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Softstar, Western Sydney University (Australia), The University of Sydney (Australia), University of South Florida (USA) research collaboration report

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Introduction:

Recent research investigating the long term effects of moderately minimalist shoes [1] (46% minimalist index) on a child's foot strength, muscle structure and balance, indicated improvements in balance, but not statistically significant changes in foot muscle size and strength. The use of minimalist shoes in running in adults however, showed significant foot muscle size increase [2]. This longitudinal trial was designed and undertaken to investigate whether true minimalist shoes (Softstar, 94% minimalist index) would increase foot muscle strength, size and improve balance in children aged 8 to 12 yrs.

Study Design:

Children aged 8 – 12 years were recruited from the same school (Sydney's Northern Beaches) where the previous study was conducted [1]. 34 participants gave consent to take part in the study on initial screening. At pre-intervention testing, 6 participants declined to participate, which left 28 who undertook full initial testing.

Testing was conducted at the school, and included the following tests, in the same manner they were conducted in the previous study to be able to compare minimalist and control groups [1]:

- All anthropometric measures, including foot length, foot arch height, body mass and height.
- Ultrasound cross-sectional area of two foot muscles involved in balance: abductor hallucis (AH) (stabilises great toe) and flexor digitorum brevis (FDB) (pushes lesser toes into the ground).
- Toe flexor strength (TFS) of the great toe and lesser toes separately
- Standing long jump
- Semi-dynamic balance – Y-balance test.

The shoes were worn during school hours, according to uniform policy, for 6hrs per day for 3 days per week, over 3 full school terms.

The same tests were redone at the completion of the trial +/- 8 months later, and a one-way ANCOVA was used as the statistical method to compare the minimalist shoe group in this study, with the control group in study [1].

Study results:

Of the 28 participants who were tested at intake, only 17 completed the full study (attrition of 37%). The reasons for drop out were varied, but the majority were early in the study (within the first month). The main reason given was foot discomfort due to little protection from the minimalist shoe soles, which caused pain during their varied play activities, on a variety of surfaces. These surfaces included: concrete, grass, dirt (with pebbles) and mixed terrain. Several also reported some tripping due to the width of the shoes. All participants who dropped out of the study said they liked shoe flexibility, but preferred more cushioning in the sole. Those who remained in the study reported that they liked the comfort of the shoes.

Significant findings were the development of greater cross-sectional area of the FDB muscles, suggesting that the increase in lesser toe movement in the minimalist shoes encouraged muscle growth, compared to the control group (Fig 1). There was however no significant change in toe flexor strength. This may be due to several factors; including the relatively short exposure (only during 3 school days per week), and the beachside location, which may result in significantly more barefoot time out of school hours, compared with other population groups.

In terms of wear and tear, the shoes were very resilient to everyday use by children at school. Only one child wore through shoes rapidly, but overall, they were long lasting.

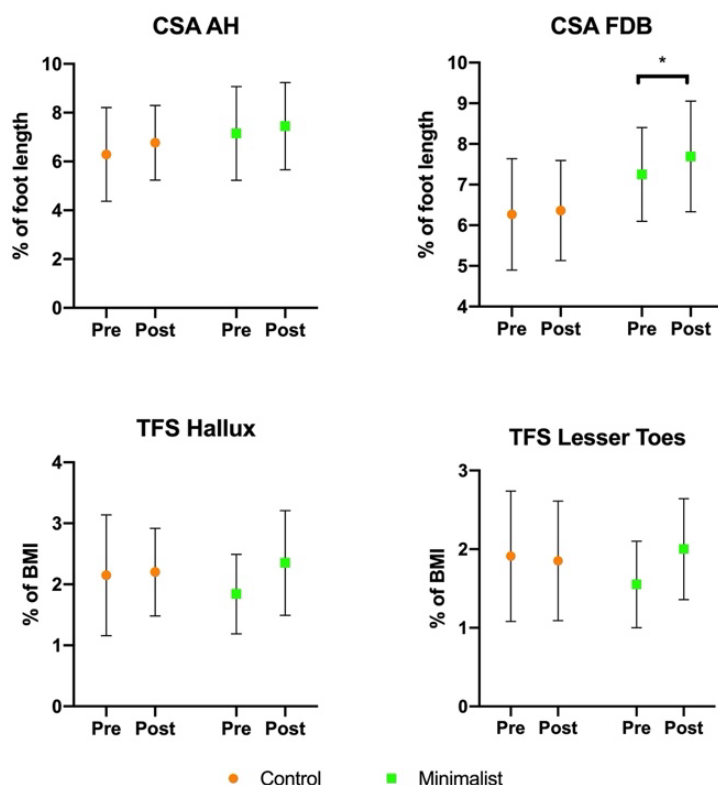


Figure 1 Cross-sectional area (CSA) and toe flexor strength (TFS) of selected intrinsic foot muscles before and after intervention.

Conclusion

Minimalist shoes result in a greater FDB muscle size, but not AH. Toe flexor strength and balance also remain unchanged over the 8-month period.

1. Quinlan, S., et al., *The long-term effects of wearing moderate minimalist shoes on a child's foot strength, muscle structure and balance: A randomised controlled trial*. Gait & Posture, 2022. **92**: p. 371-377.
2. Chen, T.L., et al., *Effects of training in minimalist shoes on the intrinsic and extrinsic foot muscle volume*. Clin Biomech (Bristol, Avon), 2016. **36**: p. 8-13.