

PEER REVIEW HISTORY

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ARTICLE DETAILS

TITLE (PROVISIONAL)	Motor Impairment and its relationship to fitness in children
AUTHORS	Morris, Martyn; Dawes, Helen; Howells, Ken; Janssen, Roel

VERSION 1 - REVIEW

REVIEWER	Professor Beth Hands Director, Institute for Health Research University of Notre Dame Australia
REVIEW RETURNED	05-Apr-2013

THE STUDY	<p>In general the authors tended to make some very sweeping statements and to over generalise their findings (and those of others). It would be helpful if they were more precise in their terminology and able to better justify the conclusions reached. For example, how much did the poorer coordination of the LMC group contribute to their poorer outcomes - for example could that have affected their capacity to maintain the cadence on the bike?</p> <p>A major concern is the use of the movement M-ABC to group the participants into high and low competence. The test is designed to identify motor impairment and not motor competence in general- consequently the included items are very limited in the aspects they measure. It may be better to group the participants into those with scores above and below the 15th percentile.</p> <p>I found the results very difficult to follow and would like to see the results tabulated – for example the authors should provide a table of the participant characteristics and all outcome measures. How many were in each group- was it 18 in the LMC and 17 in the HMC? How did you select the 10 in each group who completed the MVIC? - what was their M -ABC scores? Why was the whole sample not tested? P10/18- HMC groups were mentioned- how many groups were there? Or was that a typo?</p> <p>One reference omission that may assist in a more balanced interpretation is Cairney, J., Hay, J., Wade, T., Faught, B., & Flouris, A. (2006). Developmental coordination disorder and aerobic fitness: is it all in their heads or is measurement still an issue? <i>American Journal of Human Biology</i>, 18, 66-70.</p>
RESULTS & CONCLUSIONS	Some statements are not linked directly to the results. Many seem to be simply hypothetical. The authors do not consider what other explanations could be offered?
GENERAL COMMENTS	<p>P213 This statement does not make sense. Remove the double negative.</p> <p>P2119 safer than what?. What does the second sentence mean? How is this different from other aerobic exercise tests such as walking/running on a treadmill?</p> <p>P3112 Should this be maximal voluntary isometric contraction?</p>

	<p>P3122+ this is a very long sentence. Break it into 2.</p> <p>P5110 The references used to support this statement are not appropriate. Low fitness may or may not be associated with low PA- this is the opposite to argument of paper.</p> <p>P5122 in a series of interviews with (rather than in) adolescents..... and with (rather than in) Children</p> <p>P5124 Spelling on individuals</p> <p>P7122 Start sentence with a word rather than a number i.e.Thirty five. Check paper for other instances (e.g p9122, p1018)</p> <p>P71181 correct spelling of scales</p> <p>P1019 add percentile after 5th</p> <p>p10117 That is a large SD for max HR for LMC group. What were p-values? The data seem very skewed.</p> <p>p1126 It is unclear what you are trying to say in this sentence- please rephrase.</p> <p>P1213 Please explain clearly how you reached this explanation.</p> <p>P1217+ A very long sentence please break into 2 as meaning becomes lost. What does last part mean? Please clarify. Such statements need to be linked directly to the results. It seems to be simply hypothetical. What other explanations could be offered?</p> <p>P12112 rises not raises</p> <p>P1316 Could some children have a lower pain threshold? Lower motivation to push themselves? See (Cairney, Hay, Wade, Faught, & Flouris, 2006) Cairney, J., Hay, J., Wade, T., Faught, B., & Flouris, A. (2006). Developmental coordination disorder and aerobic fitness: is it all in their heads or is measurement still an issue? American Journal of Human Biology, 18, 66-70.</p> <p>P1319 What does this sentence mean?</p> <p>P13118 Don't repeat results in the discussion section.</p>
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REVIEWER	<p>Dr Duncan Buchan Senior Lecturer Institute of Clinical Exercise and Health Science University of the West of Scotland Almada Street Hamilton, South Lanarkshire ML3 0JB</p>
REVIEW RETURNED	05-Apr-2013

THE STUDY	<p>Whilst this is a very interesting paper, limited information has been supplied concerning the participants characteristics. For instance:</p> <ol style="list-style-type: none"> 1. No maturation information provided. 2. No information concerning the weight status of participants i.e. overweight / obese. 3. No information regarding current physical activity behaviours. <p>This submission would be improved if this information is provided. The authors may wish to further analyze the relationships between low physical activity / weight status and motor competence.</p>
GENERAL COMMENTS	<p>This is a very interesting paper and further work should explore the effects of differing exercise interventions upon motor competence.</p>

VERSION 1 – AUTHOR RESPONSE

Reviewer: Professor Beth Hands
Director, Institute for Health Research
University of Notre Dame Australia

In general the authors tended to make some very sweeping statements and to over generalise their findings (and those of others). It would be helpful if they were more precise in their terminology and able to better justify the conclusions reached. For example, how much did the poorer coordination of the LMC group contribute to their poorer outcomes - for example could that have affected their capacity to maintain the cadence on the bike?

Author response: The authors would like to thank the reviewers for their detailed assessment of the submitted manuscript. The feedback has allowed us the opportunity to more thoroughly support the findings of the work, and to focus the important conclusions and support with relevant literature in a more succinct manner and to be more precise with the terminology used throughout.

In response to the point raised regarding the level of coordination and its potential impact on the participants with low motor competence performance, there was no difference in the cadence maintained between the groups during the exercise test. Albeit a rather crude measure of coordination, it did reflect the ability of the participants to follow instruction. Also, the reliability data in the 10 high motor impaired (HMI) participants demonstrate that had their poor coordination impacted on the results, it did so in a reliable fashion and therefore substantiates its usefulness in describing the fitness levels in this population. Although it cant be reported that coordination did not impact the results, the high RER and RPE at the end of the exercise supports the argument that the limitation was physiological. One potential measure we could have used to help investigate coordination issues, and its impact on the exercise outcome, is EMG to report the level of coordination between the major muscle groups utilise during cycling and any evidence of co-contraction. However, we feel that although useful, it would somewhat deter away from the main aim of the work.

A major concern is the use of the movement M-ABC to group the participants into high and low competence. The test is designed to identify motor impairment and not motor competence in general- consequently the included items are very limited in the aspects they measure. It may be better to group the participants into those with scores above and below the 15th percentile.

Author response: A valid point raised regarding the use of impairment or competence. As rightly stated, the M-ABC is identifying motor impairment therefore the group identified previously as low motor competence (LMC) have been renamed high motor impairment (HMI) with the previous high motor competence (HMC) group renamed (LMI). The title of the paper has been altered also to reflect this. In the manuscript (p6 110) it states that any child scoring below the 15th percentile would be classified as being HMI.

I found the results very difficult to follow and would like to see the results tabulated – for example the authors should provide a table of the participant characteristics and all outcome measures.

Author Response: I agree that a table outlining the results enables the reader to have a clearer view on the outcome measures of the paper. A table has been included in the results section, incorporating all outcome measures

How many were in each group- was it 18 in the LMC and 17 in the HMC?

Author response: Yes, 18 LMC v 17 HMC. However, to improve the clarity of this point it has been added to the opening section of the results and also added to table 1. Manuscript now reads:

Eighteen participants obtained total scores considered to be HMI, i.e. below the M-ABC 15th percentile, with 5 at or below the 5th percentile, and 17 classified as low motor impairment (LMI) (M-ABC > 15th percentile).

How did you select the 10 in each group who completed the MVIC? - what was their M-ABC scores? Why was the whole sample not tested?

Author response: Participants were randomly selected from the groups to undertake the maximal strength test. This required a second visit to the laboratory which not all participants could attend. However, the M-ABC scores for the groups were representative of the whole group (LMC 4.3 (5.4) and HMC 68.6 (19.9) respectively. The M-ABC results for the participants are included in table 2 to improve clarity of this point for the reader.

P9116- HMC groups were mentioned- how many groups were there? Or was that a typo?

Author response: Apologies this was a typo, now removed.

One reference omission that may assist in a more balanced interpretation is Cairney, J., Hay, J., Wade, T., Faught, B., & Flouris, A. (2006). Developmental coordination disorder and aerobic fitness: is it all in their heads or is measurement still an issue? *American Journal of Human Biology*, 18, 66-70.

Author response: The author agrees that this is a useful reference when looking at the psychological aspects of exercise in children with high motor impairment. It was originally referenced on P5 I1 and has now also been utilised to support a more balanced argument toward the possible limitations to exercise performance in this population. Within manuscript on p13 I11 now reads:

Work by Cairney et.al.18 suggested that reduced exercise performance of children with motor impairment was partly related to the level of perceived adequacy for the task. The findings of this current work suggest that the limitations to exercise in the high motor impairment group had strong physiological underpinnings reflected in the criteria for a maximal effort being attained in all but one of the participants.

Some statements are not linked directly to the results. Many seem to be simply hypothetical. The authors do not consider what other explanations could be offered?

Author response: The thorough review by the reviewers has allowed us to really focus the paper and better link the results to our conclusions. Hypothetical statements have been removed and findings placed in better context, supported by the research literature.

P1712 This statement does not make sense. Remove the double negative.

Author response: Double negative removed to improve clarity of message.

P17123 safer than what?. What does the second sentence mean? How is this different from other aerobic exercise tests such as walking/running on a treadmill?

Author response: Given that we did not compare across modalities we have altered 'safer' and used 'safe' as that is what we have found in this work. What we were implying in this sentence is that cycling ergometry demonstrated to be a safe mode of exercise, allowing all participants bar one to reach maximal criteria. However, the second half of the sentence makes note of the fact that this mode of exercise does not take into account whole body exercise, placing obvious reliance on the lower limbs, which may over emphasise the weakness in these limbs in this particular population. Manuscript now reads:

- The use of cycle ergometry is a safe option for maximal testing, allowing participants to give a maximal effort. However, due to the nature of the exercise, the weakness in the exercising musculature may be accentuated.

P2112 Should this be maximal voluntary isometric contraction?

Author response: Yes, this has now been corrected.

P2I22+ this is a very long sentence. Break it into 2.

Author response: Sentence broken into two as suggested. Within manuscript now reads:
The lower heart rate at exercise cessation, coupled with reduced movement efficiency and lower muscle strength reported in this group, would suggest exercise is limited by impairment at the muscular level. This finding was supported by the high RER values despite low maximal heart rate values attained during the exercise test and reduced maximal strength.

P4I10 The references used to support this statement are not appropriate. Low fitness may or may not be associated with low PA- this is the opposite to argument of paper.

Author response: On reflection this sentence did not add to the manuscript so it has been removed.

P4I17 in a series of interviews with (rather than in) adolescents..... and with (rather than in) Children

Author response: Sentenced altered as suggested. Within manuscript now reads:
In a series of interviews with adolescents with Developmental Coordination Disorder (DCD) 13 14 and with children with cerebral palsy

P4I22 Spelling on individuals

Author response: Spelling changed.

P5I23 Start sentence with a word rather than a number i.e.Thirty five. Check paper for other instances (e.g p9I22, p10I8)

Author response: Corrected throughout manuscript.

P6I14I correct spelling of scales

Author response: Spelling corrected.

P9I6 add percentile after 5th

Author response: Percentile added

P9I15 That is a large SD for max HR for LMC group. What were p-values? The data seem very skewed.

Author response: There was a wider range of maximal heart rates in the LMC group. However, the author is happy that this is not because of a lack of motivation from the participants as evidenced by the high RER values at exhaustion. This supports one of the major findings of the work in that the cardiovascular system is not being maximally taxed due to the failure of the exercising musculature. The p value for the comparison of heart rate between groups was $p=0.02$.

p10I25 It is unclear what you are trying to say in this sentence- please rephrase.

P11I2 Please explain clearly how you reached this explanation.

Author response: The two points raised above have been addressed in the rewrite of the opening paragraph of the discussion. Manuscript now reads:

Examination of the exercise test data showed a significant difference in peak, / workload, oxygen pulse, maximum heart rate and MVIC between the HMI and LMI group. Interestingly there was no difference in maximal rating of perceived exertion or RER. When considering limits to exercise in people with high motor impairment, the maximal RER and fat oxidation levels at test termination, suggest low levels of aerobic muscle performance and not a heightened perceived level of exertion, were limiting exercise performance.

This was rewritten to more clearly highlight that the children with HMI clearly pushed themselves maximally (as reflected in meeting criteria for maximal exercise) but did not have a heightened perception of effort as this was the same as that reported by the LMI group.

P1115+ A very long sentence please break into 2 as meaning becomes lost. What does last part mean? Please clarify. Such statements need to be linked directly to the results. It seems to be simply hypothetical. What other explanations could be offered?

Author response: Sentence broken into two as suggested. The sentence has been adjusted to link our findings to the literature and the importance of muscle for health. Manuscript now reads:

These findings are important as they highlight a low level of aerobic muscle performance as a major factor limiting exercise performance in children with poor coordination. Muscle plays a central role in health and disease across the lifespan²⁹ and, if left unaddressed in children with HMI, is likely to continue into adulthood and contribute to the development of metabolic disorders in this population.

P11114 rises not raises

Author response: Corrected.

P1214 Could some children have a lower pain threshold? Lower motivation to push themselves?

Author response: It is the authors belief that the children did not show a reduced motivation to push themselves. This is reflected not only in the maximal RPE level reached at the end of the test, but by the maximal RER levels reported at the end of the test. A RER level greater than 1.0 is reflective of an increased contribution from anaerobic energy and therefore would have generated high amounts of lactic acid (unfortunately this was not measured in this study, however lactic acid levels have shown high variability in the children). In light of this, the children demonstrated good motivation to tolerate this intensity of exercise as shown by the RER levels of 1.15 (0.09) and 1.18 (0.09) in the HMI and LMI group respectively.

P1218 What does this sentence mean?

Author response: O₂ pulse is an indirect measure of cardiac function (stroke volume). Despite the difference shown between the groups in this study (probably due to the greater exercise capacity in the LMI group), the O₂ pulse of 12.1 ml.beat reported in the HMI is still within the normal range for this age group and therefore demonstrates that their exercise performance was not limited by central mechanisms. This supports our argument for the limitation being predominately peripheral in nature.

P13118 Don't repeat results in the discussion section.

Author response: Results removed as suggested

Reviewer: Dr Duncan Buchan
Senior Lecturer
Institute of Clinical Exercise and Health Science
University of the West of Scotland
Almada Street
Hamilton, South Lanarkshire
ML3 0JB

Whilst this is a very interesting paper, limited information has been supplied concerning the participants characteristics. For instance:

1. No maturation information provided.

Author response: No data for maturation was collected in this current cohort. Despite this, there was no significant difference in age, stature and weight between the groups and given this, it could be assumed that there was a spread of maturation levels within the groups. Without access to a clinical doctor for physical examination of the participants, a self-assessment questionnaire for pubertal status could have been utilised. Despite such scales having shown to underestimate pubertal status we acknowledge that some further information on maturation status is warranted in future work in

such populations.

2. No information concerning the weight status of participants i.e. overweight / obese.

Author response: Participant information now included in table 1 alongside the outcome measures. We now feel this makes the results section much easier for the reader to navigate and digest the main findings of the manuscript and offers an increased descriptor of the participants involved in the study.

3. No information regarding current physical activity behaviours.

Author response: We did utilise the Physical Activity Questionnaire developed by Kowalski et al (1997), however this was the last item in the test battery and hence compliance was not as good due to time constraints. Compliance was particularly poor in the LMI group with the response rate from the HMI group being greater than participants with LMI (HMI, n = 16 (out of 18), PAQ score of 1.87 (0.8) v LMI, n = 7 (out of 17), PAQ score of 2.17 (0.78)). Due to the poor response rate from the LMI group this data was omitted from the original manuscript. This data could be included to manuscript.

This submission would be improved if this information is provided. The authors may wish to further analyze the relationships between low physical activity / weight status and motor competence.

Author response: This is very interesting area, one that we had not thought of investigating previously, and we were intrigued to do so. When looking at the measures we found that there was no relationship between BMI and M-ABC score, as would be expected with a non-significant difference in BMI between the groups ($r = -0.18, p > 0.05$). These relationships will most certainly be something we will be exploring in future work, we thank you for raising this, and would be happy to add this analysis into the manuscript.

This is a very interesting paper and further work should explore the effects of differing exercise interventions upon motor competence.

VERSION 2 – REVIEW

REVIEWER	Professor Beth Hands, PhD Director, Institute for Health Research The University of Notre Dame Australia 19 Mouat Street (PO Box 1225) Fremantle Western Australia 6959
REVIEW RETURNED	23-May-2013

THE STUDY	P6112 I don't think you can call those who scored above the 15th percentile as low motor impairment as it still implies some level of motor impairment- perhaps use "no motor impairment"? (NMI?). Add information about this group in this section.
RESULTS & CONCLUSIONS	Figures 1 and 2 If the MABC scores are percentiles the x axis should only for to 100. What are the regression line equations? Table 1 what is measure for MABC? Should headings read HMI and LMI (or NMI). Is this percentile?
REPORTING & ETHICS	There should be a statement in the paper that the study received an ethical clearance from the primary institution and that all parents (and ideally) children were consented.
GENERAL COMMENTS	General Comments I n general the paper is much improved and more clearly delivers the key message. However, the use of the terms high or low motor

impairment does not work. I would suggest motor impairment and no motor impairment. Using LMI implies there is still some level of impairment.

The authors also need to clearly define the terms motor impairment, movement difficulties and poor coordination. These terms are all used in the paper. On page 4 the authors suggest movement difficulties are distinct from poor coordination. The discussion is very repetitive and could be tightened up significantly- at present it gives the impression of "padding out".

There should be a statement in the paper that the study received an ethical clearance from the primary institution and that all parents (and ideally) children were consented.

Specific Comments

P2114 How was motor impairment measured- this needs to be reported in the abstract.

P313 Add a period after impairment. Start a new sentence

P413 The second part of the sentence needs a reference.

P415 What is the difference between movement difficulties, poor coordination and motor impairment?

P4112 Reference 11 does not seem relevant to this sentence

P6112 I don't think you can call those who scored above the 15th percentile as low motor impairment as it still implies some level of motor impairment- perhaps use "no motor impairment"? (NMI?). Add information about this group in this section.

P1112 You did not measure the participant's perceptual factors and many of the physiological factors before undertaking the test. So you cannot claim that the individuals had different physiological or perceptual factors beforehand (just motor impairment).

P1115 add "in" between difference and maximal.

P11111 rewrite this sentence. What should be left unaddressed... muscle?

P11119 This sentence seems to be a repeat on one in paragraph above (l10). In fact much of the discussion is repeating the same point based on different outcomes- this could be written much more succinctly.

P1717 You have a double negative in this point. Please rewrite.

P17113 These two dot points are almost contradictory. Please

	<p>rewrite to clarify.</p> <p>Figures 1 and 2 If the MABC scores are percentiles the x axis should only for to 100. What are the regression line equations?</p> <p>Table 1 what is measure for MABC? Should headings read HMI and LMI (or NMI). Is this percentile?</p>
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VERSION 2 – AUTHOR RESPONSE

1. P6112 I don't think you can call those who scored above the 15th percentile as low motor impairment as it still implies some level of motor impairment- perhaps use "no motor impairment"? (NMI?). Add information about this group in this section.

Author response: We feel this a very valid point and have therefore adjusted the description of this group (highlighted on p6112) so as the children scoring above the 15th percentile are described as: 'Children scoring above the 15th percentile were classified as having no motor impairment (NMI).' Low motor impairment (LMI) has subsequently been changed to NMI throughout the manuscript and on accompanying figures and tables.

2. There should be a statement in the paper that the study received an ethical clearance from the primary institution and that all parents (and ideally) children were consented.

Author response: There was a statement on p519 that the study was approved by the University Research Ethics board and also that parents and child consent were gained prior to the study (p5112) in the previous submission. This has been highlighted in the text but we are happy to clarify further should the reviewers wish.