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**Adaptation of Running Biomechanics to Repeated Barefoot Running: A Randomized Controlled Study: Letter to the Editor**

Peter Francis, Catherine B. Tucker, Cassie Oddy and Mark I. Johnson

Dear Editor,

We read with great interest the recent article published in the American Journal of Sports Medicine by Hollander et al[4] entitled ''Adaptation of Running Biomechanics to Repeated Barefoot Running.'' We commend the authors on a well-conducted randomized controlled study. We agree with the authors' assertion that there is a need for ''prospective studies investigating the habituation to barefoot locomotion.''

We believe the data in this study address the intended research question; however, there is a dissonance between the title, introduction, results, and discussion which we believe may lead to some confusion in relation to the interpretation of the findings and the conclusions drawn. The main tension that runs throughout the article is the confusion of adaptation and habituation. The title proposes a study that will investigate adaptations to repeated barefoot running, but the introduction addresses the subject of habituation to barefoot running. In our view, the data then address the issue of habituation, but the discussion, unlike the introduction, focuses completely on adaptation to barefoot running. We will now attempt to outline why we feel this may lead to some confusion in the understanding of the findings.

First, the difference between adaptation and habituation must be addressed. Habituation, in this context, refers to how an individual adjusts to a task and the environment to optimize performance. For example, maximal voluntary strength may be assessed twice separated by 7 days in order to reduce the effects of habituation (ie, a learning effect).[2] This would be important prior to a resistance training intervention design to stimulate muscular adaptation. In this context, reducing the effects of habituation allows researchers to interpret the findings, primarily, as adaptation rather than habituation.[1] It is clear that Hollander et al[4] have addressed the issue of habituation using a small dose (15 minutes) of running once a week. Most studies in human science, designed to promote adaptation, administer a dose of the intervention at least 3 times per week.

Improvements in task performance as a result of habituation, such as the 5% improvement in strength from a single repeat assessment we have previously reported, are thought to arise from refinements in the neuromuscular system in response to the task rather than any lasting physiological change.[3] For example, we would not classify an improvement in strength as a result of repeat assessment in the same way we might an improvement from 12 weeks of progressive resistance training—the inference being that the former arises from habituation and the latter from neuromuscular changes in the tissue, such as an increase in muscle size. Hollander et al[4] identify an increased loading rate in response to habituation or in crude terms, an increase in confidence (limb stiffening) running barefoot on a treadmill. However, the authors suggest that their findings contrast with those of Lieberman et al,[5] who reported lower loading rates in habitually barefoot runners. The runners in the Lieberman et al study were habitually barefoot; that is, they were not only habituated to barefoot running but adapted to barefoot running and therefore were not the appropriate comparison. The discussion continues to focus on comparing their habituation data with adaptation data such as those reported by Tam et al,[6] the overall conclusion of which is that the short-term effects of barefoot running might be a reaction to an unfamiliar condition and cannot be directly transferred to longer-term adaptations. We agree with this conclusion and would also suggest that adaptation to barefoot running is likely highly individual. It would have been interesting in the present study to see the individual responses or to have grouped responders and nonresponders to the habituation. Hollander et al[4] did not measure adaptation to barefoot running and therefore cannot infer that their findings are contradictory to the

previously suggested injury prevention potential of barefoot running attributed to reduced loading rates.

We commend the authors on their study and hope that our additional comments provide greater clarity in relation to the interpretations and conclusions that can be drawn from it.


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