor is limited due to the small sample size of children (n=66) that continuously participated (n=49) or did not participate (n=17) and represents a relatively unstable character over time (n=106 children changed their status of sports club participation from YES to NO or vice versa). Therefore, we decided not to adjust our analysis regarding the influence of living area on physical fitness development for the factor sports club participation.

Comment: Minor Essential Revisions
1. It would be advisable to use current references in the introduction.

Statement: We updated the Introduction section by referring to the currently available literature. That is: “Recent studies regarding the health burden of chronic diseases revealed significant inverse associations between physical fitness and various cardiovascular risk factors (e.g., blood pressure, insulin resistance, cholesterol/lipids, overweight/adiposity) in children and adolescents [3-5]. Further, there is evidence that physical fitness and its health-related outcomes track from childhood over adolescence into adulthood [6, 7].”

Comment: 2. It is not recommended speak about a tendency towards a significant finding because it is going to depend on the size of sample

Statement: We agree with you and deleted information stating a tendency towards a significant finding.
Response to Referee #2: highlighted changes in grey

Comment: Reviewer's report: This manuscript addresses an important public health issue, regarding the effect or living area and the sports club participation in the level of physical fitness among children, during 4 years. The manuscript is clear, well-structured and well written. The topic is quite new in the scientific literature. Some minor might be addressed, to improve the current status of the manuscript. See the comments below.

Statement: We would like to thank the reviewer for the positive review.

Minor Essential Revisions:
Comment: 1. Introduction/Discussion
- When referring studies focused on the association between rural vs urban population with fitness levels, it is suggested including the study from Chillón et al. (2011) targeted between Spanish children and adolescents (J Sci Med Sport. 2011 Sep;14(5):417-23, Physical fitness in rural and urban children and adolescents from Spain).

Statement: As suggested, we included the study of Chillón et al. [8] in the Introduction and Discussion sections of the revised manuscript.
“Lastly, Chillon et al. [8] observed heterogeneous results in youth (7-13 years) with students from rural areas showing better performances in measures of aerobic capacity (20-m shuttle run), muscle endurance (bent-arm hang), and strength (handgrip). On the other hand, students living in urban areas showed better performances in measures of speed (5 x 10-m shuttle run), flexibility (sit-and-reach), and muscle endurance (sit-ups).”

Comment: 2. Results
- In the 1st paragraph, it seems there are some mistakes regarding the sample size when referring to the participation in sports club (from 4th to 7th lines). It is suggested reviewing it, since 49+17 is a much lower sample size that the sample included in the study (n=172).
Statement: The reviewer is right that incomplete information were provided. For clarification, we added information on sample size in the Method section (see Questionnaire). To see whether living area and/or sports club participations has an effect on physical fitness development in children, “Only children that did not change their residential status (n=172) over the 4-year study period were included for further analyses. Sixty-six out of 172 children either continuously participated (n=49) or did not participate (n=17) in a sports club at all”.

Comment: Figures 1 and 2.
- Include the legend (i.e., the significance symbols and the meaning of the two different data –white and black triangles or circles-).
- Include the title

Statement: As suggested by the reviewer, titles, figure legends, and notes regarding significance / data symbols were included in Figures 1 and 2.

Figure 1. Development of physical fitness in primary school children according to class and living area: (a) 50-m sprint, (b) 1-kg ball push, (c) triple hop, (d) stand-and-reach, (e) star coordination run, and (f) 9-min run. Notes. * p < 0.05; † p < 0.01; Filled triangles indicate urban and unfilled triangles indicate rural children

Figure 2. Development of physical fitness in primary school children according to class and sports club participation: (a) 50-m sprint, (b) 1-kg ball push, (c) triple hop, (d) stand-and-reach, (e) star coordination run, and (f) 9-min run. Notes. * p < 0.05; † p < 0.01; ‡ p < 0.001; Filled circles indicate children with and unfilled circles indicate children without continuous sports club participation

References used for revision:

