Reviewer’s report

Title: Foot orthoses alter lower limb biomechanics but not jump performance in basketball players with and without flat feet

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Reviewer: Hannah Jarvis

Reviewer's report:

Thank you for the invitation to review this interesting and generally well written article by these authors. I enjoyed reading it and it provides a useful research publication in an area of little research. I have itemised some queries and comments regarding the manuscript below.

1. Title - Should the title include "in basketball players?" I leave this to authors discretion, but the article pertains specifically to basketball players and when discussing the results the authors discuss basketball players and the implications of their results on the outcome of a game, so I wonder if this might be a useful inclusion?

Abstract

2. Methods:
   a. Page 2, Lines 24-25: Please can the authors describe how they classified participants foot type as normal arched or flat footed?

Results:

b. Page 2, line 35: "There were no significant interactions in both jumping tasks (p>0.05)."
   This sentence is open ended, and I'm not sure this sentence is even needed as the authors discuss the interactions between tasks in the next sentences.

Main article

3. Background

a. The first paragraph is very long, please consider splitting into two paragraphs.

b. Page 4, line 9-21: "Biomechanically, for an effective push-off during jumping, the foot supinates at the subtalar joint. Supination makes the foot rigid and provides an effective lever for propulsion. Flat-footed individuals have been postulated to have 'weak feet' [2] and demonstrate poor ability to control movements in the ankle and foot complex [3]. A flat (or pronated) foot does not supinate effectively [2] and thus may limit one's potential to jump efficiently."

Whilst undoubtedly the work of Whitman is landmark for its time and provided useful information on foot biomechanics, it is published in 1896 and I question the validity and applicability of it when compared to our understanding of foot and ankle biomechanics today. The "rigid lever" theory stems
from the seminal work of Root et al (1977) and Wright et al (1964) which has also been heavily
criticised in recent research (see separate works by Nester, Jarvis, Lundgren, Buldt). I would suggest
the authors revise this section of the background and add in more recent and relevant research

c. Page 4, line 35: "More studies are required to substantiate the relationship"
I would suggest revising this to "investigate the relationship" as substantiate suggests there is a
relationship between these variables, but actually it warrants further investigation.

d. Page 4. Lines 35-44: "More studies are required to substantiate the relationship between flat feet and
jumping biomechanics in trained athletes during shod conditions as this
provides a more realistic condition to enhance the understanding of flat-footed individuals' performance in sports."
I understand what the authors are suggesting here but I think it needs revising. Why should shod
conditions provide a more realistic condition?

e. Page 5, lines 20-21: The second hypotheses reads: "flat-footed athletes wearing foot orthoses would
have better jump performance and take-off biomechanics"
Do the authors mean better jump performance and take-off biomechanics than without foot orthoses
and/or those who are normal arched? Please can the authors add clarification on this as the statistical
tests they have included indicates that you have conducted all of these comparisons?

4. Methods

a. Page 6, line 7-17: "Participants were included if they had normal-arched feet or flat feet. They were
deemed eligible if both their left and right feet were classified as either normal-arched or flat-footed
based on the criteria set out in two of the three screening tests: Chippaux-Smirak index, navicular drop
test and the resting calcaneal angle measurement."
I think the authors need to add further clarification as to why they chose these measures to define
participants with a normal arched or flat feet. For example, why did the participants not use clarke's
angle? (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4310876/). There is considerable evidence to
question the validity and reliability of these measures which in-turn questions the classification of
participants used in this study so statements to support their inclusion would help support this work.

b. Page 6, lines 54 to page 7 lines 2: Resting calcaneal stance angle measurement: For the resting
calcaneal angle measurement, the degree of angular deviation of the calcaneal bisection line from
perpendicular is measured using a goniometer [15]. A flat foot is one with a calcaneal angle of more
than 5 degrees, while a normal-arched foot has a calcaneal angle of between 0 to 5 degrees [15].
Reference 15 does not refer to or describe this classification of foot type, please revise or include
another reference to verify this statement.

c. Page 8 line 21-23 "CMJ by going into a squatted position with hips and knees bent.."
Instead of "bent," should "flexed" be used?

5. Results

a. Example of a result in text reads "0.58(0.08) m" should it be written 0.58m (0.08)?

b. Page 10, lines 35 onwards: The mean jump heights of the normal arched with and without foot
orthoses was 0.58(0.08) m and 0.57(0.07) m respectively. The jump height of the flat-footed group was
0.60(0.08) m with and without foot orthoses. There was no significant interaction effect between foot
type and foot orthosis (p>0.050) for all variables. There was a significant effect of foot type on ankle
plantarflexion (p=0.008) and peak hip joint power (p=0.012) at CMJ take off. The flat-footed group exhibited less ankle plantarflexion (Table 1) and less peak hip joint power than the flat-footed group (Table 2). There was a significant effect of foot orthosis on ankle eversion only (p=0.016) at CMJ take off."

The authors present some interesting findings, but the results section needs clarification:

Why do the authors not present p values for the comparison between normal arched and flat footed with and without orthoses? Would it be more useful to write it or a similar derivative of:
"The mean jump height achieved by the group with normal arched feet when not wearing orthoses (0.57(0.07)) was similar to when they were wearing orthoses (0.58m (0.08) p = xx) and was similar to the flat footed group wearing and not wearing orthoses (0.60m(0.08) p = xx and p = xx)."

c. Although they are not significant, why do the authors not present any p values for the comparison between the variables described above?

d. Page 10, line 45: "There was no significant interaction effect between foot type and foot orthosis (p>0.050) for all variables"

What variables are the authors referring to here? This is the same problem for SBJ as well, please can the authors clarify?

e. Page 11, line 1: There was no significant difference in jump distances due to foot type and foot orthosis.

I am not sure this sentence is required

6. Discussion

I think generally the discussion is well written and the section Page 12, lines 1 -42 provides some interesting points for discussion and future work. The authors present a relatively well-balanced view and try to explain any differences or no differences between groups, but need to be careful not to extrapolate the results too much to indicate greater differences than were recorded. Well done.

a. Page 11, Lines 35: The authors present findings 1 and 3, but not 2.

b. Page 12, line 5: "the findings of Fu and his colleagues3"

Please correct reference error.

c. Page 12, lines 1 -42: It is a long paragraph - consider splitting in half.

d. Page 13, lines 41-42: "pronation [7,8] it is expected that kinematic differences would be seen primarily in the frontal plane."

Whilst I agree with this statement, pronation is tri-planar so what about sagittal and transverse planes?

7. Tables and Figures

a. I think the is a formatting error but Figure 1 and 2 are presented twice.

b. Table 1 and 2, I think the comparison "interaction" in the table needs further explanation?

c. If formatting allows it, maybe shading to add emphasis or separate groups?
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