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Running shoe model use and their characteristics – a descriptive study among high calibre runners at the 2019 Stockholm marathon

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\textbf{KEYWORDS} Footwear; features; prevalence; road running; competition

\textbf{Introduction}

Running shoe characteristics have been implied to influence running-related injuries (RRI) and running performance. With regards to RRI, the extensively discussed running shoe characteristics have been stack height, drop, and cushioning properties (particularly related to ground reaction forces and medio-lateral motion). From a causal perspective, however, specific running shoe characteristics are neither sufficient nor necessary for RRI. However, based on a recent biomedical model of RRI-aetiology (Bertelsen et al., 2017), their contribution should perhaps not be entirely dismissed but rather regarded as effect-measure modifiers with regards to load distribution.

Regarding running performance, recently discussed running shoe characteristics have been longitudinal bending stiffness (LBS), geometry, weight, as well as midsole resiliency and compliance. These characteristics have been scientifically investigated and heavily discussed within the running community since the launch of the record-breaking Nike Vaporfly 4% (Hoogkamer et al., 2018). Now many other models exist with similar characteristics, such as high LBS achieved by long and rigid midsole components (e.g. plate or rods), by updating the midsole from EVA or TPU to PEBA, or by infusing nitrogen into their EVA or TPU midsoles.

These changes to shoe characteristics are quite large considering the limited period of time in which they have been implemented. Surprisingly, there is no previous research that has descriptively examined race shoe use and their characteristics among marathon runners. The prevalence of the latest running shoes, or any particular shoe model amongst these runners is therefore unknown.

\textbf{Purpose}

The purpose of this cross-sectional study was to descriptively examine which running shoe models and characteristics are used by high calibre runners during a marathon.

\textbf{Methods}

Runners were recording using a Panasonic HC-V800EG-K at 100 Hz during the 2019 Stockholm Marathon. The camera was placed on a tripod 0.33 m above the ground at the 42 km mark inside the Stockholm Olympic Stadium. The fastest 200 runners were included for analysis. Shoe models were visually identified based on brand and design features. Web
searches of shoe model images were conducted to confirm the visual identification. Salespersons at Runners Store, Stockholm, assisted with shoe identification.

**Results**

A total of 60 models (including different versions) were identified among 196 runners, with 4 (2%) runners using shoes that were not identified. Most runners neither used the latest model nor the latest version of already existing models (Figure 1 and Table 1). Consequently, only a minority used shoes with high LBS-features (42%), or PEBA-based midsole (36%). A wide range of shoe characteristics typical for both low-profiled racers and heavy trainers were used (see Table 1 for characteristics ranges).

**Discussion and conclusion**

This study explored running shoe model use and their characteristics, with some unexpected findings. Using old models or model versions was common, and some high calibre runners even used shoes designed for non-race situations. To some extent, the characteristics observed matched the shoe feature recommendations for high calibre runners seen in a recent Delphi study (Honert et al., 2020), although many runners used shoes with higher weight, heel height, and drop.

These findings suggest that high calibre marathon runners may use materialistically inferior running shoe models, which if corrected could lead to improved performance.

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