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Special Article

The art of choosing the right running shoe: a review article

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Abstract

This review aims to synthesize current knowledge on running biomechanics, structure and materials of running shoes, and critical factors to consider when choosing the right running shoe to enhance performance and reduce injury risk. A search was performed across major electronic databases, including PubMed, EMBASE, Web of Science, and Google Scholar. Selected studies were then analyzed and synthesized to pinpoint the key factors in choosing the right running shoe, including biomechanics, shoe structure, injury prevention, and the benefits and limitations of different running shoe options. The running shoe choice significantly affects the running performance and injury risk. Key features, such as shoe drop, cushioning, stiffness, and weight must be considered based on the runner's anatomy, gait, and training regimen. Personalized recommendations, informed by a thorough understanding of shoe biomechanics and individual runner needs, are crucial for optimizing the running efficiency and minimizing injuries.

Level of Evidence V; Therapeutic Studies; Expert Opinion.

Keywords: Biomechanics; Foot anatomy; Overuse injuries; Running shoes.

Introduction

Running is a popular current sport, enjoyed by millions worldwide for its physical and mental health benefits. However, its high-impact nature places significant stress on the musculoskeletal system from hips to feet, often leading to injuries. Choosing the right running shoe is crucial for minimizing the injury risk and enhancing performance.

As healthcare professionals, we are familiar with osteosynthesis materials and medical devices, their application technique, and their biomechanical properties. However, as we often walk, run, and wear athletic shoes, knowing and understanding more about such a common element in our daily life as running shoes is essential. Knowing the biomechanics of running and the technology behind running shoes is necessary, especially given the rise of sports and running in recent years. This article reviews the basic principles of running biomechanics, the structure and materials of footwear, and the characteristics to be considered for choosing running shoes correctly.

Running has grown in popularity each year, with a significant increase in races and competitors. Data shows an increase in the number of runners, although the average time to finish a marathon is also increasing. A recent article about the New York Marathon reported that, in 2016, there were approximately 23,000 registered runners, with an average time of 4 hours and 23 minutes to finish the race. In 2022, there were approximately 40,000 registered runners, with a final race time of 4 hours and 50 minutes. What does this show us? There are more and more amateur runners and beginners in this sport, therefore, more people require proper running shoes. These competitors are at an elevated risk for overuse injuries, as most amateur and novice runners share

Study performed at Pontificia Universidad Javeriana, Medsport, Hospital Universitario de la Samaritana, Bogotá, Colombia.

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three main risk factors for injury: (1) lack of musculoskeletal system strength and conditioning, (2) undirected and progressive sports training, and (3) inadequate equipment, particularly running shoes.

The sports footwear industry is a high-tech benchmark, having undergone significant changes in the last 50 years in terms of structure, technology, and materials engineering. Some studies support these advances, not only from the sports performance point of view, but also in the biomechanics applied to different types of footwear and their biomechanical characteristics. However, there is a fashion and marketing boom behind this innovation, and marketing strategies or flashy models should not bias us.

Therefore, we must recognize the characteristics of running shoes, how to apply them to the foot biomechanics, and the possible pathologies associated with the sport. In addition, we must prevent overuse injuries. From a sporting point of view, the goal is to make running more efficient. Efficiency is the best performance (faster speed) with the lowest energy consumption (VO2), and recent literature has also included the concept of injury prevention within efficiency. The industry seeks to design running shoes with cushioning, stability, lightness, ground responsiveness, comfort, and an attractive design.

This review provides an evidence-based guide to help healthcare professionals and runners select the most appropriate footwear based on current orthopedic research and biomechanical principles.

Methods

Identifying the research question

The following research question guided the review: What biomechanical factors should be considered when selecting the best running shoe?

Identifying relevant studies

The search used PubMed, EMBASE, Web of Science, and Google Scholar. Search terms covered the population and outcomes relevant to the research question. Overlapping terms were included to ensure the broadest possible scope of studies was identified by searching the electronic databases (Table 1). The search was carried out between September and November 2023.

Table 1. Search terms used

Population	"Shoe"[Majr] OR Foot Orthoses, Arch Support, Foot OR Foot Orthotic Device
AND	"Biomechanics"[Mesh] Biomechanical Phenomena, Kinematics OR Mechanobiological Phenomena, Physical Phenomena
AND Outcomes	Impact [All Fields]

Study selection and data charting

Data was extracted and tabulated in Microsoft Excel (2019). Two templates were generated for this stage. The first template plotted descriptive data for each study: authors, year of publication, country of publication, study design, setting, sampling method, sample size and composition, and materials used. Subsequently, a second template was created for duplicate data extraction and to reassess the information, addressing any discrepancies.

Collating, summarizing, and reporting results

The heterogeneity of methodologies used required a qualitative synthesis of research results rather than a quantitative meta-analysis. No formal assessment of study quality was performed, which was consistent with the nature of this kind of review.

Results

Search results

Initial search yielded 7,432 results; after refining the search and eliminating duplicates, 3,020 documents remained for analysis. Of these, 2,875 are indexed in PubMed.

Finally, after applying the inclusion criteria (Table 1) and eliminating studies that did not assess the shoe impact on biomechanics, 13 studies were reviewed and included in the analysis.

Synthesizing the results

Applied concepts of walking and running

Gait results from a series of forces that act together, allowing the body to move forward with the minimum energy consumption.

Determinants of gait are the interaction of anatomical structures and forces that act synergistically to decrease muscle contraction and allow displacement in gait. This reduces the oscillation of the center of gravity in the sagittal plane and the rotation of the pelvis in the coronal plane, decreasing muscle action and thus improving metabolic expenditure.

Foot anatomy and biomechanics

The foot is a complex structure comprising 26 bones, 33 joints, and over 100 muscles, tendons, and ligaments. Vital anatomical features include the arch, heel (rearfoot), and forefoot, each playing a critical role in shock absorption and propulsion during running. Understanding the biomechanics of running, including the gait cycle phases (stance phase and swing phase), is essential for selecting shoes that complement natural foot movements and reduce the injury risk.

Gait determinants

Among the determinants of gait, we include[1] the center of gravity, which, in the human body, is located on the anterior face of the third lumbar vertebral body[2]; the support polygon, an imaginary space delimited by the external area of support for the feet[3]; and the axis of gravity that passes through the center of gravity and falls at the center of the support polygon[4]. Ground reaction force (GRF) is the force exerted by the ground on the body upon coming into contact with it (Figure 1.A). It is given by Newton's 3rd Law, concerning "action-reaction:" when a force is applied to a surface, it is returned to the body and generates the movement.

Gait phases

Gait has two main phases: the stance phase, which corresponds to 60% of the gait cycle, and the swing phase, which corresponds to 40% of the gait cycle (Figure 2). In running, these proportions are reversed, with the stance phase corresponding to 30% of the gait cycle and the swing phase, to 70%; this varies according to the speed of run – the higher the speed, the longer the swing phase[1]. In addition, a third

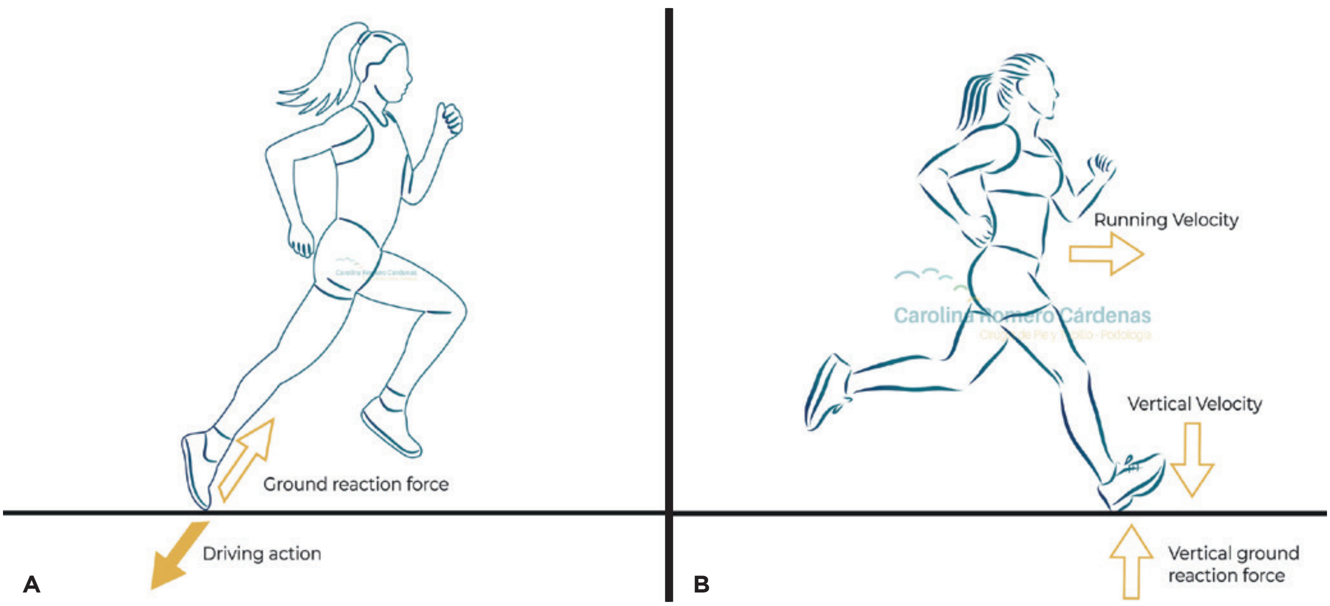

Figure 1. (A) Ground reaction force: the force exerted from the earth's center on the body upon coming into contact with it (B) In the contact phase, the objective is to respond to and absorb the ground reaction force, the force of gravity, and body load.

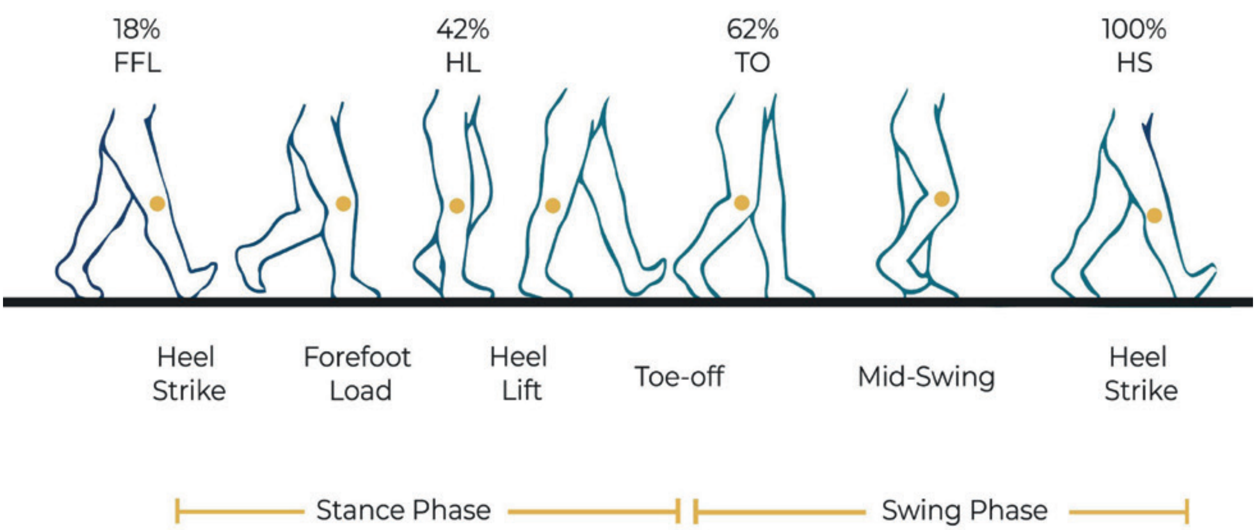

Figure 2. The gait cycle has two main phases: the stance phase, which corresponds to 60% of the gait cycle, and the swing phase, which corresponds to 40%.

phase is added in running: elevation "float" or "double elevation," where both feet are suspended in the air at the same time.

The contact phase (stance phase) is 30% of the cycle, but it is where running shoes come into play. It is subdivided into three phases: initial contact, mid-stance, and propulsion.

The contact phase goes from the initial heel strike to full forefoot strike. The objective is to respond to and absorb the GRF, force of gravity, and body load (Figure 1.B)[4]. The rearfoot is supported in six degrees of varus, pronated until the forefoot is in contact with the ground[3] (Figure 3). The initial contact occurs on the external edge of the heel, in 6 degrees in varus position; this is the reason for the normal pattern of postero-external wear of shoes.

The second phase, mid-stance, goes from the full foot strike to the beginning of heel rise. Here, the midfoot has helical movements. The subtalar joint supinates to turn the rearfoot into a rigid lever, which prepares us for the propulsion phase. There is also an anterior displacement of the load vector of the limb, moving the tibia and knee anteriorly[1].

The third take-off, or propulsion phase, starts with the heel take-off and continues until the digital take-off. A concentric contraction of the ankle flexors, added to the foot's intrinsic and the ground's reactive forces, allows the anterior propulsion[4].

Foot strike

In running, the type of footprint, or the way the foot contacts the ground when running, has been described in three types:

a. **Heel strike**: When the ankle is in dorsiflexion, the forces of impact in rotation cannot be transferred to the legs. There is also a greater energy absorption in the distal tibia, with a greater risk of shin splint. As the ankle is rigid, there is less load on the foot and on the Achilles tendon.

b. **Midfoot support**: The ankle position is neutral, ankle stiffness decreases, and there is a better load distribution in the foot and distal tibia. This makes it the most metabolically economical type of foot strike.

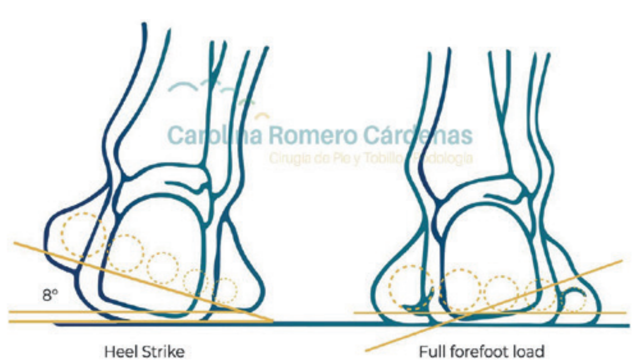

Figure 3. The rearfoot is struck in 6 degrees of varus, and the forefoot is elevated. The pronate until the forefoot is in contact with the ground.

c. **Forefoot support**: The ankle's position is in slight plantar flexion. A more significant load on the Achilles tendon and calf decreases the proximal load on the distal tibia, with a better elastic energy use, favoring the speed in the race.

In beginners, support is usually on the heel, which favors the appearance of injuries due to overuse and overload of the distal tibia. Strength training and running technique exercises can modify the type of stride over time and progressively improve the stride and running gesture[4,5]. However, it is not possible to alter the kind of stride voluntarily, suddenly, or to try to perform a foot strike that is not physiological, because this leads to an overload of the lower extremities.

Shoe anatomy

In most cases, the construction of running shoes is comprised of the following parts[5] that fulfill specific functions (Figure 4):

- **The heel counter or buttress:** it gives support to the heel; this can be soft or more rigid and controls the stability of the heel;
- **The heel:** height of the sole in the back that determines the drop;
- **The sole and midsole:** midsole are layers of thermoformed materials that form the middle of the sole; it fulfills the function of cushioning and is covered by the sole, which is the outermost portion of the shoe that provides protection and controls the friction to the ground;

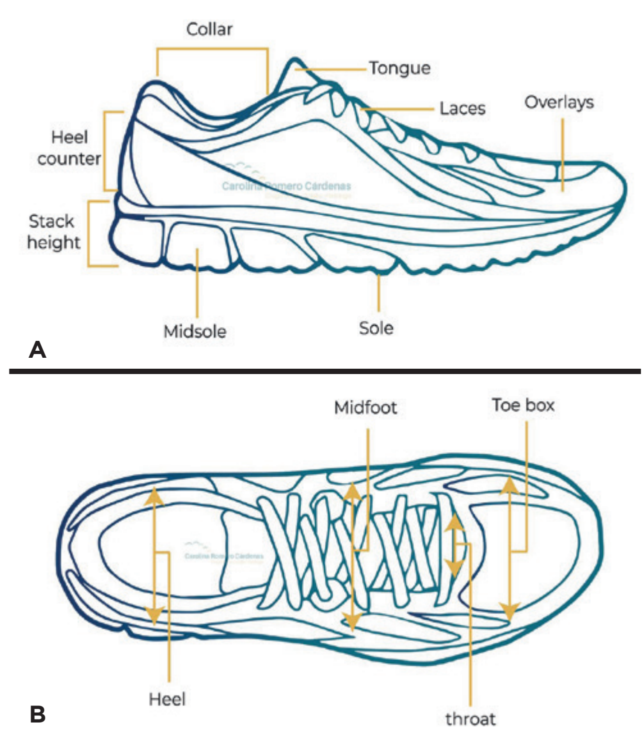

Figure 4. Anatomy of the running shoe (A) Lateral view (B) Top view.

- **The heel flare:** posterior angulation of the medial or lateral heel. The standard angle is 15º. The greater the medial or lateral heel flare, the greater the stability;
- **The upper:** material covering the foot;
- **The toe box:** the most anterior portion where the forefoot is housed;
- **The heel tab:** the tongue at the back of the shoe that helps put on the shoe and protects the Achilles tendon; and
- **The neck collar:** located on the back of the shoe, it adjusts the ankle, tongue, holes, and laces.

What are "pronator" or stability shoes?

These are shoes designed to promote a greater internal control of the foot's movement in contact phase and mid stance. (Figure 5). They are helpful for people with valgus rearfoot, flat feet, and pronation during walking. They are characterized by having materials of greater density (greater hardness) in the medial portion as wedges or arches of support in the rear portion of the heel. This results in a lower medial arch of inclination (pronation) during walking and provides stability. Due to the density of the materials, they are usually heavier shoes.

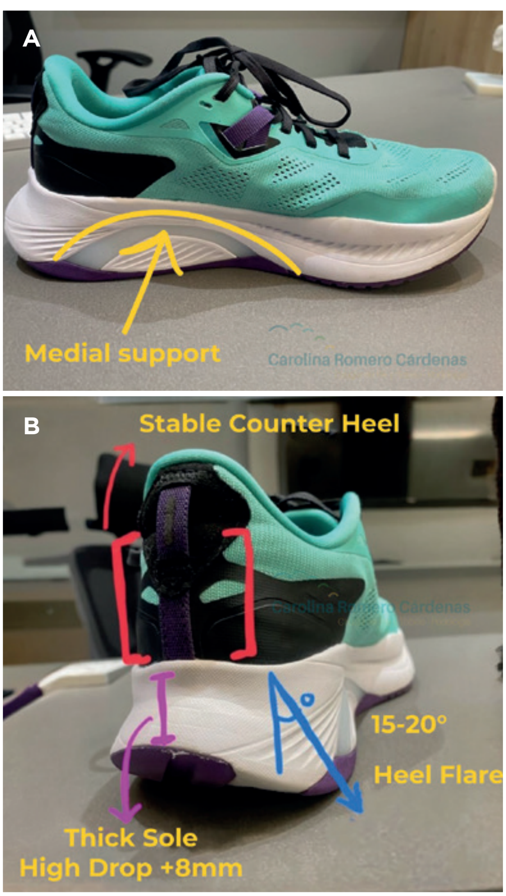

Figure 5. Pronator of stability shoes: characterized by having materials of greater density in the medial arch as wedges or arches of support in the rear portion of the heel. Also, with thick soles, the counter heel is more stable and has a wide heel flare, providing stability.

Which footwear structure characteristics have been studied?

Significant changes have been made in the biomechanics of running in shoes.

Few studies have been conducted on shoe construction; no study shows one shoe "construct" as being superior to another. Literature focuses on the relationship between performance and injury prevention. Two systematic literature reviews by Lin et al.[2] and Sun et al.[2,5] about footwear science describe the characteristics of a shoe, its function, its modifications in the biomechanics of running, and whether it has been shown that these structures can prevent the occurrence of injuries.

Which shoe structure variables or features provenly improve performance and decrease the risk of injury according to the literature?

The most reviewed variables are the drop, hardness, cushioning, stiffness, bending stiff, weight of the shoe, and height (thickness) of the sole.

Other characteristics less reported in the literature include heel flare, laces, number of lace holes, shoe fit, stiffness of the upper, and heel cup[5].

- **Midsole**: This is formed by foam layers (Figure 6), normally thermoformed materials, which means their properties are modified by heat and pressure; the most commonly

Figure 5. The midsole is formed by layers of foam that provide cushion; in between, some shoes provide more rigid materials such as carbon plates or TPU that provide stiffness.

used materials in the market are ethyl vinyl acetate (EVA) and polyurethane (PU), and their main characteristic is to provide cushioning. Densities of elastomeric materials can be divided into high, medium, or low according to the Asker scale (Ask C), done with a durometer measuring system; for example, AskC 50 is a mid-high-density material. Each company has developed and patented its own branded foams, such as Lightstrike Pro (*Adidas, Adidas, DEU*), Fuelcell (*New Balance, New Balance Athletics, Boston, MA, USA*), and Zoom X (*Nike, Nike, Inc. Oreg, USA*), among others.

The EVA is a less dense material that loses its properties under load (it wears out more). Fewer mechanical changes are seen in PU, therefore, it lasts longer. Literature indicates that the harder the midsole, the greater the reactivity to the ground, the better the take-off, and the better the medial stability control (pronation)[2,5].

- **Stiff materials and bedding stiff: carbon plates and thermoplastic polyurethane:** Recently, more rigid and light materials have been developed, such as carbon plates or thermoplastic polyurethane (TPU) (Figure 6). The "latest technology" shoes or the new "super shoes" have emerged, where layers or bars of these light and rigid materials are introduced, promoting a *bending stiff* characteristic: the resistance of a material subjected to bending. They improve the reactivity of the foot when in contact with the ground and favor the GRF take-off [6]. Several studies show that elite runners using shoes with carbon plates (Nike Vaporfly - Nike, Inc. Oreg) improve performance by 4% to 6% in comparison with shoes without carbon plates; they improve stride length and decrease the center of gravity oscillation[6,7]. They also improve VO2 and runner performance. It has been shown that the stiffer the material, the better the response to the GRF, improving propulsion, reducing the forefoot impact, and increasing ankle plantar flexion at toe-off[6]. Although they improve running performance, there are no studies showing injury prevention.
- **Sole:** The outermost portion; it is usually made of rubber or similar materials. These provide grip, control friction to the ground, and give the shoe durability. Each company has also developed alliances with different companies, such as Sketchers (*Skechers, CA*) with Goodyear, and Adidas (*Adidas, DEU)* with the Continental brand.
- **Sole thickness/height:** The higher the sole, the greater the vertical load absorption and the greater the material's durability. It promotes an improved plantar pressure, which is the sensation of feeling the sole "in contact" with the ground[2].
- **Weight:** It affects the running economy. It may sound logical – the heavier the shoe, the greater the metabolic expenditure; it has been shown that 100 g increases VO2 by 1%. Therefore, the lighter the shoe, the lower the energy consumption. For example, a stable neutral shoe for daily training, such as the Brooks Ghost (*Brooks Sports, WA*), weighs approximately 298 g, while the Hoka Carbon X3 (*Hoka, CA*) weighs 198 g, a lighter shoe with a greater reactivity for race day.
- **Heel flare:** The more significant the lateral angle, the greater the lever arm. Thus, the arc of movement is more critical when the rearfoot makes varus contact and initiates pronation to achieve the hole forefoot support. There is a greater pronation control when the flare is medial, while the lateral flare improves axial load in contact. No changes in ankle kinematics have been demonstrated, nor are there studies that show injury prevention.
- **Drop:** It is the shoe sole inclination, given by the difference in millimeters between the heel and the forefoot. If the heel measures 35 mm and the forefoot, 26 mm, the shoe drop is 9 mm. Shoes are divided according to the drop into high: 8 mm–10 mm, medium: 5 mm–8 mm, low: 1 mm–4 mm, and zero: 0 mm. The drop affects the impact of the foot contact with the ground, the distribution of loads on the foot, knee, and hip, and the foot take-off.

When the drop is high, the arc of mobility of the ankle decreases (up to 5º). This reduces load absorption in the foot, ankle, and Achilles tendon, with load being transferred to the distal leg and knee. It favors heel strike and increases tibial acceleration[7] (Figure 7A-B). In the low drop, there is a greater arc of ankle mobility in dorsiflexion. This favors midfoot and forefoot support, absorbs a more significant impact, and makes the footwork a spring. Load on the hip, gluteus, iliotibial band, and knee is decreased. It has been shown to improve the running chain[7] (Figure 7C-D).

Therefore, high-drop shoes are indicated in patients with foot and ankle pathology to protect them. These are also useful in beginners in running, since their musculoskeletal and articular systems are not yet adapted to support the running load. In addition, this type of runner usually starts running with a heel-supported running technique, so the high drop decreases the load on the foot.

On the other hand, medium- or low-drop shoes are better tolerated by more experienced athletes, since their musculoskeletal system is adapted to the load and the running technique used has been developed to support the midfoot and forefoot. Therefore, the more proximal knee and hip region are protected from impact. Zhang et al.[8] conducted a study on female runners showing that high-drop shoes (10.5 mm) increase the knee extension moment in the midstance phase and the patellofemoral stress area. Therefore, for patellofemoral pain ($p = 0.003$), it is suggested using medium-low drop shoes.

How can we apply this information?

Not all shoes are meant for all athletic activities, and not all shoes are for everyone. How to choose the correct shoe? Three variables must be considered:

1. What is the type of activity?
2. How is the physical examination of the running patient?
3. Does the patient suffer from previous sports or overuse injuries?

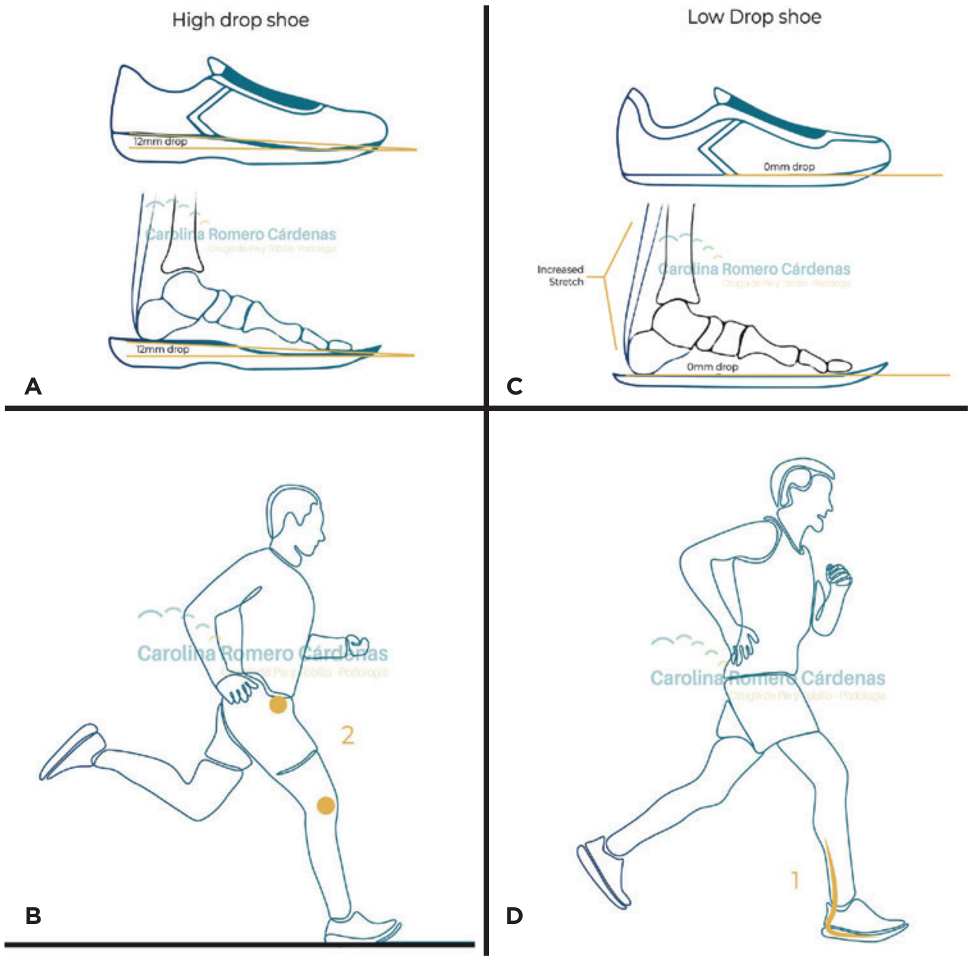

Figure 7. (A) High drop shoe: position of foot, ankle, and Achilles tendon (B) High drop shoes reduce load absorption in the foot, ankle, and Achilles tendon; the load is transferred to the distal leg and knee (C) Low drop shoe: position of foot, ankle, and Achilles tendon (D) In low drop shoe midfoot and forefoot absorb more significant impact.

In running, there are different types of "activities" or workouts that require different shoe types, which can be grouped as:

a. Shoes for daily training (daily trainer) or easy run shoes;
b. Shoes for long run training;
c. Shoes for interval or speed training (e.g., track training); and
d. Shoes for competition or race day.

From this arises the concept of "shoe rotation." It has been shown that rotating or alternating at least two pairs of shoes adapted to each activity decreases the training load, improves performance, prevents injuries, and optimizes the technology (cost-benefit) when used for the indicated activity.

Example of "shoe rotation" options currently available on the market: a) easy run shoes, NB 10180 (*New Balance Athletics, Boston MA)* – stable, with adequate cushioning, high drop; b) long-distance shoes, Adidas Boston 12 (*Adidas, DEU)* – high drop, good rearfoot cushioning, reactivity in the forefoot portion; c) interval/speed shoes, Hoka Match X (*Hoka, CA)* – medium drop, medium carbon midsole in forefoot, light; d) competition shoe, Nike Vaporfly (*Nike, Inc. Oreg)* – carbon plate, medium-high drop, lightweight, very reactive.

A physical examination by a specialist physician or physiotherapist is essential (Figure 8), examining patient while standing and walking. It must evaluate the heel in contact and mid-stance phase further evaluating the structure of the foot – neutral foot, valgus flat foot, or supinated pes cavus. The constitution and weight of the patient are also essential[9]. This guides us to choose a neutral or stable shoe (shoes for pronators). For example, shoes such as Brooks Glycerine (*Brooks Sports, WA)*, neutral shoes with high soles and high density, would be ideal for a person with a thick and large constitution; on the other hand, the top-of-the-range shoes Nike Alpha Fly 2 (*Nike, Inc. Oreg)* are shoes with beveled heels and lightweight for people with the high pace

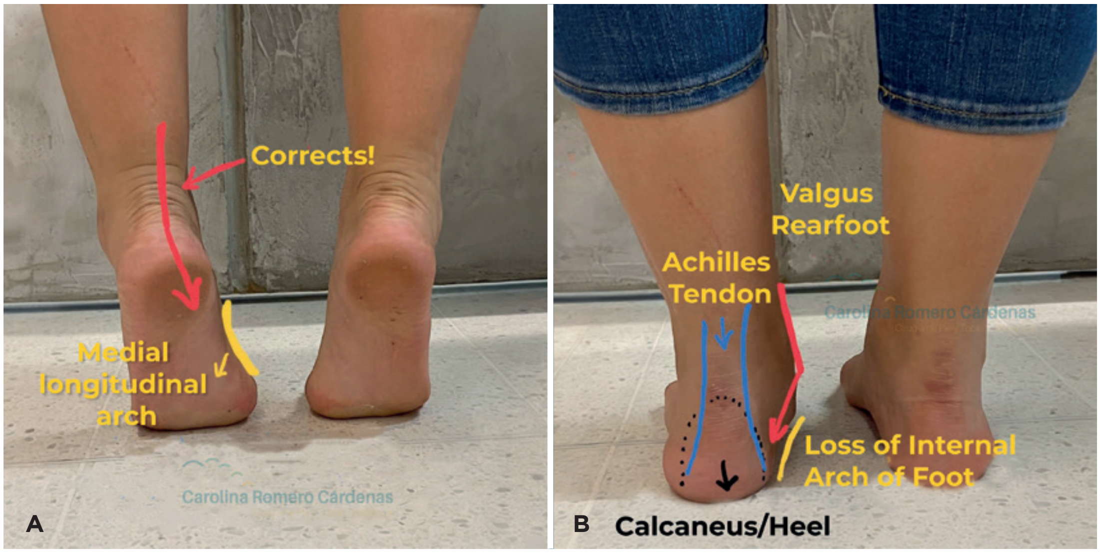

Figure 8. Physical examination should be performed while standing and walking. An example is a hind foot valgus.

of a light constitution. In turn, performing a proper anamnesis and evaluating musculoskeletal injuries or previous overuse injuries is also important. Among the most frequent injuries in runners are stress fractures, splints shinst, patellar tendonitis, plantar fasciitis, and Achilles tendonitis[10].

What would be the ideal shoe?

No ideal construct has been described in the literature[2,5]. There are many studies on running biomechanics, overuse injury prevention, running efficiency, and shoe materials. However, there is little literature on how to guide our athlete patients in choosing an ideal shoe, especially for amateur runners just starting out in the sport. As runners become more experienced, not only does their musculoskeletal system adapt to the load, but they also recognize what type of shoe they can choose during different types of training[11].

In my idea as a physician and amateur runner, an ideal shoe for beginners or experienced amateur runners who want a shoe for daily training (daily trainer) and long-distance races should have the following characteristics[11,12]:

1. Neutral, with adequate stability. Only pronator shoes for runners with flat feet and pronation in contact phase and mid-stance phase;
2. Medium–high drop (7 mm–10 mm). This provides better shock absorption and ankle and foot protection[12,13];
3. Adequate cushioning. Rearfoot with an adequate load absorption capacity and forefoot with stiffer and lighter materials that favor the release and reactivity to the ground.
4. Long-distance training. For daily use (daily trainer) or for long-distance races.

Discussion

Choosing the right running shoe is paramount for enhancing performance and preventing injuries among runners. This review highlights the critical interplay between shoe design and running biomechanics. The intricate structure of the foot and the phases of the gait cycle underscore the necessity for footwear that complements natural foot movements while mitigating the risk of overuse injuries.

The review outlines the essential components of running shoes, such as the midsole, heel, upper, and outsole, each contributing to the overall functionality and comfort of the shoe. The midsole plays a pivotal role in cushioning and shock absorption, with materials like EVA and PU offering varying levels of durability and responsiveness. The integration of advanced materials, such as carbon plates and TPU, has led to the development of "super shoes" that enhance running efficiency by improving ground reactivity and reducing energy expenditure.

The discussion on shoe drop highlights its significant impact on load distribution and injury prevention. High-drop shoes benefit beginners and those with foot and ankle pathologies, as they reduce the load on these areas. Conversely, experienced runners may benefit from low- to medium-drop shoes that promote a more natural running gait and protect the proximal knee and hip regions from impact.

Shoe rotation is another critical concept that emerged from this review. Alternating between different pairs of shoes tailored for specific training activities can reduce training load, enhance performance, and prevent injuries. This approach underscores the importance of selecting shoes based on the type of running activity, from daily training to competition.

The practical application of these findings involves thoroughly examining the runner, considering factors such as foot structure, weight, and previous injuries. This personalized approach ensures that the recommended shoe type aligns with the runner's biomechanical needs and training goals.

Despite the advancements in shoe technology, there is no universally ideal running shoe. The optimal choice varies based on individual biomechanics, running style, and specific needs. It is crucial that future research shifts its focus to longitudinal studies. These studies can provide valuable insights into the long-term effects of different shoe constructs on performance and injury rates among diverse populations of runners, not just elite or professional runners.

In conclusion, the art of choosing the right running shoe lies in understanding the intricate relationship between shoe design, foot biomechanics, and individual running requirements. By applying biomechanical principles and leveraging advancements in shoe technology, healthcare professionals play a crucial role in providing informed recommendations. These recommendations can significantly enhance running efficiency and reduce the risk of injuries.

Strengths and limitations

This review comprehensively analyzes the relationship between running shoe design and running biomechanics, offering valuable insights for healthcare professionals and runners. One of its key strengths is the detailed examination of the anatomical and biomechanical factors that influence running efficiency and injury prevention. By synthesizing information from various studies, the review highlights critical components of running shoes, such as midsole materials, shoe drops, and advanced technologies like carbon plates. This allows a more informed understanding of how these factors contribute to runners' overall performance and safety.

Additionally, the practical recommendations for shoe selection based on individual biomechanics and running activities are a significant strength. This personalized approach can guide healthcare professionals in advising runners on the most suitable footwear, potentially reducing overuse injuries.

However, this review also has limitations. The rapidly evolving nature of running shoe technology means that innovations and materials may need to be fully covered. Furthermore, reliance on existing literature implies that the quality and scope of previous studies constrain the review. Many of the studies reviewed have focused on elite athletes, which may limit the generalizability of findings when it comes to amateur runners. Additionally, there is a need for more longitudinal studies to assess the long-term effects of different shoe constructs on performance and injury prevention.

Future research recommendations

Future research should focus on longitudinal studies assessing the long-term effects of different running shoe constructs on performance and injury prevention across various populations, including amateur and recreational runners. More comprehensive studies are needed to evaluate the impact of emerging technologies and materials in running shoes, such as carbon plates, advanced cushioning systems, and sustainable materials.

Additionally, research should investigate biomechanical differences in running mechanics among diverse demographic groups, including age, gender, and body types, to determine how personalized shoe recommendations can be optimized for each individual. Studies should also explore the effects of different training regimens in conjunction with various types of footwear to better understand how shoe characteristics affect training outcomes and injury risk over time.

Finally, interdisciplinary research involving collaborations among biomechanics specialists, podiatrists, orthopedists, and sports scientists could provide a more holistic view of the interaction between footwear and human biomechanics. This would help develop more precise guidelines for selecting running shoes tailored to individual needs, enhancing performance and reducing injury rates among runners.

Other recommendations

Currently, the market offers various running shoe options, and it is not easy to know their characteristics. But, nowadays, there is non-medical literature available with very accurate and good-quality information that allows us to quickly review the characteristics of shoes, enabling us to suggest and guide our patients. I dare to suggest some non-medical accounts updating the boots on the market, such as https://www.runnea.com/, @doctorsofrunning, and https://solereview.com, among others.

With these sources, you can evaluate general characteristics, such as gender, weight, drop, cushioning, stability or neutrality, patient's constitution, type of footprint, use of the shoe (competition—training), technology (with carbon plates or TPU), forefoot support, distance to run, reactivity, and shoe flexibility.

Conclusion

Running is a booming sport worldwide, and more and more patients are consulting for musculoskeletal injuries and asking for advice on purchasing running shoes. The variety in the market is vast, and we should not be guided only by fashion or flashy models. Behind every design, literature and studies provide valuable information about the shoe structure and biomechanics.

Health professionals should focus their recommendations on the patient's activity, perform a thorough examination, and evaluate previous injuries caused by overuse. It is critical to guide the patient to the best shoe option that suits their needs.

The right running shoe can improve a runner's performance, prevent injuries, and promote a healthier and safer running experience. The running shoe industry has advanced significantly, offering products that combine advanced technology with ergonomic design. Leveraging these advances and applying biomechanical knowledge in clinical practice is essential to provide the best advice to our running patients.

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