



# ARCHES OF FOOT

If the feet were more rigid structures, each impact with the ground would generate extremely large forces of short duration (shocks) that would be propagated through the skeletal system. Because the foot is composed of numerous bones connected by ligaments, it has considerable flexibility that allows it to deform with each ground contact, thereby absorbing much of the shock. Furthermore, the tarsal and metatarsal bones are arranged in longitudinal and transverse arches passively supported and actively restrained by flexible tendons that add to the weightbearing capabilities and resiliency of the foot. Thus, much smaller forces of longer duration are transmitted through the skeletal system.

The arches distribute weight over the pedal platform (foot), acting not only as shock absorbers but also as springboards for propelling it during walking, running, and jumping. The resilient arches add to the foot's ability to adapt to changes in surface contour. The weight of the body is transmitted to the talus from the tibia. Then it is transmitted posteriorly to the calcaneus and anteriorly to the "ball of

- the foot” (the sesamoids of the 1st metatarsal and the head of the 2nd metatarsal), and that weight/pressure is shared laterally with the heads of the 3rd–5th metatarsals as necessary for balance and comfort. Between these weight-bearing points are the relatively elastic arches of the foot, which become slightly flattened by body weight during standing. They normally resume their curvature (recoil) when body weight is removed.
- The **longitudinal arch of the foot is composed of**
- medial and lateral parts. Functionally, both parts act as a unit with the transverse arch of the foot, spreading the weight in all directions. The **medial longitudinal**
- **arch is higher and more important than the lateral**
- longitudinal arch (Fig. 5.103A & B). The medial longitudinal arch is composed of the calcaneus, talus, navicular, three cuneiforms, and three metatarsals. *The talar head is the keystone of the medial longitudinal arch. The tibialis anterior and posterior, via their tendinous attachments, help support the medial longitudinal arch. The fibularis longus tendon, passing from lateral to medial, also helps support this arch.* The **lateral longitudinal**
- **arch is much flatter than the medial part of the arch** and rests on the ground during standing. It is made up of the calcaneus, cuboid, and lateral two metatarsals.

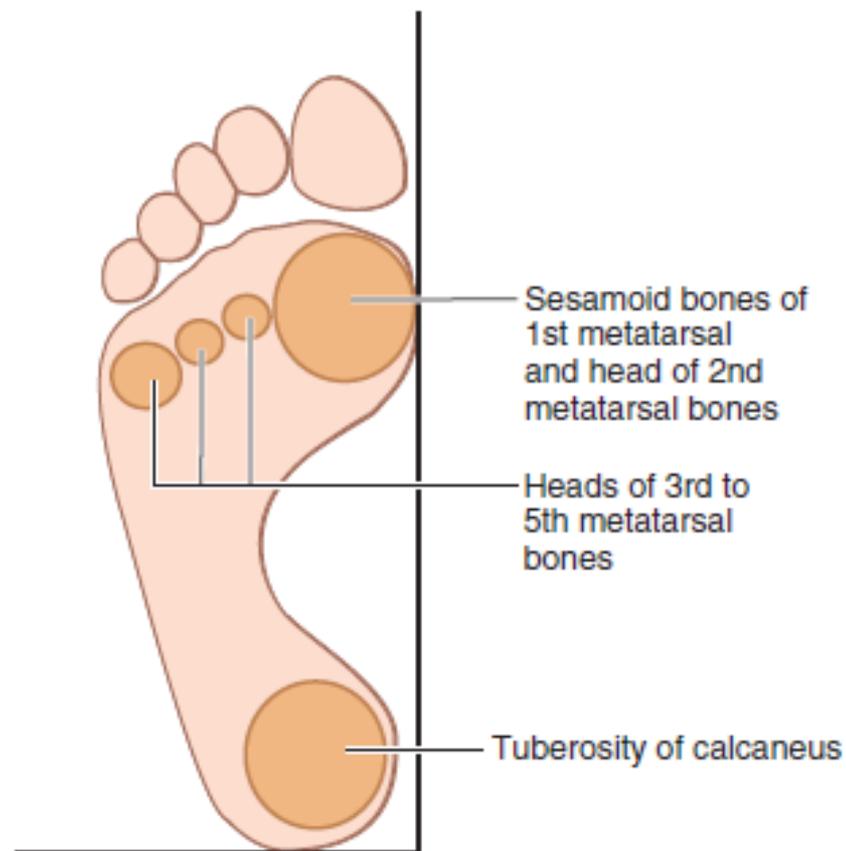
- The **transverse arch of the foot runs from side to side** (Fig. 5.103C). It is formed by the cuboid, cuneiforms, and
- bases of the metatarsals. The medial and lateral parts of the longitudinal arch serve as pillars for the transverse arch. The tendons of the fibularis longus and tibialis posterior, crossing under the sole of the foot like a stirrup (Fig. 5.103C), help maintain the curvature of the transverse arch. The integrity of the bony arches of the foot is maintained by both passive factors and dynamic supports (Fig. 5.103E). Passive factors involved in forming and maintaining the
- arches of the foot include: The shape of the united bones (both arches, but especially the transverse arch). Four successive layers of fibrous tissue that bowstring the longitudinal arch (superficial to deep):

1. Plantar aponeurosis.

2. Long plantar ligament.

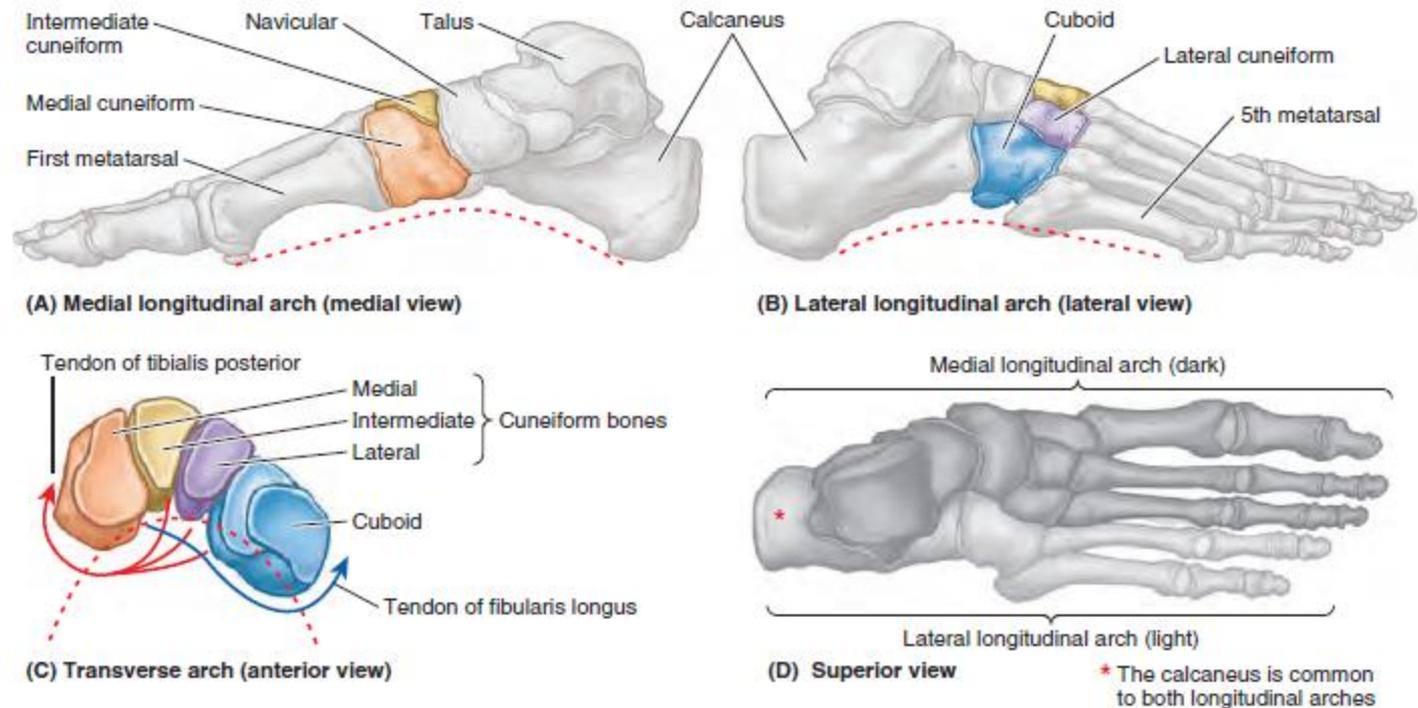
3. Plantar calcaneocuboid (short plantar) ligament.

4. Plantar calcaneonavicular (spring) ligament. Dynamic supports involved in maintaining the arches of the foot include: Active (reflexive) bracing action of intrinsic muscles of foot (longitudinal arch). Active and tonic contraction of muscles with long tendons extending into foot: Flexors hallucis and digitorum longus for the longitudinal arch. Fibularis longus



**Plantar view**

**FIGURE 5.102. Weight-bearing areas of foot.** Body weight is divided approximately equally between the hindfoot (calcaneus) and the forefoot (heads of the metatarsals). The forefoot has five points of contact with the ground: a large medial one that includes the two sesamoid bones associated with the head of the 1st metatarsal and the heads of the lateral four metatarsals. The 1st metatarsal supports the major share of the load, with the lateral forefoot providing balance.



**FIGURE 5.103. Arches of foot.** **A and B.** The medial longitudinal arch is higher than the lateral longitudinal arch, which may contact the ground when standing erect. **C.** The transverse arch is demonstrated at the level of the cuneiforms, receiving stirrup-like support from a major invertor (tibialis posterior) and evertor (fibularis longus). **D.** The components of the medial (*dark gray*) and lateral (*light gray*) longitudinal arches are indicated. The calcaneus (*medium gray*) is common to both. The medial arch is primarily weight-bearing, whereas the lateral arch provides balance.