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The Science of Running: Factors Contributing to Injury Rates in Shod and Unshod Populations

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There has been a recent increase in the popularity of minimalist running shoes, which allegedly resemble barefoot or "unshod" running (e.g. Nike Free or Vibram). It is hypothesized that barefoot training improves strength differently than running in shoes or "shod" by activating both extrinsic and intrinsic muscles of the foot. It has been suggested that footwear influences foot strike pattern (how the foot initially contacts the ground). Foot strike can be described as rearfoot (RFS), midfoot (MFS), or forefoot (FFS). Minimalist footwear is associated with a more anterior strike pattern than traditional footwear (Goss et al. 2012). With shod running (versus unshod), there is a faster loading rate at initial contact (Squadrone 2008), leading some to conclude that shod running correlates to higher injury rates.

Habitually barefoot participants will demonstrate:
- No significant increase in injury rate based on shod or barefoot condition
- No significant increase in injury rate based on foot strike pattern
- No significant difference in injury rate based on mileage walked or run
- No significant difference in injury rate based on hours of sports participation

Methods

Thirty Ugandan participants (15 male, 15 female) who typically wear shoes were compared to 21 participants (9 male, 12 female) who typically do not wear shoes. Participants were interviewed to gain subjective reports of injury history, shoe wearing habits and physical activity level. Markers were then placed on the right ankle and knee. Participants were asked to wear their usual footwear and take both a walking and running session. The participants walked 200m and ran 100m under the following conditions: (1) habitual shoe wearing and (2) shoe-free running. Participants were asked to wear their usual running shoes and rate their comfort level and acceptance of running with each shoe. Participants ran after a warm-up to familiarize them with the equipment. Participants were asked to rate their comfort level and acceptance of running with each shoe. Participants ran after a warm-up to familiarize them with the equipment. Participants were then asked to rate their comfort level and acceptance of running with each shoe.

Injury rates in shod and unshod participants

<table>
<thead>
<tr>
<th>Foot strike pattern</th>
<th>Injury rate</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>RFS</td>
<td>0.23</td>
<td>0.81</td>
</tr>
<tr>
<td>MFS</td>
<td>0.20</td>
<td>0.89</td>
</tr>
<tr>
<td>FFS</td>
<td>0.18</td>
<td>0.91</td>
</tr>
</tbody>
</table>

Discussion

- No significant differences in injury rates seen when comparing: shod versus barefoot, foot strike patterns, sports participation.
- No significant differences in foot strike pattern between shod and unshod groups.
- Most females demonstrate RFS patterns.
- Biomechanical differences at initial contact and self-selected running speed are more attributable to foot strike pattern rather than the shod or unshod condition, which is consistent with biomechanical analysis by Shih et al. (2013).

Further research studies are needed to investigate how injury rate is related to tissue adaptation time, physical activity level, gender and degree of footwear support in a population of habitually shod and unshod runners.

Declarative Statements

1. Therapists should educate patients on the insignificance of footwear or foot strike running pattern in regard to injury risk.
2. Development of individualized training programs with considerations for tissue adaptation time should be standard of care to reduce risk of injury for runners who desire to change their foot strike patterns or footwear.
3. Therapists should educate patients that increasing running mileage to >3-miles per day does not increase injury rate; however, therapists should develop individualized training programs to accommodate the increase in mileage.

References


