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How do road runners select their shoes? A systematic review

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ABSTRACT

Running shoes are often considered essential to participate in running. Runners may look for recommendations from friends, specialty running stores, and healthcare professionals when selecting shoes. Despite the existence of shoe prescription guidelines, these recommendations are often not evidence-based or designed with runners' preferences in mind. This review aims to synthesize original research that identifies how road runners select running shoes. Following PROSPERO registration (CRD42021242523), the PubMed®, Scopus®, Web of Science®, and SPORTDiscus™ electronic databases were systematically searched in March 2021, and monitored until 1 February 2022. Original research that identified factors influencing running shoe selection in road runners published in English were included. Data were qualitatively synthesized. Seven studies representing 1947 road runners were included, and conducted either online, in laboratories, or via interview. Forty influencing factors were identified and thematically sub-grouped into five categories: subjective, shoe-specific characteristics, market features, peer evaluation, and runner characteristics. Comfort, cushioning, fit, and price were cited most frequently as influential factors in road runners' footwear selection. Most of the studies reviewed were not specifically designed to address the research question of this review. Lack of consistent definitions and varying research methods are found across studies. There is limited research targeting the factors that influence running shoe selection. Comfort and cushioning appear to be the most important factors in shoe selection, although the relationship between both variables may confound their individual importance. Runners also consider fit, price, and several other factors when selecting shoes. Shoe choice remains relatively unexplored, with no running shoe selection study conducted in store.

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preference

Introduction

Running is a popular form of physical activity worldwide (Galic, 2021) associated with many health-related benefits, including a decreased risk of all-cause mortality (Pedisic et al., 2020). In fact, road running or jogging is one of the most popular outdoor activities in the USA based on 18,000 respondents aged six and over (16.7% participation) (Outdoor Foundation, 2021). Unfortunately, many runners are at risk of injury, with 14.9% of novice runners (range: 9.4–94.9%; follow-up: 6 weeks to 18 months) and 26.1% of recreational runners (range: 17.9–79.3%; follow-up: 1–24 months) injured according to a recent review (Fredette et al., 2022). Justifiably, common goals in runners include injury prevention and running longevity (Dhillon et al., 2020; Malisoux & Theisen, 2020).

Although running does not require specialized equipment for participation like many other sports (e.g. golf or mountain biking), runners generally consider shoes as essential for running participation (Walton & French, 2016). There is debate regarding the efficacy of using running shoes to prevent injury or minimize injury risk. There

is no consensus on whether any shoe can prevent injury (Richards et al., 2009; Theisen et al., 2016) or whether training loads can fully explain injury rate, which highlights the multifactorial nature of running-related injuries (Blazey et al., 2021; Malisoux et al., 2021).

Individuals have different preferences and goals when selecting their running shoes, including injury prevention and performance (Dhillon et al., 2020). There is no consistent terminology used in research or industry when classifying footwear (Marchena-Rodriguez et al., 2020) despite attempts from researchers to standardize terminology and develop objective criteria to distinguish minimalist from maximalist shoes (Esculier et al., 2015). Recently, technologically advanced 'super shoes' have been associated with improved world record running times (Dyer, 2020; Muniz-Pardos et al., 2021), which might entice recreational runners to purchase super shoes given the running economy and performance advantages they can confer (Hébert-Losier et al., 2020). Runners, therefore, do not only need to navigate inconsistent terminology and technical shoe features,

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but also consider the overall comfort, injury reduction potential, and performance enhancing possibilities of footwear (Honert et al., 2020). Furthermore, the footwear industry and running culture constantly propagate the idea that specific running shoes can reduce injury risk and improve performance (e.g. force attenuation, running faster or farther) (Walton & French, 2016) despite the lack of research to substantiate these claims in relation to injury (Knapik et al., 2015) and the existence of individualized responses to footwear in terms of performance (Hébert-Losier et al., 2020; McLeod et al., 2020). As a result, runners face potential pitfalls, biases, and misinformation throughout the shoe selection process. There is no evidence-based best practice consensus regarding shoe recommendation or selection.

Running shoe prescription based on comfort has come to the forefront of the running shoe literature, with Nigg et al. (2015) proposing that runners select their shoes using a 'comfort filter'. The comfort filter suggests selecting shoes based on comfort, which reduces injury by supporting the natural mechanics of runners (Nigg et al., 2015). However, few research has been undertaken to support this paradigm (Agresta et al., 2022). Blazey et al. (2021) suggest that despite the potential effect of footwear comfort on running-related injury, a comfortable shoe may not be the ideal shoe for performance. Hence, it might be difficult to runners to find a shoe that is perceived as comfortable, reduces the risk of injury, and enhances performance at the same time. Some footwear experts suggest that the priorities of shoe design are to improve comfort, reduce injury risk, and improve performance regardless of running ability (Honert et al., 2020). Footwear manufacturers must consider a multitude of design elements and may prioritize them differently across models.

Despite the array of research on running shoe features (Nigg et al., 2020; Sun et al., 2020) and the variety of shoes available for purchase (Barff & Austen, 1993; Ramsey et al., 2019), little is known regarding how runners select their running shoes. Therefore, this systematic review aimed to identify factors that influence the selection of running shoes for road runners, whereby the term 'selection' encapsulates running shoe preference, choice, and purchase.

Methods

This systematic review follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines (Page et al., 2021). The review was pre-registered in The International Prospective Register of Systematic Reviews (PROSPERO, protocol CRD42020198955). Initially, a risk of bias assessment was planned. Due to the broad range of study designs and breadth of outcomes, as well as the exploratory nature of this review, risk of bias assessment was not implemented.

Eligibility criteria

The eligibility criteria for studies were set using the Participants, Interventions, Comparisons, Outcomes, and Study Type (PICOS) framework (Page et al., 2021). *Participants:* Studies that included road runners were

eligible. Research was excluded if the population involved runners that trained primarily off-road or used shoes designed for another sport (e.g. rugby, football, track spikes, trail running, etc.). *Intervention:* Studies were eligible for inclusion when using an intervention that identified preferences, contributing factors, or reasons why runners selected (or preferred, chose, or purchased) their road running shoes. Studies were excluded when the intervention pertained to sports or shoes other than road running. *Comparisons:* Factors that influence running shoe selection were of interest; hence, studies that involved comparisons between running shoes were eligible. Studies that also examined shoe selection (or preference, choice, or purchase) in road runners without direct comparisons between shoes were also included. *Outcomes:* Outcomes of interest were those quantifying or describing factors that influence shoe selection, which could include survey responses, interviews, visual analogue scales, Likert-based scales, and rankings. Studies focussed solely on the effect of shoes on other outcomes (e.g. biomechanical or physiological) without reporting outcomes related to shoe selection specifically were excluded. *Studies:* Articles were eligible for inclusion if they were peer-reviewed original research written in English. Acceptable study designs included qualitative, quantitative, or mixed methods approaches. Studies that were not original research (e.g. reviews, editorials, and conferences) or not in the English language were excluded.

Information sources and search strategy

The following four electronic databases were systematically searched on 16 March 2021 with no specified start date (i.e. from database inception): PubMed, Scopus[®], SPORTDiscus[™], and Web of Science[®]. These databases were monitored until 1 February 2022. The general search strategy applied within the main search bar of these databases was: (Running OR run*) AND (footwear OR shoe*) AND (select* OR purchas* OR choice* OR choos* OR prefer* OR buy* OR bought). The [supplementary material](#) contains a detailed description of the search syntax for each database ([Supplement 1](#)). The reference lists of included articles were searched for qualifying studies.

Selection process

Citations from the database search were imported into Endnote 20.0.1 (build 15043, Clarivate Analytics, Philadelphia, PA, USA) and duplicates were removed. The remaining references were then imported into the online software platform Covidence (Veritas Health Innovation, Melbourne, Australia) where additional duplicates were identified and removed. Thereafter, two reviewers independently reviewed the titles, abstracts, and full-text articles, in that order, for inclusion and exclusion. At each stage, the two independent reviewers (AF and CK) discussed any conflicts that arose. A third reviewer (KHL) was available to arbitrate any disagreements but did not participate because the primary reviewers were able to resolve all conflicts.

Data collection process and items

Reviewers independently extracted data from the full-text articles meeting inclusion using a data extraction template customized in Covidence. Data were extracted from the following categories: study design and aims; participant inclusion/exclusion criteria; population characteristics (number, age, gender, and running experience); results related to footwear selection, preference, choice, or purchase; and key conclusions. Following the independent data extraction, the two reviewers (AF and CK) discussed any differences in the data extracted. A third reviewer (KHL) provided quality assurance of the data extracted.

Synthesis methods

Data extracted were compiled and analyzed using Microsoft Excel 2019 (Microsoft Corp., Redmond, WA, USA). The results were summarized using weighted means and standard deviations (means \pm SD) for participant characteristics (weighted based on the sample size of the included studies), minimum-to-maximum ranges, counts, and/or percentages. Data are presented using a narrative synthesis throughout the results section. Key concepts were tabulated and thematically organized to highlight the most common factors reported to influence running shoe selection and complement the narrative synthesis.

Results

Study selection

Seven studies met eligibility from the 584 articles identified (Figure 1) and are summarized in Table 1. The most

common reason for excluding studies was ‘wrong outcomes’. This occurred when studies focussed solely on the effect of shoes on other outcomes (e.g. biomechanical or physiological) without reporting outcomes related to shoe selection specifically.

Study characteristics

Four studies were experimental (Dhillon et al., 2020; Kong et al., 2015; Kong & Bagdon, 2010; Tay et al., 2017), two were observational (Westerman et al., 2007; Willems et al., 2019), and one was a qualitative interview-based study (Walton & French, 2016). Across studies, 1947 runners were examined (31% female, 69% male), where 80.3% of the total sample originated from a single study (Dhillon et al., 2020). Four studies included males and females (Dhillon et al., 2020; Kong & Bagdon, 2010; Walton & French, 2016; Willems et al., 2019), and the remaining three involved males only (Kong et al., 2015; Tay et al., 2017; Westerman et al., 2007). The weighted mean age of participants was 35.4 (4.4) years.

Most studies required participants to meet a specified running frequency or distance, often once or twice per week for a period of at least one month (Dhillon et al., 2020; Kong et al., 2015; Tay et al., 2017; Willems et al., 2019). The other studies involved current or former runners (Walton & French, 2016), runners with <1–30 years of running experience (Westerman et al., 2007), or runners with unreported running experience (Kong & Bagdon, 2010).

Results of individual studies and syntheses

Forty factors were identified from the seven included studies (Table 2) and were grouped thematically into the

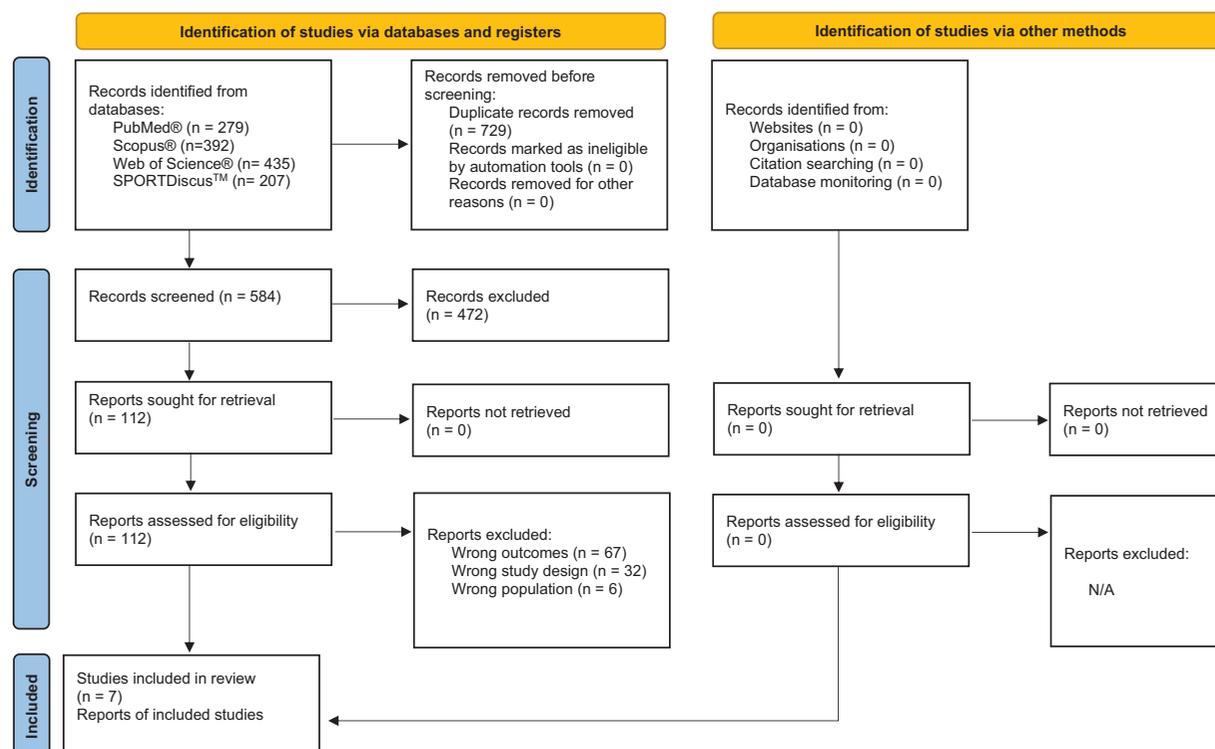


Figure 1. PRISMA flow diagram of the search strategy and article screening process.

Table 1. Summary of included studies, influencing factors examined, and key results relevant to running shoe selection.

Authors	Design and aims	Design and methods, and setting	Population	Influencing factors examined	Key results
Walton and French (2016)	Design: qualitative research Aim: gather information about running experiences with focus on barefoot and minimalist running	Methods: in-depth interviews Setting: quiet convenient location	Sample: N = 8 (6 F, 2 M) Age: 35 years Experience: current or former recreational runners	Cushioning, support, comfort, price	Support is poorly defined, yet desirable. More expensive shoes were perceived to be of higher quality. Comfort linked to cushioning.
Dhillon et al. (2020)	Design: two-part (1) observational; (2) experimental Aim: (1) document factors considered by runners selecting footwear and compare perceptions on footwear and injury risk in runners and HCPs; (2) evaluate the perceived usefulness of an online educational module	Methods: (1) online survey; (2) pre-post online survey with an educational module Setting: online survey	Sample: N = 1564 (520 F, 1034 M) Age: 38.1 (10.5) years Experience: 8.8 (8.2) years running; 38.6 (24.2) km per week	Comfort, injury prevention, performance, brand, cost recommendations, discount, reviews, technologies, style, colour	Runners rely mainly on comfort when selecting new footwear, followed by performance and injury prevention.
Kong et al. (2015)*	Design: experimental Aim: examine perception of running shoes between China (Beijing) and Singapore; and discover if running shoe preference depends on assessment methods	Methods: within (shoe assessment method) and between (country) group comparisons Setting: gym and laboratory	Sample: N = 100 (50 Singapore; 50 Beijing) Age: 23.5 (2.6) years Experience: Beijing 4.2 (1.3) sessions/week; Singapore 2.5 (1.4) sessions/week	Comparison tool used (visual analogue scale vs. 'head to head' method), country, fit, cushioning, arch support, stability	'Head to head' comparison differed from visual analogue scale ranking. Cushioned shoes were preferred over other models. Beijing runners ranked attributes higher than Singapore. Singapore ranked lighter shoe as much less stable than Beijing runners. Shoe preference based on gender. Men preferred the cushioning model, and women preferred the lightweight shoe. The stability model was the least preferred.
Kong and Bagdon (2010)	Design experimental Aim: compare shoe preferences based on subjective comfort between walking and running. The effect of gender, running experience, and body mass on shoe preference were explored.	Methods: within (shoes) and between (gender) group comparisons Setting: laboratory	Sample: N = 41 (19 F, 22 M) Age: 27.4 (9.0) years Experience: sedentary to competitive runners	Gender, cushioning, shoe mass	Shoe preference based on gender. Men preferred the cushioning model, and women preferred the lightweight shoe. The stability model was the least preferred.
Tay et al. (2017)*	Design: experimental Aim: examine the strength of individual footwear perception factors to influence the overall preference of running shoes	Methods: regression analysis with four perception variables to predict overall preference Setting: gym and laboratory	See Kong and Bagdon (2010)	Cushioning, fit, arch support, stability	Cushioning and fit were the most important variables used to predict overall preference from the four variables examined.
Willems et al. (2019)	Design: observational Aim: investigate if consumer behaviour towards footwear is a risk factor for lower extremity injuries	Methods: prospective study correlating injury rates to shoe choice Setting: online survey	Sample: N = 104 (49 F, 55 M) Age: 50.0 (11.6) years Experience: 95.7% recreational 95.7%, 4.3% competitive	Colour, model, material, closure mechanism, presence of specific properties, price, quality, price quality ratio, sales and discounts, brand, fashion, advertisement, comfort, necessity, sport specificity, right fitting, technology, and store service.	Caring for the right fitting during purchase protected against injuries OR 0.11. Data are based on runners and walkers. 79.3% of participants purchased shoes from sports shop, 11.5% from specialty running store, and 1% online. 66.8% underwent gait

(continued)

Table 1. Continued.

Authors	Design and aims	Design and methods, and setting	Population	Influencing factors examined	Key results
Westerman et al. (2007)	<p>Design: experimental</p> <p>Aim: report on the effectiveness of Consumer Decision Support System in the context of Internet and in-store application</p>	<p>Methods: imaginary purchase experiment between 5 pairs of shoes in three conditions (1) product only; (2) Decision Support System only; (3) Decision Support System with product</p> <p>Setting: laboratory</p>	<p>Sample: 30 M</p> <p>Age: 29.6 (9.9) years</p> <p>Experience: 10 advanced, 16 intermediate, 4 beginners; 11.28 (8.75) years running (range: <1–30 years)</p>	<p>Durability, flexibility, tread, weight, cushioning, stability, support, reflective material, price, aesthetics, brand, colour, upper material, technical, build quality, fashionable, previous use, maintenance, toe area, comfort/fit, recommendation, water resistant, dual purpose, sole parts, inside, laces</p>	<p>analysis. 64.4% were influenced by advice of others.</p> <p>Durability, price, support, weight, cushioning, flexibility, stability, tread, and reflective material were weighted most to least important in shoe selection. Aesthetics and brand were most frequently considered as additional attributes.</p>

F: female; M: male; OR: odds ratio.

Note. Relevant data extracted from the included studies of the present review.

* Denotes that both studies used the same data set.

following five subcategories: subjective ($n=7$ factors, 17.5%), shoe-specific characteristics ($n=18$ factors, 45%), market features ($n=9$ factors, 22.5%), peer evaluation ($n=2$, 5%), and runner characteristics ($n=4$, 10%). Comfort (Dhillon et al., 2020; Kong & Bagdon, 2010; Walton & French, 2016; Westerman et al., 2007; Willems et al., 2019) and cushioning (Kong et al., 2015; Kong & Bagdon, 2010; Tay et al., 2017; Walton & French, 2016; Westerman et al., 2007) were the most frequently cited factors to influence shoe selection, identified in five articles each. Fit (Kong et al., 2015; Tay et al., 2017; Westerman et al., 2007; Willems et al., 2019) and price (Dhillon et al., 2020; Walton & French, 2016; Westerman et al., 2007; Willems et al., 2019) were the next most common factors, cited in four articles each. Twenty-five (62.5%) of the 40 factors identified were referenced once only.

In terms of subjective factors, runners identified comfort (Dhillon et al., 2020; Kong & Bagdon, 2010; Walton & French, 2016; Westerman et al., 2007; Willems et al., 2019) and fit (Kong et al., 2015; Tay et al., 2017; Westerman et al., 2007; Willems et al., 2019) as important factors when choosing their road running shoes, in addition to running injury and performance considerations (Dhillon et al., 2020). Shoe-specific characteristics influencing running shoe selection included stability (Kong et al., 2015; Tay et al., 2017; Westerman et al., 2007) and technologies (Dhillon et al., 2020; Westerman et al., 2007; Willems et al., 2019). The market features identified included price (Dhillon et al., 2020; Walton & French, 2016; Westerman et al., 2007; Willems et al., 2019), colour (Dhillon et al., 2020; Westerman et al., 2007; Willems et al., 2019), and style (Dhillon et al., 2020; Westerman et al., 2007; Willems et al., 2019). Despite the relative importance of price on shoe selection, only one article reported the price of shoes and identified that price was not related to injury (Willems et al., 2019). Runners in the included studies were also influenced by peer evaluations, such as recommendations (Dhillon et al., 2020; Westerman et al., 2007; Willems et al., 2019) and reviews (Dhillon et al., 2020). In terms of runner characteristics, runners from the included studies selected footwear differently based on country (Kong et al., 2015), necessity (Willems et al., 2019), previous use (Westerman et al., 2007), and gender (Kong & Bagdon, 2010).

Discussion

Subjective factors

Comfort was the most frequently cited factor alongside cushioning to influence footwear selection in road runners. Despite comfort being consistently identified to affect shoe selection (Dhillon et al., 2020; Kong & Bagdon, 2010; Walton & French, 2016; Willems et al., 2019), footwear research, in general, lacks standard definitions and protocols when addressing comfort (Menz & Bonanno, 2021). Comfort has been defined as a 'pleasant state or relaxed feeling of a human being in reaction to its environment' (Vink & Hallbeck, 2012). This definition highlights the subjective nature of comfort and the potential difficulty in measuring or comparing comfort meaningfully. Menz and Bonanno (2021) advanced two key comfort concepts relevant to footwear, 'pure comfort' and 'thermal comfort',

Table 2. Summary of factors that influence running shoe selection and the number of studies (frequency) that addressed each specific factor.

Category	Factor	Frequency	References
Subjective	Comfort	5	^{1, 2, 5, 6, 7}
	Fit	4	^{3, 4, 6, 7}
	Comparison tool	1	³
	Dual purpose	1	⁶
	Injury prevention	1	¹
	Performance	1	¹
	Sport specificity	1	⁷
Shoe-specific characteristic	Cushioning	5	^{2, 3, 4, 5, 6}
	Stability	3	^{3, 4, 6}
	Technologies	3	^{1, 6, 7}
	Arch support	2	^{3, 4}
	Material	2	^{6, 7}
	Shoe mass	2	^{2, 6}
	Support	2	^{5, 6}
	Quality	2	^{6, 7}
	Closure mechanism	1	⁷
	Durability	1	⁶
	Flexibility	1	⁶
	Inside	1	⁶
	Laces	1	⁶
	Maintenance	1	⁶
	Sole parts	1	⁶
	Toe area	1	⁶
	Tread	1	⁶
	Water resistant	1	⁶
	Market features	Price	4
Colour		3	^{1, 6, 7}
Style		3	^{1, 6, 7}
Discount		2	^{1, 7}
Advertisement		1	⁷
Brand		1	^{1, 6, 7}
Model		1	⁷
Value		1	⁷
Store service		1	⁷
Recommendations		3	^{1, 6, 7}
Reviews		1	¹
Runner characteristic	Country	1	³
	Necessity	1	⁷
	Gender	1	²
	Previous use	1	⁶

Note. Factors identified to influence running shoe selection. References: ¹Dhillon et al. (2020); ²Kong and Bagdon (2010); ³Kong et al. (2015); ⁴Tay et al. (2017); ⁵Walton and French (2016); ⁶Westerman et al. (2007); ⁷Willems et al. (2019).

which illustrates the importance of clearly defining what and how footwear comfort is being measured.

There are few validated tools and standardized measurement protocols used to assess product comfort (Tunprasert et al., 2021). Kong et al. (2015) identified that different comfort assessment tools influence outcomes. More specifically, runners' shoe rankings were different when based on ratings from a 15 cm visual analogue scale than from a 'head to head' comparison of two shoes simultaneously worn on each foot. This finding led the authors to recommending that runners use a 'head to head' comparison when selecting shoes (Kong et al., 2015). Despite this recommendation being made to runners, more recent recommendations for researchers advise the use of visual analogue scales for measuring footwear comfort, with 10 and 15 cm scales most frequently used (Menz & Bonanno, 2021). While visual analogue scales may be useful in research, runners typically do not use such scales when trying on or selecting shoes, and rather employ a 'head to head' approach to compare shoe comfort.

Footwear comfort is multifactorial in nature (Menz & Bonanno, 2021). The running shoe comfort assessment tool

(RUN-CAT) uses metrics, such as heel cushioning, forefoot cushioning, shoe stability, and forefoot flexibility to create a composite comfort score (Bishop et al., 2020). The RUN-CAT tool highlights the interplay between comfort and cushioning, where two of the four metrics relate to comfort. The concept extends further when considering overall shoe preference, whereby cushioning and fit were the most important variables in predicting overall shoe preference when considering fit, cushioning, arch support, and stability (Tay et al., 2017). Hence, the apparent interrelation between comfort, cushioning, and other subjective factors like fit may confound their individual importance in footwear selection.

Indeed, like cushioning, fit also appears linked to comfort (Hennig, 2011). The appropriate size of shoes or their construction (e.g. last shape or upper flexibility) may affect the perception of shoe fit and comfort. When trying on running shoes at a specialty store, a sales associate may guide runners through the shoe-selection process (Gibson, 2012). Differences in sizing create fit discrepancies across brands and models and complicate fit comparisons (Jurca & Dzeroski, 2021). Runners may perceive the sales associate as an authority with expertise and source of reliable information, although the recommendations may not be evidence based (Malisoux & Theisen, 2020; Richards et al., 2009). The subjective nature of shoe comfort and individual preference may create a challenge in defining what constitutes the 'right fit'. Willems et al. (2019) identified that runners who cared about purchasing a shoe with the 'right fit' were less likely to sustain a running related injury, although this result could be due to many factors, including differences in personalities, training habits, and sleep quality and quantity (Mousavi et al., 2021). Following comfort, injury prevention was the second most important factor reported to influence running shoe selection in the largest cohort of runners from the seven studies reviewed herein (Dhillon et al., 2020).

Shoe-specific characteristics

Cushioning was cited just as often as comfort with regards to influencing running footwear selection (Kong et al., 2015; Kong & Bagdon, 2010; Tay et al., 2017; Walton & French, 2016; Westerman et al., 2007), although only two studies reported cushioning properties (Kong et al., 2015; Tay et al., 2017). As a result, cushioning could also be considered as subjective rather than a measured construct defining shoe properties. Comfort and cushioning also appear linked (Walton & French, 2016, p. 460), with cushioned running shoes most often perceived as the most comfortable (Dinato et al., 2015; Kong & Bagdon, 2010; Sterzing et al., 2013).

Runners may have difficulty perceiving differences in the mechanical cushioning properties of shoes (Delattre & Cariou, 2018). For instance, runners report no differences in perceived comfort of cushioning at the forefoot and rear-foot regions, regardless of cushioning technologies (Dinato et al., 2015). Nonetheless, adding cushioning technologies (i.e. Air, Gel, and Adidas-Adiprene) was perceived as more comfortable overall compared to using only ethylenevinyl acetate (EVA) foam as the impact absorption system. This

result may be due to the greater density and lower cushioning of EVA. Given that all runners in the latter study were rearfoot strikers (Dinato et al., 2015), the link between forefoot and rearfoot cushioning and overall comfort due to cushioning technologies requires further exploration, as it is potentially influenced by gait patterns (Sterzing et al., 2013). Furthermore, runners who ranked cushioned shoes as more comfortable than minimalist shoes ran less (average 26.5 km/week) than those who ranked minimalist shoes as more comfortable (average 33.7 km/week) (Mills et al., 2018). This observation suggests that experience level may also affect the cushioning–comfort relationship.

Although cushioning appears to influence runners' shoe selection; like comfort, it is not consistently defined or measured in a standardized manner across the footwear literature (Ramsey et al., 2019).

Market features

Financial considerations appear to play a role in the selection of road running footwear. Price, discount, and value were identified in several articles as factors influencing shoe selection (Dhillon et al., 2020; Walton & French, 2016; Westerman et al., 2007; Willems et al., 2019). Willems et al. (2019) reported the average price of shoes at 125.75 (43) EUR, or 140 (48) USD, which is significant considering that shoe manufacturers recommend replacing shoes every three to six months or after 300–500 miles of wear (Brooks, 2020), the equivalent of ~480–800 km of wear. The recommendation to replace shoes by distance may be related to diminished cushioning after 500 km (~310 miles) of use compared to new (Wang et al., 2012). Although runners might prioritize comfort, cushioning, fit, and price, runners also seek shoes that are stylish (Dhillon et al., 2020; Westerman et al., 2007; Willems et al., 2019). Historically, fashion has played a large role in influencing the footwear industry (Thompson & Coughlin, 1994), which is also seen in runners selecting road running shoes based on colour and style (Dhillon et al., 2020; Westerman et al., 2007; Willems et al., 2019).

Peer evaluation

Amongst others, recommendations from peers encapsulate retailers, healthcare providers, friends/family, running clubs, and elite athletes (Dhillon et al., 2020). Recommendations from others was reported to influence 64.4% of individuals during footwear selection (Willems et al., 2019). Despite footwear prescription not being evidence-based (Agresta et al., 2022; Richards et al., 2009; Walton & French, 2016; Warne et al., 2021), recommendations from peers appeared in almost half ($n=3$, 43%) of the articles included. Runners look to others to guide them in their shoe selection, although it is unclear how helpful recommendations actually are. The individual preference of one person may not apply to another. Therefore, it may be problematic to implicitly trust coaches, team mates, or friends in terms of footwear recommendations.

Runner characteristics

The runner characteristics category highlights the individualized nature of running shoe selection, which includes considerations based on country and gender. In terms of country, runners from Beijing ranked the same shoes more favourably than runners from Singapore (Kong et al., 2015). In terms of gender, shoe preference based on the subjective feeling of comfort differed between males and females (Kong & Bagdon, 2010). More specifically, when presented with a cushioned, stability, and lightweight shoe for running, most males preferred the cushioned shoe whereas most females preferred the lightweight one. Westerman et al. (2007) found that runners sometimes select shoes based on past experience, and select the same model as their previous ones. Although not addressed in the reviewed articles, age is another factor linked to runners that likely influences running footwear selection. Indeed, the priorities of more mature individuals during apparel and footwear selection differ from those of younger individuals (Moschis et al., 2011), which likely extend to running footwear. Runners may have different shoe priorities when selecting footwear based on running experience and ability, where high-calibre runners may prioritize performance whereas novice runners may prioritize comfort (Honert et al., 2020). To date, limited experimental data from runners are available to support these recommendations from footwear experts.

A note on injury

Given the relatively high injury incidence in runners (Fredette et al., 2022; Kakouris et al., 2021), it is unsurprising that injury prevention was identified as an important factor in running shoe selection in the study with the largest cohort of runners in this systematic review (Dhillon et al., 2020). Runners may perceive wearing the wrong shoes for their foot type, shoes without cushioning, or worn-down or old shoes as affecting their injury risk (Saragiotto et al., 2014). Changing running shoes is a relatively easy intervention compared to more active interventions, such as gait retraining or training load monitoring, and makes shoe choice an appealing solution to injury prevention. Runners should be conscious of the multifactorial nature of running injuries (Warne et al., 2021) rather than relying solely on shoe choice for injury prevention. Malisoux and Theisen (2020) suggest 'the role of running shoe technology in injury prevention has been largely over-rated'. Recently, a longitudinal study with a large cohort ($n=848$) identified that shoes with higher cushioning properties may have a protective effect against injury in lighter runners (Malisoux et al., 2021). The authors of the present review are not aware of evidence that supports a comfort-based shoe selection approach to reduce injury incidence. If comfort is critical to shoe choice and potentially related to injury, research should be conducted to standardize comfort definitions, measurements, and reporting methodologies.

Strengths and limitations

Although examining the frequency of factors is a useful first step in identifying themes across research, citation frequency does not necessarily represent their relative importance in road running footwear selection. Out of the 40 factors that influenced shoe selection, 25 (62.5%) were referenced only once, which reflects the differences in study designs and selected outcome measures as opposed to their potential influence on running footwear selection. For instance, a runner's previous use of a given shoe may be a primary determinant of footwear selection, but this aspect was addressed in only one study (Westerman et al., 2007). Similarly, an individual runner may prioritize the existence of a particular technological feature, such as motion control or the presence of a carbon-fibre plate, or recommendations from peers above other factors.

One limitation of the studies reviewed is that none of the included studies took place in a running store, which limits external validity. When comparing or ranking shoes against one another, it is challenging to understand which specific factors influence preference (Kong et al., 2015; Kong & Bagdon, 2010; Tay et al., 2017; Westerman et al., 2007). Runners may prefer many aspects of a specific shoe, such as its comfort, style, and price, but select a different shoe because of the lacing pattern. Running shoe selection is a nuanced process where runners must consider many parts that lead to overall preference.

A large proportion of runners represented in this review derives from a single online survey study (Dhillon et al., 2020), with some studies having limited sample sizes that might preclude the generalization of findings (Walton & French, 2016). In addition, the low number of studies in the area highlights the paucity of research directly exploring footwear selection from a runner's point of view. Furthermore, the two largest studies in terms of sample size explored a wide range of shoe features (Dhillon et al., 2020; Willems et al., 2019); however, the other five studies only focussed on a limited number of shoe features (Kong et al., 2015; Kong & Bagdon, 2010; Tay et al., 2017; Walton & French, 2016; Westerman et al., 2007). This disparity limits the ability to make strong inferences on shoe selection preferences due to limited comparability of results.

Future directions

There are three main stakeholders involved in running research: runners, footwear manufacturers, and scientists. Runners are the ones that choose shoes typically for comfort, injury prevention, or performance (Dhillon et al., 2020). Manufacturers develop and market shoes, advertising that specific shoe technologies (e.g. cushioning properties) confer desirable attributes (e.g. greater comfort or performance). Scientists commonly focus on identifying relationships between footwear or footwear properties to inform footwear prescription (Honert et al., 2020). Kram (2022) suggests that since shoe development advances more quickly than academic publishing, it can render model-specific research for scientists irrelevant, which prevents knowledge translation to runners as manufacturer-based research is not often published. We recommend that manufacturers ensure their marketing claims are based on scientific

evidence (e.g. about injury prevention or benefits on performance) published in peer-reviewed literature to convey a clearer message to runners. Ultimately, to answer the question of how road runners select their shoes would require the three parties to collaborate.

To better understand which factors influence the selection of running shoes, we make the following recommendations for future directions. First and foremost, it becomes important to achieve a consensus definition and measurement tool for footwear comfort (Agresta et al., 2022; Bishop et al., 2020) and various footwear characteristics (Ramsey et al., 2019). Laboratory-based experiments with road runners could be useful to determine how individual shoe characteristics, market features, or peer recommendations affect the footwear preference of runners by systematically altering a given feature (e.g. effect stack height). Large population-based surveys targeting specific groups of runners could address how runner characteristics influence shoe selection; for example, comparing factors between male and female or novice and experience runners. Studies examining in-store shoe selection using interviews and questionnaires would increase the external validity of findings as would reflect real-life situations and actual footwear selection of runners. Finally, studies exploring how prioritizing injury prevention, comfort, or performance affect shoe selection criteria are needed as factors driving footwear selection for preventing injuries might differ from those for performance, for instance.

Conclusion

The present review identified factors that influence the selection of road running shoes. Comfort, cushioning, fit, and price were the most commonly cited factors to influence running shoe selection. Comfort is multifactorial and poorly defined, with both cushioning and fit shown to affect comfort. The interrelatedness of factors makes it difficult to parse the relative importance of individual factors. Studies designed to directly address how runners select their shoes are necessary to create a robust source of knowledge for runners themselves.

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