Author's response to reviews

Title: The association between physical fitness and depressive symptoms among young adults: results of the Northern Finland 1966 birth cohort study

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Author's response to reviews: see over
Covering letter with a point-by-point response to the Reviewers

Dear Editor,

In reply to your letter of 9 April 2013, please find attached a copy of our manuscript entitled “The association between physical fitness and depressive symptoms among young adults: results of the Northern Finland 1966 birth cohort study” (authors Kadri Suija, Markku Timonen, Maarit Suviola, Jari Jokelainen, Marjo-Riitta Järvelin and Tuija Tammelin) which has been carefully revised in the light of the comments of the Reviewers, as detailed on the attached sheets.

On behalf of all co-authors I would like to thank the Reviewers for their constructive review of our manuscript.

We hope that this revised version will now be judged ready for publication in BMC Public Health.

I look forward to hearing from you.

Yours sincerely,

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Reviewer’s report (in italic) with answers

**Major Compulsory Revisions**

A demographics description and/or table was missing.

Answer:

We added a demographic descriptive data into the manuscript.

**Minor Essential Revisions**

Depression and depressive symptoms are both used in this article. However, since no structured interview was used to confirm official depression diagnoses, only depressive symptoms should be used in this article.

Answer:

We agree with your comment and corrected the terminology.

**Discretionary Revisions**

**Background**

In this article cross-sectional results about physical fitness and depressive symptoms were examined. However, the background mainly showed studies about physical activity and depressive symptoms and not about physical fitness while physical fitness is the most important variable in this article. Adding a paragraph with previous literature about physical fitness measurements in relation with depressive symptoms would be needed. There are also articles about depressive symptoms and other physical fitness measurements available such as hand grip strength (for example Rantanen et al. and Van Milligen et al.) which you could mention in this additional paragraph. In last paragraph of the background the suggestion was generated that physical fitness was an example of physical activity. My suggestion would be to split the information about this variables by adding a paragraph about physical fitness (see earlier comments) and to extend the last paragraph with concluded findings of the literature of both variables and to confirm two aims: 1) To determine the cross-sectional associations between physical activity and depressive symptoms and 2) to determined the cross-sectional associations between physical fitness (both cardiorespiratory and muscular fitness) and depressive symptoms. You could also writing about the differences between a self-reported
questionnaire for determine physical activity level and a more objective measurement of the physical fitness measurements. A beautiful very large cohort was used to answer the aims in this research. My suggestion would be to mention this important strength in last paragraph of the background. Further, it is a great plus point that physical fitness was measured with objective measurements which are in generally more objective thanself-reported questionnaires. My suggestion would be to mention this point in the last paragraph of the background.

Answer:
Thank you for your suggestions. We added the paragraph about fitness measurements and depressive symptoms as well as corrected the last paragraph of the background. Information about objective measurements of physical fitness is added into the background and also mentioned in the strength and limitation section.

Methods
In the study population section a short description of the cohort study was missing, such as description of the recruitment, percentage male/female etc. Further, a follow-up survey was conducted in 1997. Does this survey only included a self-report questionnaire with depressive symptoms and physical activity items or was the follow up more extensively? Could you add some information of the total follow up? 5497 persons completed the fitness test, do you mean both tests (cardiorespiratory and muscular tests)?

Answer:
We added a short description of the cohort into the methods section. You are right, this survey include both a self-report questionnaires and fitness tests and altogether 5497 persons completed it.

In the depressive symptoms section a mean score of 1.55 or 1.75 was used. In my opinion you should add that these points were a cut off point for important clinical depressive symptoms. A official depressive disorder diagnosis could not be reached by this measurement.

Answer:
We agree with your comment. We added this information into the manuscript.

In the paragraph Leisure-time physical activity a description of the quintiles was missing. Further, I wondered which questionnaire you have used to measure physical activity, was it a standardized measurement (such as the physical activity questionnaire of Craig et al.)?
Answer:
Quintiles of physical activity (Q1-Q5) were formed from five equally distributed groups of physical activity or fitness. The exact numbers of each quintile can be found in Table 1. We added this information into the manuscript.
The questionnaire used in this birth cohort study was developed for this purpose, and is described in detail in the methods section.

In the paragraph Physical fitness has been written that subjects were screened for cardiovascular diseases and orthopaedic problems. However, the results of this screening were not be given. Are there any drop outs due to this screening?
Answer:
Less than 10% of all subjects were excluded from the analyses for various reasons. The most common reasons for not performing step or trunk extension tests at this age of 31 years were ill health and pregnancy. We added this information into the manuscript.

Further, you could speculate about the fact whether heart rate is a good indicator of cardiorespiratory fitness. Why don’t you use maximal oxygen consumption (VO2max) which you do describe in this section? VO2max gives a more accurate and complete idea of cardiorespiratory fitness. However, if you choose to use heart rate is indicator of cardiorespiratory fitness, why do you describe maximal oxygen consumption in the methods although you do not use this variable in your analyses?
Answer:
We agree with you that VO2max gives a more accurate and complete idea of cardiorespiratory fitness. In the present study we estimated cardiorespiratory fitness by submaximal exercise test, and heart rate after step test can be considered as an estimate of VO2max [Tammelin T, Näyhä S, Rintamäki H: Cardiorespiratory fitness of males and females of northern Finland birth cohort of 1966 at age 31. Int J Sports Med 2004, 25:547-552.].
The main reason we performed submaximal exercise test was that direct measurement of VO2max during a maximal exercise test is time-consuming, requires laboratory equipment and involves certain health risks for some subjects especially in large populations.
You do not adjust for somatic diseases since your sample was very young. However, even in a young sample somatic diseases could have large impact at physical and mental functioning. Are the results different when you will adjust all analyses for somatic diseases?

Answer:
We agree with your comment that somatic diseases may have impact at physical and mental functioning also in young sample. We performed new statistical analyses and adjusted also for somatic diseases. The results did not change significantly. We added this information into the manuscript (Table 2).

In the Statistical methods section in first sentence ‘prevalence of depression’ have to be replaced by ‘depressive symptoms’ since you do not use official depressive disorder diagnoses.

Answer:
We clarified this issue in the manuscript.

It would be most clearly when the sequence of paragraphs in the Methods is comparable to the sequence of the variables in table 1. Further, a description is the quintiles of each variable in the methods was missing.

Answer:
We changed the sequence of paragraphs.

Results
Why were men and women separated in the analyses? May you could add an interaction term to explain this separation?

Answer:

In second paragraph important outcomes of the prevalence of depressive symptoms were described. However, numbers and important p-values were missing. Further, figures of the
data of table 1 may give a better overview of the results than table 1. In the tables ‘heart rate’ was mentioned although in the text ‘cardiorespiratory fitness’ was used. I would suggest that same indication will be used.

Answer:
We added some numbers and p-values into the second paragraph.
We also corrected the terminology (cardiorespiratory fitness and heart rate).
We discussed with authors your suggestion to make figure instead of table but we were afraid that we will lose important data. Thus, we decided to keep table.
Thank you for your suggestions.

Discussion
The discussion section is not very extended. The author may give more information about the differences between men and women in the association between physical fitness and depressive symptoms. Further, the findings of this study could be compared to earlier research with for example self-reported questionnaires and the author may give their reaction on their earlier determined hypotheses. So, more detailed explanations of the results are needed. First paragraph gives a good overview of the most important results of this study: poor muscular fitness was associated with more depressive symptoms which is following the author new information about this association. However, I don’t think that these results are new but the results are consistent with previous research of Rantanen et al., Van Milligen et al. and Goodwin et al., who all showed associations between hand grip strength/ lung function and depressive symptoms.

Answer:
We extended the discussion according to your comments.

Study limitations and strengths
In my opinion, third paragraph should be replaced to the background section because of the global information which was given between physical fitness/ activity and depression.

Answer:
We added the information about physical fitness measurement into the background. However, we mention this important strength also in the discussion part.

Level of interest: An article whose findings are important to those with closely related research interests
Quality of written English: Acceptable

Statistical review: No, the manuscript does not need to be seen by a statistician.

Declaration of competing interests: I declare that I have no competing interests.

Answer:

Thank you for your review and comments.
Reviewer 2
Joel Hughes

Reviewer’s report (in italic) with answers

This cross-sectional study was well executed and written. The data are exceptional; large sample size, good measures (not all self-report), etc.
The authors note that there is an epidemiological literature on depression and physical activity, as well as some longitudinal studies and some intervention studies. Therefore, demonstrating what this manuscript adds to the literature is important. This made some parts of the introduction confusing. For example, “the etiological mechanisms and causal directions underlying the link between physical activity and depression are, however, unknown.” Will this study uncover etiology or causal directions? I didn’t think so.
Answer:
We agree with your comment and re-wrote some parts of the background.

The discussion does a better job of “selling” the novelty of measures of muscle strength in addition to cardiorespiratory fitness. The null findings for fitness could be a ceiling effect? Were most participants “good enough” at sub-maximal stepping? How can you control for motivation of depressed participants? Do they give the best possible effort given their higher depressed mood?
Answer:
Thank you for your comment. Ceiling effect was not seen in step test, but was observed during trunk extension test, when 19% of men and 39% of women reached the maximum time of four minutes. Your question about motivation of depressed participants is important. All objective performance measurements partly depend upon the subject’s motivation to perform. We did not measure our participants’ motivation it specifically. However, all the participants gave their informed consent and therefore we hope that all the participants also gave their best possible effort.

- Major Compulsory Revisions
Revise the introduction to lead to specific research questions that the design can evaluate.
Avoid critiquing the literature in ways that your study does not address.
Answer:
Thank you for your comment. We clarified the introduction.

- **Discretionary Revisions**

  Consider the critiques above re; ceiling effects and motivation-I don’t know the answer. Just thoughts for consideration.

  Answer:
  Thank you. We added these issues into the manuscript.

  **BMC Public Health** has a policy of publishing all scientifically sound research whatever its level of interest. However if you choose one of the first three categories below, we may ask the authors if they would like the manuscript considered instead for the more selective journal **BMC Medicine**.

  - Do you hold or are you currently applying for any patents relating to the content of the manuscript? Have you received reimbursements, fees, funding, or salary from an organization that holds or has applied for patents relating to the content of the manuscript?
    No
  - Do you have any other financial competing interests?
    No
  - Do you have any non-financial competing interests in relation to this paper?
    No

  'I declare that I have no competing interests'

  **What next?**

  - Accept after minor essential and discretionary revisions (which the authors can be trusted to make)

  **Level of interest:** An article whose findings are important to those with closely related research interests

  **Quality of written English:** Acceptable

  **Statistical review:** No, the manuscript does not need to be seen by a statistician.

  **Declaration of competing interests:**

  'I declare that I have no competing interests'

  Answer:

  Thank you for your review and comments.
Reviewer’s report (in italic) with answers

The aim of the current study was to determine the association between physical activity and physical fitness and depression. The authors used a cross-sectional cohort design. They found that physical strength and self-reported physical activity was inversely related to depression. They found no association between cardiorespiratory fitness and depression.

Abstract:
The abstract is well-written. Please provide the ORs and CIs for negative findings as well.
Answer:
We provided ORs and CIs also for negative findings.

Introduction
A fair presentation of the case and hypothesis. I am not convinced if actual physical fitness has not been used before - the Copenhagen City Heart Study? I agree with the authors that cross-sectional studies only show associations (like the present) and cannot claim causality. However, this goes for the prospective cohort studies as well. And they do not 'indicate' any causality. 'Suggest' is more soft.
Answer:
We agree with your comment and used 'suggest' instead of 'hypothesis'.

Methods
Please provide the percentage after '5497 (XX percent) persons participated in the fitness test'
Answer:
We added this percentage into the manuscript.

Why did you choose a submaximal test and not a maximal test, especially in this young population?
Answer:
The main reason we performed submaximal exercise test was that direct measurement of VO2max during a maximal exercise test is time-consuming, requires laboratory equipment and involves certain health risks for some subjects especially in large populations.

*What were your thoughts on the depression test? It is not very used in clinical practice*

**Answer:**
We used Hopkins’ Symptom Checklist-25 (HSCL-25). A depression subscale of HSCL-25 consists of 13 items. We used this questionnaire because it is short self-rating scale for depression and we have expertise in this questionnaire. Additionally, HSCL-25 has proved to be an acceptable screening scale for obtaining information on symptoms of depression among large population [Sandanger I, Moum T, Ingebrigtsen G, Dalgard OS, Sörensen T, Bruusgaard D: *Concordance between symptom screening and diagnostic procedure: the Hopkins Symptom Checklist-25 and the composite international diagnostic interview I*. Soc Psychiatry Psychiatr Epidemiol 1998, 33:345-354.].

*If I understand correctly, you used the heart rate after a submaximal test as an indicator of physical fitness. I am very concerned with this. I my experience there is not a very high correlation between these two measures. Could you please elaborate on this potential problem in the methods section and provide data that your method is acceptable.*

**Answer:**
Thank you for this comment. We performed a submaximal four-minute single step test and used heart rate after step test as an indicator of cardiorespiratory fitness. The main reason for performing submaximal exercise test instead of maximal test was that direct measurement of VO2max during a maximal exercise test is time-consuming, requires laboratory equipment and involves certain health risks for some subjects especially in large populations. The correlation coefficient between heart rate after step test and peak oxygen uptake during maximal exercise test as 0.53 among 123 adults aged 31 years [Tammelin T, Näyhä S, Rintamäki H: *Cardiorespiratory fitness of males and females of northern Finland birth cohort of 1966 at age 31*. Int J Sports Med 2004, 25:547-552].

We have also developed the VO2max prediction model that includes self-reported physical activity, but in the present study we wanted to keep all fitness measures objective. We agree with your, that maximal testing is more accurate than submaximal test, however, there are always pros and cons. According to the literature both tests can be used [Noonan V, Dean E:

**Results**

*Table 1. It is a bit awkward using 95% CI on different mean amount of physical activity. It is not an estimate, and secondly the overlap the other categories.*

**Answer:**

Thank you for your comment. After a careful consideration with the statistic of our research group we decided not to change the statistical methods.

**Discussion**

*The authors argue that their unexpected findings of no association between actual physical fitness and depression must be a mistake - then why analyze it?. Could it be that this finding is actually correct. That patients with depression underestimate the amount of time they actually engage in physical activity – recall bias?*

**Answer:**

We found that that low level of isometric endurance capacity of trunk extensor muscles is associated with high level of depressive symptoms in both sexes. In males, also poor handgrip strength was associated with increased levels of depressive symptoms. The physical activity level was inversely associated with the prevalence of depressive symptoms among young adults. Interestingly, there was no significant association between objectively measured cardiorespiratory fitness and depressive symptoms in either males or females.

We agree with your comment that patients with depression may underestimate the amount of time they are engaged in physical activity. Further investigations are needed to clarify this issue.

*The authors claim that physical activity is good due to its positive effects on both physical and mental health - and do not provide a reference. The evidence that exercise should be beneficial in depression from RCT is not discussed - only a small study finding a positive effect is cited. The largest study to date was published in BMJ last year - showing no effect of exercise on depressive symptoms - what so ever. I think that is worth a mentioning in this discussion. Overall a fair and balanced description of the results.*

**Answer:**

We extended the discussion according to your comments and added missing references.
Level of interest: An article of limited interest
Quality of written English: Acceptable
Statistical review: No, the manuscript does not need to be seen by a statistician.
Declaration of competing interests:
I declare that I have no competing interests

Answer:
Thank you for your review and comments.