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Background Information

- Foot strike patterns (FSP) are categorized into rear-foot strikers (RFS), mid-foot strikers (MFS), and fore-foot strikers (FFS).
- Several studies have found discrepancies when categorizing FSP of runners. Indicating, further research using more specific center of pressure (COP) calculations could provide a better classification system for FSP ⁽¹⁾ causing the strike index (SI) to shift anteriorly.
- FSP have shown to directly correlate with injury prevalence and performance in runners. It is therefore important for health care professionals to understand the essentials of FSP when taking preventative or rehabilitative measures towards runners ⁽²⁾.

Aim of the Study

The main aim of the study is to create new COP thresholds for categorizing FSP in runners when using the SI. A secondary aim of the study is which region is most susceptible to a running-related injury, relative to the FSP a runner uses.

Method

Participants

48 Participants, 35 males and 13 females (Age: 34.0 [24.5-48.0]) were recruited from Fontys University and running clubs in Eindhoven. 79.2% run as a primary sport, 58.3% run competitively and 35.4% train three times a week. A retrospective questionnaire was used to screen participants.



Inclusion Criteria:

- Normal body mass index (BMI)
- Run a minimum of six kilometers once a month
- Healthy individuals (≥ 18 years) with or without a history of running-related injuries in the last 12 months.

Protocol

The following SI thresholds were defined: a) Standard threshold using a COP threshold of 140; b) The first new COP threshold taking 30% of the maximum COP; and c) The second new COP threshold taking the average COP during single leg stance. The Arion (ATOGEAR), a valid and reliable pressure sensitive insole was used to measure the thresholds ⁽³⁾. Each participant ran around a 375-meter tartan track twice, with a small break in-between to measure the static single leg weight. Descriptive data was analyzed using the Shapiro-Wilk test. Kappa tests between the standard and new methods were done to answer the main research question.

Results

Main Research Goal

Kappa results of ‘no agreement’ to ‘moderate agreement’ were found for the second new method. Indicating a shift in the SI (Figure 1). Within the left foot: five RFS and two FFS became MFS, whereas in the right foot six RFS changed: two became MFS and four became FFS. The results highlight anterior shifts in the SI, consistent with the increased COP threshold of the second method (385.8) compared to COP threshold of the standard method (140).

Second Research Goal

Table 1 depicts the most common FSP, for a location of injury. The hip found mixed results across all methods, within the knee and ankle RFS was the most common. A second analysis showed the knee to be the most prevalent location of injury (47.5%).

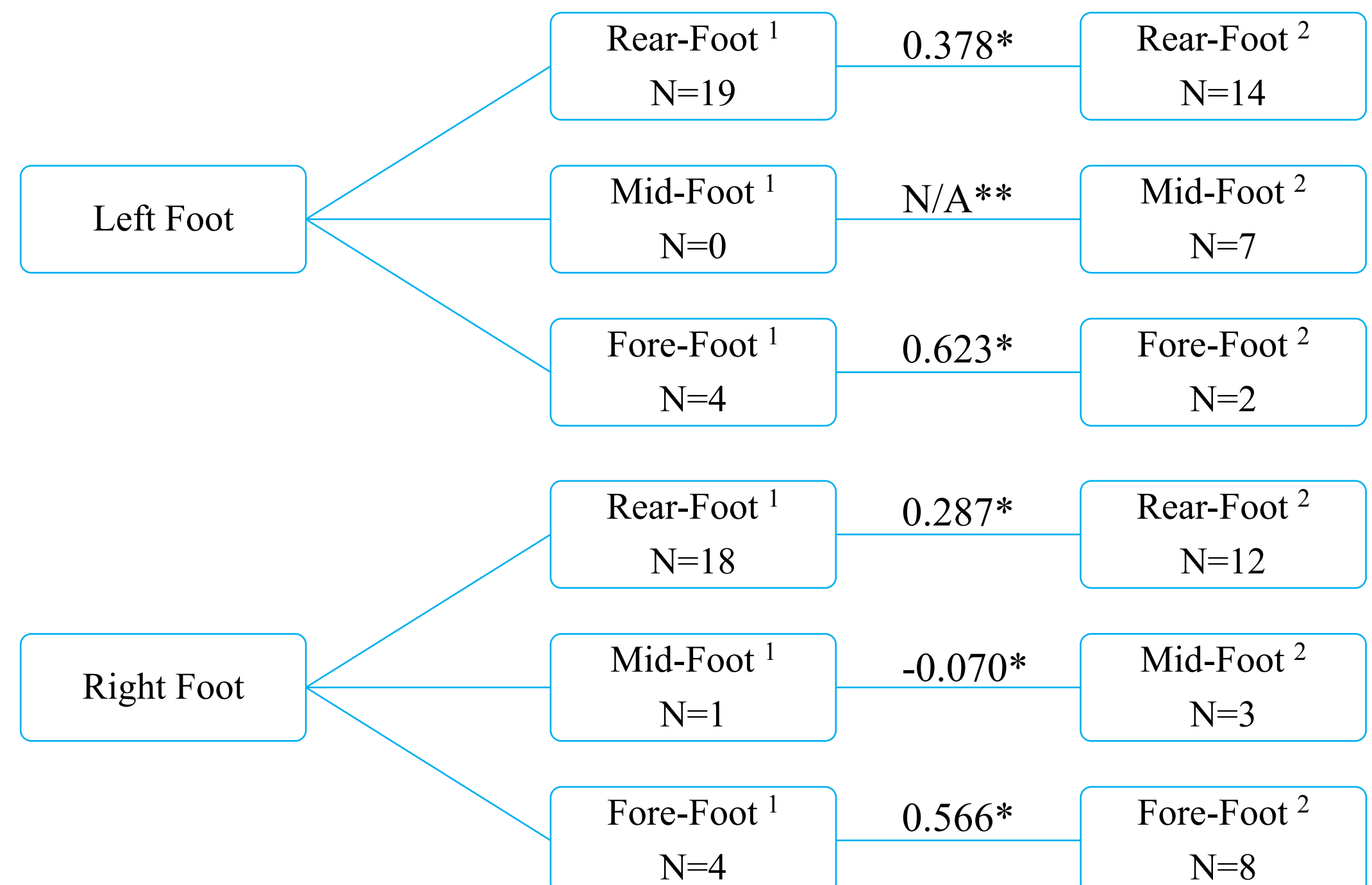


Figure 1. Foot Strike Pattern Categorization Methods

- N: Number of Participants, **N/A: missing values
- *Kappa Value: No agreement (≤ 0); none to slight (0.01-0.20); fair (0.21-0.40); moderate (0.41-0.60); substantial (0.61-0.80); and almost perfect (0.81-1.00).
- ¹Standard foot strike pattern categorization method: using 30-bit as the threshold of a maximum of 256-bit.
- ²The second new categorization: took the average center of pressure reading from the single leg stance phase.

Table 1. Most Common Strike Index and Injury Location

Location	Standard Method		First Method		Second Method	
	Left	Right	Left	Right	Left	Right
Hip	99	FFS	99	MIX	99	FFS
Mechanism	99	66.7%	99	33.3%	99	100.0%
Knee	RFS	RFS	RFS	RFS	RFS/MFS	RFS/FFS
Mechanism	85.7%	83.3%	81.3%	83.3%	50.0%	50.0%
Ankle	FFS	RFS	RFS	RFS	RFS	RFS
Mechanism	55.6%	66.7%	55.6%	66.7%	66.7%	66.7%

- 99: missing values, RFS: rear-foot strike, MFS: mid-foot strike, FFS: fore-foot strike, MIX: equal FSP division
- Percentages are depicted as the majority for the corresponding foot strike pattern and therefore do not add up to 100%

Discussion

As previous literature uses such a low threshold (140) the initial contact point defines the FSP. ⁽¹⁾ Our theory to the anterior shift is with a higher threshold, measurements further along the entire foot become accounted for. As the second new method displayed better results, it is hypothesized to be due to the customized setting of the single leg weight measurements. The anterior shifts highlight possible solutions to the discrepancies found in research and more studies should be done using a higher COP threshold. A possible explanation for the mixed results found within injury prevalence can be due to the levels of runners measured, as well as the small population size.

Conclusion

In conclusion, the results are not significant or conclusive enough to be considered the new standard. However, the current study shows promising results towards a more accurate FSP categorization method by means of a higher COP threshold. No conclusive results concerning the location of injury and dominant FSP were found. The knee mechanism was the most prevalent location of injury.

References

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