# Barefoot Running
(การวิ่งเท้าเปล่า)

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## Abstract

Running is one of the most popular sport activities which millions of people have engaged in. It is convenient, inexpensive and offers numerous health benefits. With a pair of shoes, people can start running. The modern running shoes have been thought of a protective device from different surfaces and environment. Shock attenuation has been one of the primary roles for running shoes to provide shock absorption. The various materials have been added to improve the wearer's performance and impact force reduction but some researchers concluded that expensive running shoes were no better at reducing impact forces than were low-cost shoes as well as other studies which postulated that barefoot running could reduce impact force. In addition, the incidences of running and overload injuries which occur as a result of repetitive microtrauma from chronic loading of skeleton, especially lower extremities, had risen as well. With the release of the book about Tamahumara Indians in Mexico, Born to Run, barefoot running has seen a rise in popularity over the last half a decade. There still are the controversial issues if barefoot running is helpful or harmful. Some studies showed the impact reduction which leads to injury prevention while some studies argued that it could stimulate more injuries and long-term effects on feet. There are still a lot of debates over barefoot running about benefits and safety. However, this trend has spread to the footwear manufacturers. The minimalist shoes which offer little protection on the heel have been launched to the market.

**Keywords :** barefoot, minimalist, running injuries, footwear, biomechanics of runnin

## บทคัดย่อ

การวิ่งเป็นหนึ่งในกิจกรรมกีฬาที่ได้รับความนิยมสูงสุด ผู้คนจำนวนนับล้าน...... การวิ่งเป็นกิจกรรมที่สะดวกต่อการเข้าร่วม ค่าใช้จ่ายน้อย และมีประโยชน์ต่อสุขภาพเป็นอย่างยิ่ง คนเราสามารถเริ่มต้นออกกำลังกายด้วยการวิ่งได้ด้วยรองเท้ากีฬาเพียงคู่เดียว รองเท้ากีฬาในปัจจุบันทำหน้าที่เป็นอุปกรณ์ในการป้องกันร่างกายจากพื้นผิวและสภาพแวดล้อมที่แตกต่างกันออกไป การลดแรงกระแทกเป็นหนึ่งในบทบาทหลักสำหรับรองเท้าวิ่ง เพื่อดูดซับแรงกระแทก วัสดุหลากหลายประเภทได้รับการเสริมเข้ามาเพื่อปรับปรุงประสิทธิภาพของผู้สวมใส่รองเท้า

และลดแรงกระแทก แต่ผู้วิจัยบางรายสรุปว่า รองเท้าวิ่งที่มีราคาแพงไม่ได้ช่วยลดแรงกระแทกมากไปกว่ารองเท้าที่มีราคาถูก เช่นเดียวกับงานวิจัยอื่นๆ ที่เสนอแนะว่า การวิ่งเท้าเปล่าสามารถลดแรงกระแทกได้ นอกจากนี้ อุบัติการณ์ของการบาดเจ็บซ้ำจากการวิ่งซึ่งผลให้เกิดการบาดเจ็บในระดับเซลล์หรืออเนื้อเยื่อจากแรงกระแทกต่อโครงสร้างร่างกายเป็นระยะเวลานาน โดยเฉพาะรยางค์ขา มีอัตราเพิ่มสูงขึ้น จากการที่หนังสือ "Born to Run" เกี่ยวกับชาวเผ่าอินเดียแดงทามาฮูมาราในประเทศเม็กซิโก ทำให้การวิ่งเท้าเปล่าได้รับความนิยมมากยิ่งขึ้นในช่วงระยะเวลา 5 ปีที่ผ่านมา แต่ก็ยังมีประเด็นโต้แย้งว่า การวิ่งเท้าเปล่านั้นมีประโยชน์หรือโทษ การศึกษาบางงานแสดงถึงการลดลงของแรงกระแทกซึ่งนำไปสู่การป้องกันการบาดเจ็บ ในขณะที่งานวิจัยบางงานโต้แย้งว่าการวิ่งเท้าเปล่าสามารถกระตุ้นให้เกิดการบาดเจ็บมากยิ่งขึ้น และส่งผลในระยะยาวต่อเท้าด้วย การโต้แย้งเกี่ยวกับการวิ่งเท้าเปล่าเกี่ยวกับประโยชน์และความปลอดภัยนี้ยังคงมีอยู่มาก อย่างไรก็ตาม แนวโน้มของการวิ่งเท้าเปล่านี้ได้แพร่ขยายไปสู่ผู้ผลิตรองเท้ารองเท้า Minimalist ซึ่งให้การป้องกันส้นเท้าน้อย จึงไปเริ่มมีการวางจำหน่าย

**คำสำคัญ** : เท้าเปล่า minimalist การบาดเจ็บจากการวิ่ง รองเท้า ชีวกลศาสตร์ของการวิ่ง



## Introduction

Millions of people are involved in recreational running all over the world. Running is one of the most popular forms of aerobic exercises which requires no membership, inexpensive and offers numerous health benefits. The health benefits of running are similar to the benefits achieved by all forms of moderate intensity cardiorespiratory exercise. It helps improve the efficiency of cardiorespiratory system, decrease cholesterol, prevent heart diseases and hypertension, improve immune system, control body weight. Aside from health benefits, there are several psychological benefits such as stress reduction, confidence and attitude improvement. Running can be performed anywhere with a pair of shoes and comfortable clothes.

## Biomechanics of Running

Running is a complex task involving the coordination of all the body's segments. It is a modification of walking but different in significant aspects. The running cycle consists of a stance phase, where one foot is in contact with the ground while the other leg is swinging, followed by a float phase where both legs are off the ground or no double support. The stance phase is divided into two sub-phases: early stance and late stance, and the swing phase is divided into three sub-phases: early swing, mid-swing and late swing (Fig. 1) (Hunter et al., 2008).

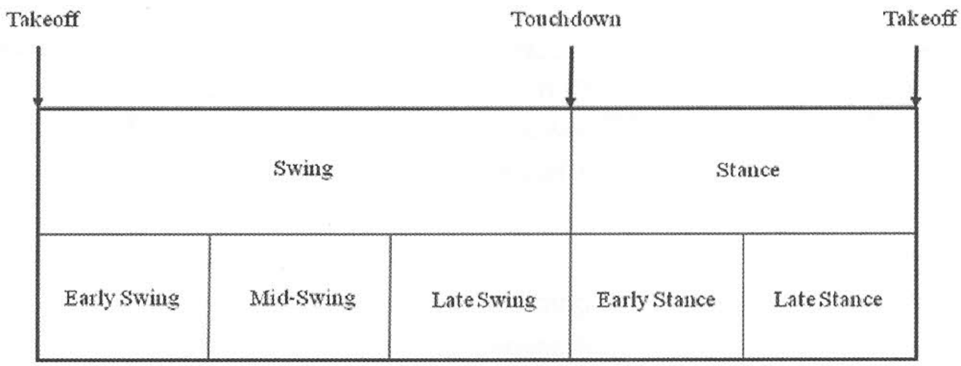


**Fig. 1.** Phases of running cycles, based on event of a single lower-limb (Hunter et al., 2008).

The stance phase serves to absorb impact forces and maintain forward momentum and to support the body's weight. The late stance functions to accelerate the body forward and upward by an increase in the limb length. The swing is the enhancement of the forward and upward ground reaction thrust. This phase begins as the foot moves forwards.

## Kinematics of Running

Kinematics is the study of the motion of object. The variables describes as a function of the percentage of the total running cycle. The trunk and pelvis are tilted forward in order to keep the forward acceleration. The hip is flexed between 25° and 30° at foot strike. The hip extends maximally just before toe-off. During the early stance, the knee and ankle joints flex. A further 20–30° of knee flexion occurs early in the stance period which is a natural mechanism that cushions some of the impact force. Most runners initially contact the running surface with their rearfoot. In the late stance, the knee extension and ankle plantarflxion are followed. The ankle plantarflexes up to 30° before toe off (Novacheck, 1998; Lafortune et al, 2000). The heel contacts the ground with the foot in a slightly supinated position (Mann et al., 1981). After that, the foot progresses into pronation accompanied by hindfoot eversion and tibial internal roation which increases mobility of subtalar joint and forefoot. After maximal foot pronation, the subtalar supination begins at heel-off and remainder of the stance phase for propulsion (Dugan & Bhat, 2005). After take-off, the hip starts to flex and continue through the midswing. The knee and ankle undergo flexion for toe clearance. The hip and knee joint start to extend in preparation for touchdown at late swing phase (Hunter et al., 2008).

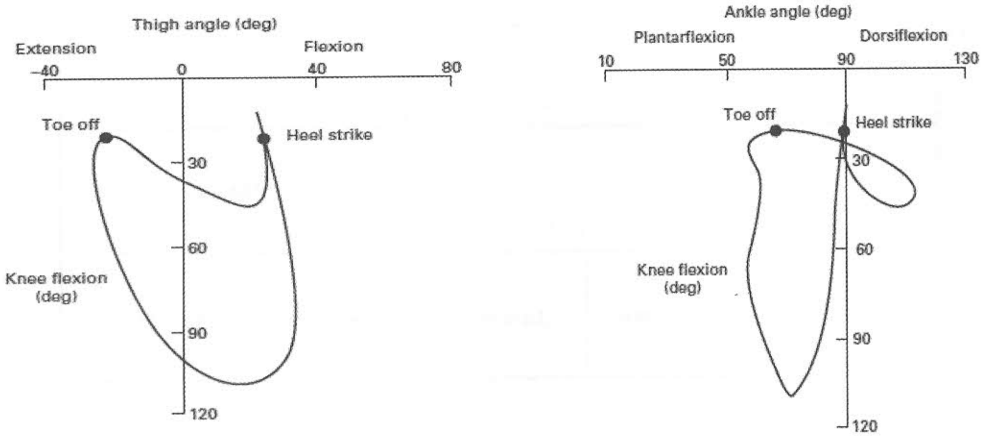


**Fig. 2**. Knee flexion angle as a function of (a) the thigh angle and (b) the ankle angle (Lafortune et al., 2000)

### Kinetics of Running

According to the 3rd law of Newton, Foot contact generates a reaction force from the ground which is divided into three components; vertical ground reaction force, anteroposterior ground reaction force, and mediolateral ground reaction force. The vertical component is the largest component which effects the human skeleton. The previous studies provided the information concerning the magnitude, direction and point of application. Its magnitude is 1.3 to 1.5 times body weight during walking while the magnitude of vertical ground reaction force in running is able to approach 3 to 4 times body weight. In addition, the peak impact force relates to running speed. As the running velocity increases, the amplitude of ground reaction forces increases (Cavanagh & Lafortune, 1980).



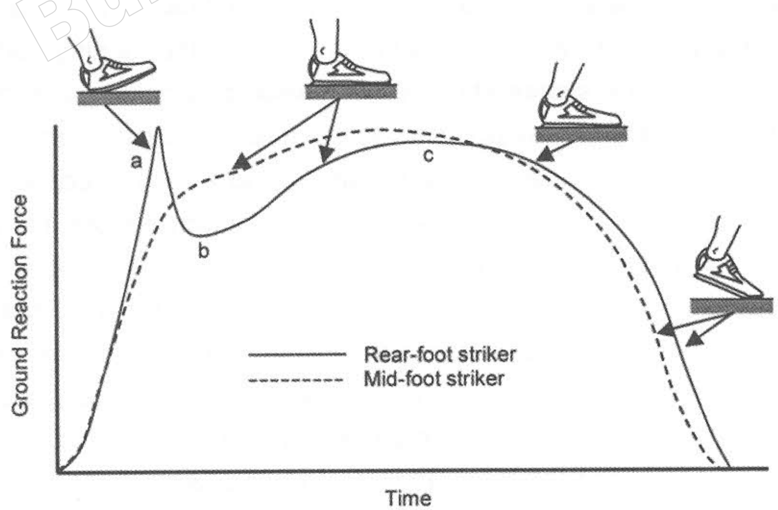


**Fig. 3.** Vertical ground reaction forces compare between rearfoot striker and midfoot striker (Blazevich, 2007)

The vertical impact force presented in Fig. 3 showed the characteristics of a rearfoot runner and midfoot runner. Running style is classified according to which part of the foot makes first contact with the ground. Runners with a mid-or forefoot impact will tend to experience a lower impact force as the loading is cushioned by the active contraction of the calf muscles (Grimshaw et al., 2006)

## Human Foot and Functions

In order to provide support for standing and a lever for propulsion, the stability of foot during weight bearing derives from articulations and ligaments from the heel to the central metatarsal heads. As well as being the firm supporting base, it needs to be flexible for propulsion and moving on the irregular surfaces. The human foot is a complex structure with 26 bones, several joints, ligaments and soft tissues. It is divided into 3 parts; forefoot, midfoot and rearfoot. The forefoot, the most flexible part, includes five metatarsal bones and fourteen phalanges. The midfoot includes five tarsal bones arranged in two rows. The rearfoot includes talus, which forms the pivot of ankle joint, and calcaneus which forms the heel (Fig. 4a).

There are three arches from the structural formation (Fig. 4b); the medial and lateral longitudinal arches, and transverse arch. The medial longitudinal arch is the highest and most important, is composed of the calcaneum, talus, navicular, cuneiforms and the first three metatarsals. The lateral longitudinal arch is lower and flatter than the medial arch. It is composed of the calcaneus, cuboid, and the fourth and fifth metatarsals. The transverse arch is composed of the cuneiforms, the cuboid, and the five metatarsal bases. These arches are strengthened by ligaments and tendons (McKinley & O'Loughlin, 2008).

The arch of the foot is an important design feature for the stability and function of the foot. It is capable of supporting itself by the foot natural arch support mechanism known as the windlass mechanism (Hicks, 1954), that the medial longitudinal arch is raised on dorsiflexing the first metatarsophalangeal joint.

## Running Injuries

Many injuries are related to running because of the high impact forces. Since recreational running becomes dramatically popular among people, the incidence of running injuries has risen. Several literatures indicated that the etiology of running-related injuries was multifactorial characteristics (Keller et al., 1996; Satterthwaite et al., 1999; Taunton et al., 2002; van Middelkoop et al., 2008; Buist, et al, 2010; Buist, et al, 2010; Harrast & Colonno, 2010; Lynch & Hoch, 2010; Chang et al., 2011). The factors that causing running injuries could be categorized into three factors: training, anatomical, and biomechanical factors. The training factors have been routine excessive mileage, increased intensity, duration and frequency of running, irregular surface running, running experiences, orthotic use, the type of shoe insoles, the racing group, training duration and terrain, incorrect footwear, training errors. The anatomical factors have been identified as the abnormalities or malalignment of the body, especially lower extremities such as tibia varum, rearfoot varus, and leg length discrepancies. The biomechanical factors have been the magnitude of impact forces (Cavanagh & Lafortune, 1980), the rate of impact loading (Nigg, 1986), and the magnitude of push off forces (Winter, 1983).

Most of the running injuries are overuse injuries which occur as a result of repetitive microtrauma from chronic loading of tendons, muscles, or bones. Lun et al. (2004) studied musculoskeletal injuries of 87 recreational runners who had no history of injury at the start of the study and found the incidence was 79%, which was the same for both sexes. van Gent, et al (2007) summarized that running injuries occurred 7%-50% at knee, followed by the lower leg (9%-32.2%), the foot (5.7%-39.3%) and upper leg (3.4%-38.1%). van Mechelen (1992) stated that 50-75% of injuries are due to overuse from running.

The modern running shoes have been thought of a protective device from rough and uneven surfaces, excessive ground impact forces, and cold - wet environments. Running shoes were first designed in the 1970s. Footwear characteristics found to influence injury rates include shock absorbing properties (Finestone et al., 1992; Milgrom et al., 1992; McKay, Goldie & Oakes, 2001; Torkki et al., 2002), arch support system, outsole and midsole materials (Chiu & Wang, 2007), shoe flexibility, toe box room (Miller, 2000), pressure over the plantar surface area (Jordan, Payton & Bartlett, 1997). Shock attenuation has been a major concern for footwear designers and manufacturers, as one of the primary roles for running injuries reduction by providing shock absorption (Cavanagh, 1980; Nigg, 1986). In addition, the deformity of the foot such as overpronation has also been identified as a key factor related to running injuries (Hart and Smith, 2009).

The three primary categories of running footwear in the market are motion control, cushion trainers, and stability shoes. Motion control shoes are developed to control excessive rearfoot motion (Williams et al., 2001). Motion control running shoes are rigid, durable, stable control-oriented running shoes that limit pronation. These shoes are designed to provide significant support for flat-footed or severe overpronators. Cushion trainer shoes are developed to attenuate lower extremity loading (Williams et al., 2001). The investigations have been focused on midsole cushioning in order to reduce the impact force and running injuries (Andreasson & Peterson, 1986). The midsole will provide the extra shock absorption and is best for runners with a high arch. Stability shoes are designed for the runners with a normal arch. It is believed that assigning running shoes matched to arch type, injury risk could be reduced (Knapik et al., 2010). Footwear manufacturers have tended to pay more attention to shock absorption and cushioning than to motion control in designing running shoes with much attention to midsole hardness.

**Barefoot Running**

Basically a minimalist lifestyle is a lifestyle that is free of complications, clutter, confusion and distraction to change their lives from turmoil, materialism, and a poor work life balance, to something more holistic. People still believes that if something is more complex and complicated then it must be better, but the minimalists prefer to look for elegant simplicity as the deciding factor of quality.

The human foot is designed that the toes are spread and extended. In well-developed societies, the foot's natural shape has been changed by long wearing footwear which the heel is elevated above the forefoot, the toes become elevated and pinched together over time. This deforms the foot, and leads to the foot problems, gait abnormalities, musculoskeletal pathologies. Several researches supported the claims that going barefoot was healthy and natural (Robbins & Hanna, 1987; Cook, et al, 1990; van Mechelen, 1992). Barefoot running, minimalist running and natural running are all terms that describe running in a manner that allows the foot to function the way it is designed. With the release of the book about Tamahumara Indians in Mexico, Born to Run: *A Hidden Tribe, Super Athletes, and the Greatest Race the World Has Never Seen,* the interest of barefoot running has popularly risen.

In order for effectiveness and safe, persons need to organize physiologic and neuromuscular responses to the environment. There are significant alterations to running pattern. Several studies have found consistent changes in barefoot running, for example, decreased stride length, increased stride rate, decreased range of motion at the ankle, knee, and hip, and more ankle plantarflexion at foot strike which allowed weight bearing at the metatarsal heads instead of the heel (Lieberman, 2010). Divert et al. (2005) concluded that these changes in foot strike pattern were largely designed to reduce the impact forces.

The potential benefits of barefoot running

1. Reduction of ground reaction forces; Barefoot running reduced impact force when performed on a sufficient number of steps (Divert, et al., 2005, 2008; Squadrone & Gallozzi, 2009; Leiberman, et al., 2010). In addition, there is adaptation

of the intrinsic musculature with resulting increased strength and, therefore, a medial longitudinal arch that is higher and better able to deform with impact and provide improved shock attenuation (Robbins & Hanna, 1987). De Wit et al (2000) found that runners adopted a flatter foot placement to attempt to limit local impact on the heel when running barefoot, whereas there was a tendency to land heavily on the heel due to the extra cushioning in running footwear.

2. Increased running economy; Burkett et al. (1985) found that oxygen consumption during running increased as the amount of mass they added to the foot increased; shoes and orthotics representing 1% of body mass increased oxygen consumption by 3.1%. Flaherty (1994) found that oxygen consumption during running at 12 km/h was 4.7% higher in shoes of mass weighing 700 g than in barefoot but there were some research stated that the difference in running economy between shod and barefoot is not significantly different (Squadrone & Gallozzi, 2009; Franz, Wierzbinski & Kram, 2012)

3. Increased proprioceptive input; It has been suggested that footwear material densities affected periphearal sensory information (Ganevia & Gurke, 1992; Kurz & Stergiou, 2003). The barrier between the plantar and supporting surfaces would hinder foot position awareness provided by feedback from plantar cutaneous mechanoreceptors in direct contact with the ground (Robbins, et al, 1995). The continuous use of modern footwear limited sensory feedback to the brain, which reduced the brain's ability to process sensations and adapt to the motor responses appropriately (Shakoor & Block, 2006; Doidge, 2007). The improved proprioceptive ability led to a reduction in foot position errors and fewer lateral ankle sprains which caused by impaired proprioception (Robbins, et al, 1995).

4. Increased muscle strength; Rao and Joseph (1992) evaluated 2,300 Indian children between the ages of 4 and 13 and found that the incidence of flat feet was more than three times greater in shod than in unshod leading them to conclude that shoe-wearing in early childhood was detrimental to the development of a normal arch. Robbins and Hanna (1987) stated that barefoot training increased adaptation of the intrinsic muscles of the foot. A recent study suggests that minimally supported shoes might actually improve rehabilitation outcomes as compared to conventional running shoes (Ryan, Fraser, McDonald, & Taunton, 2009).

5. Decreased risk of foot deformities; There were several studies concerned with the increasing of hallux valgus and flatfoot in modern societies based on the assumption of inadequate footwear's consequences. Sachithanandamm & Joseph (1995) surveyed 1,846 adolescents and found that the prevalence of flat feet had increased in those who wore shoes before the first 6 years of age which supported by the study of Staheli (1991). The stiff and tight footwear might lead to deformities

of foot structures during growing up, Wolf et al. (2008) concluded that optimum foot development could only occur in barefoot conditions.

The potential harms of barefoot running

1. Injuries from running surfaces; The skin of the foot is exposed to debris such as glass, nails, rocks and thorns and have a chance to injure. (Squadrone & Gallozzi, 2009).

2. Exposure to microorganisms/infectious agents; Cracks, blisters, or scrapes on the feet will have a higher risk of infection.

3. Lack of support; Less cushioning and a thinner heel shoes should be used with caution and awareness of the possible increased injury risks (Denton, 2005).

4. Poor running pattern; causes muscle strains.

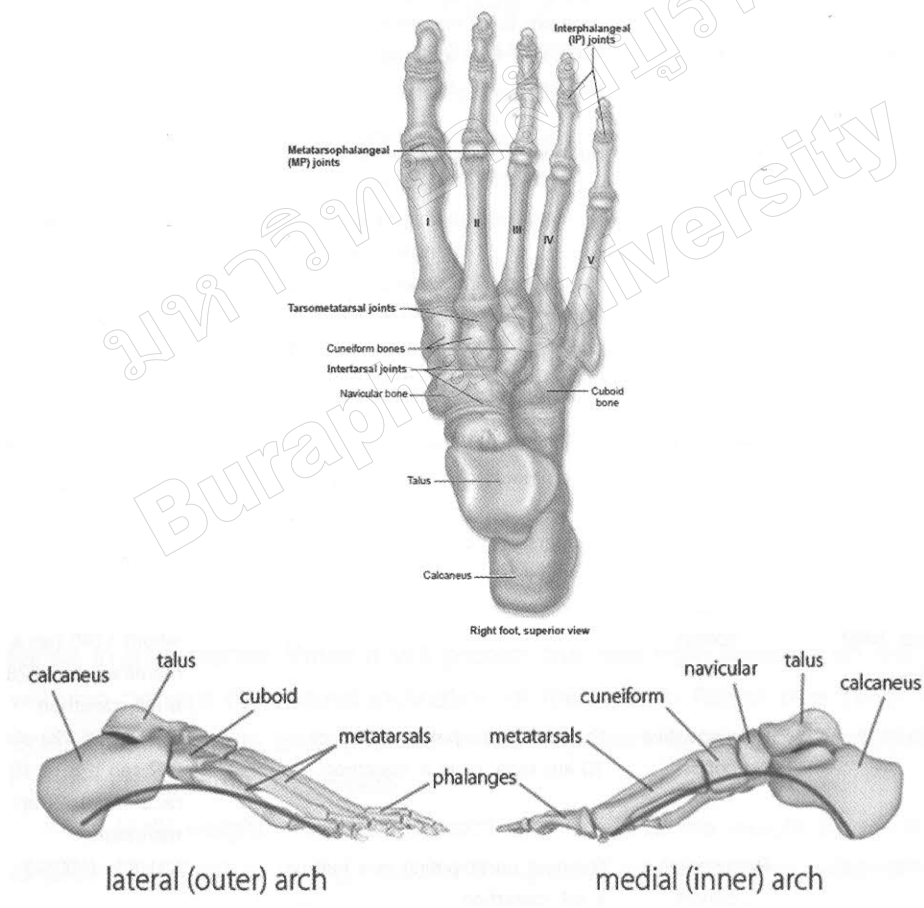


**Fig. 4** a) Anatomical structure of right foot (superior view) b) Longitudinal arches of foot (McKinley & O'Loughlin, 2008)

**Table 1** study characteristics (van Gent et al., 2007)

| Author, year of publication | Study design | Running type | No. included/analyzed (%) |
|---|---|---|---|
| Taunton et al., 2003 | Prospective cohort | Recreational runners, registered in training clinics, interested in either completing a 10 km race or improving their existing race time. | 1020/844 (82.7%) |
| Lune et al., 2004 | Prospective cohort | Recreational runners, running more than 20 km/week. | 153/87 (56.8%) |
| Steinacker et al., 2001 | Prospective cohort | 58 runners in training for a marathon, of whom 42 did participate in a marathon. | 58/58 (100%) of whom 42 ran a marathon. |
| Satterthwaite et al., 2009 | Prospective cohort | Runners participating in a marathon. | 1054/875 (83.0%) |
| Satterthwaite et al., 2006 | Prospective cohort | | 1054/916 (86.9%) |
| Wen et al., 1998 | Prospective cohort | Runners participating in a training program for a marathon. | 355/255 (71.8%) |
| Bennell et al., 1996 | Prospective cohort | Track and field athletes during one season. | 111/95 (85.6%) of whom 21 were long distance runners. |
| Macera et al., 1989 | Prospective cohort | Runners wishing to be notified of road races. | 966/583 (60.4%) |
| Walter et al., 1989 | Prospective cohort | Runners participating in a 4, 5.6, 16, or 22.4 km race and all adult members of the organizing clubs. | 1680/1288 (76.6%) |
| Bovens et al., 1989 | Prospective cohort | Runners participating in a training program for a marathon with three phases (finished with a 15, 25, and 42 km race, respectively). | 115/73 (63.5%) |
| Lysholm & Wiklander, 1987 | Prospective cohort | Competitive athletes of two track and field athletes during one season. | 60/60 (100%) of whom 28 were long distance runners. |
| Kretsch et al., 1984 | Prospective cohort | Runners participating in a marathon. | 1098/459 (41.8%) |
| Nicholl & Williams, 1982 | Prospective cohort | Runners participating in a marathon. | 3462/3429 (99.0%) of whom 1140 ran a half marathon and 2289 ran a full marathon |
| Macera et al., 1991 | Retrospective cohort | Runners participating in a 5 or 10 km race, or in a marathon. | 534/509 (95.3%) of whom 347 ran a 5 or 10 km race and 162 ran a marathon. |
| Jakobsen et al., 1989 | Retrospective cohort | Runners participating in a half or a full marathon. | 831/831 (100%) |
| Maughan & Miller, 1983 | Retrospective cohort | Runners participating in a marathon. | 497/449 (90.3%) |
| Nicholl & Williams, 1982 | Retrospective cohort | Runners participating in a half or a full marathon. | 614/557 (90.7%) of whom 242 ran a half marathon and 312 ran a full marathon |

**Minimalist running shoes**

The evolution of running footwear has been changed. Minimalist running shoes have been believed that it does not only improve the efficiency of a runner's stride, but also dramatically reduce running-related injuries. By forcing a runner to land on midfoot or forefoot instead of heel, minimalist footwear reduces the amount of impact absorbed by the ankles, hips and knees while still protecting the feet with shoes.

The characteristics of minimalist running shoes (Richards & Hollowell, 2011; Kaselj, 2012);

*1. Anatomical correctness:* Minimalist shoes have little padding or arch support. It requires a runner to rely more on their own feet and legs to take care cushioning and stability.

*2. Close to the ground:* The sole is made of a material is to allow proper communication between the sensory organs of the foot and the ground. The thinner and firmer the shoe, the more ground feel (proprioception). The increased ground feel allows the body to adjust to the forces of running in a more efficient way and is optimal for learning natural running pattern and technique. Without a firm message to the nervous system, the body does not know which muscles to use, how hard to turn them on, and how long to keep them on for. To get a clear message in thick/soft shoes, people are forced to strike the ground harder and drive the foot onto a firm surface to give the feedback that requires.

*3. Neutral/lack of drop:* This means the difference in height, as measured from the heel to the ground, and the forefoot to the ground. Regular running shoes have a 12 mm to 24 mm heel-to-toe drop, while more minimalist shoes have at least less than 9mm. It was postulated that wearing a greater heel height provided less stability in the elderly population (Robbins et al, 1997; Tencer et al, 2004). The arches of foot are designed to be supported at the ends, and that means heel, ball, and toes in level and balanced contact. This facilitates stability and balance in mid–stance. While it will protect the foot from hazards on the ground, it will also prevent the natural inclination of the arch to flatten over time. This will prevent the ligaments and muscles in the foot from developing and functioning for optimum strength and health.

*4. Light weight:* The shoe doesn't add much to the weight of the lower leg, and allows the foot to swing back to the ground with a natural motion.

*5. Wide toe box:* The toes are spread and extended. This allows for optimal balance and stride. When the big toe is compressed to be out of alignment, the front end of the arch does not work. The big toe is not allowed to aid in balance, stability, and propulsion.

*6. Rotational and Longitudinal flexibility:* Rotational flexibility is the ability to roll the shoe up from toe to heel and the longitudinal flexibility is the ability to roll the toe box in one direction and the heel in the other and. The foot naturally bends in all directions. Most shoes are stiff in the middle and stiff where the toes bend at the ball of the foot or MTP joint.

*7. Slipper-like:* Shoes should fit well enough that they can be tied loosely enough to take off without untying, but not come off mid-run. Minimalist shoes have little structure for the top of the foot.

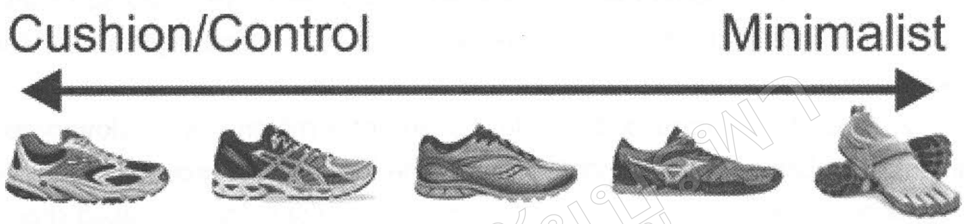


**Fig. 4.** The comparison between modern running shoes and minimalist running shoes

**New Direction in Running Footwear**

From the 1960's to present, the running footwears have been developed from brown rubber to the super cushioning heel by many research which conducted to develop for functions and styles. The several features; raised heel and arch support, are believed that these parts of the shoe will help prevent common running injuries. Why are the super cushioning footwear not able to reduce the incidences of injuries? This big question is discussed among investigators, doctors, runners and footwear manufacturers. Consumers are looking for more comfortable, safe and satisfied. Therefore, the studies are directly geared to the "back to basics" or minimalist lifestyle to improve the functioning of footwear and let the feet move in their natural way, hold the feet in the right places and support the body weight at the right locations.

Since the human lower extremity is not a delicate, rigid, passive structure but is a flexible, active, well designed structure which is capable of handling the impacts during running. Dr. Froncioni (2006), the orthopaedic doctor, predicted from the medical establishment's point of view that the changes would come about in footwear design. However, this trend has spread to the footwear manufacturers. The minimalist shoes, the better shoes with thinner heel and less midsole which offer little protection on the heel have been launched into the market.

## Conclusion

The blogosphere and popular magazines are full of debate about barefoot running, with testimonials to it as a more 'natural' and less injury. It seems that footwear design returns back to a minimalistic state as the natural design of the feet and how the feet function when running. As running shoe trends change towards "minimalist" shoes and shoe manufactures scramble to bring their new products to the market. Currently there is only evidence that forefoot or midfoot striking patterns may help prevent repetitive stress injuries. To date, there is no scientific evidence directly examining the efficiency of minimally supported or barefoot on running injuries.

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