Author's response to reviews

Title: Association between physical activity and metabolic syndrome in middle-aged Japanese: a cross-sectional study

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Response to the Reviews

Thank you very much for your constructive comments and suggestions. We have considered all the comments carefully and revised our manuscript accordingly. Our responses to each comment (show in *Italics*) are as follows.

Editors comment:
"This is an interesting paper and of importance to its field. Some amendments according to the Reviewers' suggestions will further improve the text. Please respond to these suggestions and resubmit." Additionally we feel that the quality of written English needs to be improved before the manuscript can be considered further. We advise you to seek the assistance of a fluent English speaking colleague, or to have a professional editing service correct your language. Please ensure that particular attention is paid to the abstract.

Authors
Thank you for your comments. We substantially revised the manuscript in response to your comment and the comments provided by Reviewer 1 and 2. In addition, our manuscript has been edited by a professional English editing service to correct our language.

Reviewer # 1:
Minor Essential Revisions
1. Methods, Measurement of physical activity and sedentary time
   More details should be given about the specific questions related to the accelerometer data processing. For example, what was the epoch length?
   Authors
   In accordance with your comment, we have added several sentences to the Methods to describe the use of accelerometry and data processing (Page 6).

2. The authors state “Participants who did not record 600 min/day of activity for 7 days were excluded from further analyses”. This information needs a reference.
   Authors
   As suggested, we have added a reference to support this statement (Ref. 25).

3. Methods, Components of MetS
This description needs a reference.

Authors
As suggested, we have added references to support this statement (Ref. 26 and 27).

4. Statistical analysis
The authors state “In all logistic regression models, sex, age, low intensity activity, sedentary time, smoking, nutrient intake, and BMI were included as covariates.” However, some analyses were performed separately by sex. The authors must clarify when “sex” is used as a covariate.

Authors
Thank you for your suggestion. In accordance with this comment, we have clearly stated when sex was used as a covariate in the statistical analysis section (Page 8) and in Table 3.

5. Results
Page 9 - The authors state “Significant differences were found for age, body weight, and BMI between individuals with MetS and pre-MetS, and for those without MetS in both men and women (Table 2).” However, in Table 2 there is no difference in age among men with MetS and pre-MetS, and for those without MetS. Please, clarify.

Authors
Thank you for your comment. This has been corrected on page 10.

6. Page 10 - The authors state “As shown in Fig 1, around 8 factors (MVPA, sedentary time, low intensity activity, sex, age, smoking, caloric intake and menopausal status) were evaluated in CART analysis”. However, the authors only present 3 factors in Fig 1. If the others covariates were not significant for the model that should be mentioned.

Authors
Sedentary time, low intensity activity, smoking, calorie intake and menopausal status were not significant parameters in CART analysis. As suggested by the reviewer, we have described these findings in the Results section (Page 11).

7. Discussion
Page 13 - The authors wrote 41.0% instead of 41.2%. Please correct the value.
Table 1 - Sedentary time is presented in hours/day while the others two variables are presented in hours/week. Please, clarify.

Authors
Applying EPAR2006’s physical activity recommendation resulted in MetS prevalence of 41.0% (data was not shown; the prevalence of MetS from physical activity reference recommended by EPAR 2006), which was much higher than the results acquired by applying the new cutoff value of physical activity determined in our study (25.4%; the result from cutoff value of physical activity in the our study, Fig 1). Item 2 pointed out by the referee on has been corrected as hours/week on Table 1 and 2.

8. Major Compulsory Revisions
Methods, Blood Pressure

How many measurements of the blood pressure were taken? How did the authors get the SBP and DBP values presented in Table 1?

Authors

Thank you for your suggestion. We have stated the methods used to measure blood pressure and the biochemical parameters in the revised manuscript (Page 7).

9. Methods
The relation between physical activity and MetS was analyzed using logistic regression which was adjusted for sedentary time and low intensity activity. Why did the authors adjust the regression for both variables? Did they take into account the possible multicollinearity between these two variables?

Authors

Thank you for your suggestion. In accordance with this comment, we have added the following sentence in the Statistical analysis section (Page 9).

We determined the variance inflation factors (VIF) for multicollinearity between MVPA and low intensity activity (VIF = 1.04), MVPA and sedentary time VIF (VIF = 1.12) and low intensity activity and sedentary time (VIF = 4.29), all of which were <10 (Armitage et al. 2002). These results suggest that these variables did not modify the association between MVPA and MetS.

Results of multicollinearity tests using the variance inflation factor (VIF)

<table>
<thead>
<tr>
<th></th>
<th>Correlation coefficient</th>
<th>R²</th>
<th>VIF</th>
</tr>
</thead>
<tbody>
<tr>
<td>MVPA × low intensity PA</td>
<td>0.189</td>
<td>0.036</td>
<td>1.04</td>
</tr>
<tr>
<td>MVPA × sedentary time</td>
<td>−0.325</td>
<td>0.106</td>
<td>1.12</td>
</tr>
<tr>
<td>Low intensity PA × sedentary time</td>
<td>−0.876</td>
<td>0.767</td>
<td>4.29</td>
</tr>
</tbody>
</table>
10. When analyzing the data, the authors need to take into account different age groups because the age interval is too high (24 years old). There are some studies in adults that showed that the prevalence of MetS increases with age. Moreover, the results of the CART analysis revealed that “In the > 26.5 MetS-h/week group similarly, age was the most important factor for the split”.

Authors
We agree that there seems to be a strong age-dependence in the prevalence of MetS, as reported by Cornier et al (2008). Therefore, we have revised the data presented in Tables 1 and 2 in consideration of age. We thank you for your valuable suggestion.

11. Discussion
Page 11- The authors state” The results suggested that objectively measured physical activity was significantly associated with MetS in both sexes after adjusting the age”. Please, clarify.

Authors
In accordance with this comment, we have revised the Discussion section (Page 11).

12. Page 11- The authors state” The relationship between MVPA and the prevalence of MetS in women was less clear (Table 2)”. Please, clarify.

Authors
Thank you for your suggestion. According to your suggestion, we have added the sentence in the revised “Discussion” section (Page 11).

13. Page 14 - The authors state“For these reasons, determination of an objectively measured target physical activity level may present a possible strategy for preventing MetS, especially for middle-aged Japanese”. I do not understand what the authors want to highlight with this sentence. Indeed, precise measures of physical activity are more accurate to document the frequency and distribution of physical activity and also to determine the amount or dose of physical activity required to influence specific health parameters. How can “the determination of an objectively measured target physical activity level” be used as a strategy for preventing MetS? I think that a statement emphasizing the importance of promoting physical activity is necessary.

Authors
We thank you for this comment and we agree that the original phrase was unclear in its meaning. Accelerometer is a tool that can more accurately measure the level of physical activity, as compared with questionnaires, for example. In accordance with this comment,
we have revised the Discussion to clarify the value of objective measures of physical activity (Page 14).

14. Conclusions
The authors state “Moreover, our cross-sectional study suggests that moderate physical activity of >26.5 METs h/week may contribute to decreasing MetS risk in middle-aged Japanese men” The CART analysis also shows a decrease in the prevalence of MetS in women. Please, clarify.
Authors
In accordance with this comment, we have corrected the Conclusion (Page 15).

Reviewer #2:
1. Major Compulsory Revisions
The author must respond to these before a decision on publication can be reached. For example, additional necessary experiments or controls, statistical mistakes, errors in interpretation
Authors
Thank you for your comments. We substantially revised the Statistical analysis, Results and Discussion sections in response to your comment and the comments provided by Reviewer 1. In addition, our manuscript has been edited by a professional English editing service to correct our language.