3. **Review of literature**

Metacarpals and Metatarsals are miniature long bones. They possess a single nutrient foramen which is situated in the middle third of the shaft.

Metacarpals are five in number and possess a base, shaft and distal end as their heads. 1st Metacarpal is short and stout and side facets on its base are absent. 2nd Metacarpal has a grooved base and bounding ridge is lying medially. 3rd Metacarpal has a styloid process which projects upwards from radial side of dorsal surface of its base. 4th Metacarpal is short and slender than second and third and it can be identified by a non-articular medial side of its base with a tubercal.

Metatarsals are similar to Metacarpals. 1st Metatarsal is very short having no lateral facet on its base. There is a kidney shaped proximal facet for medial cuneiform bone with hilum directed laterally. 2nd Metatarsal is longest and has four facets on its proximal end. 3rd Metatarsal has a triangular base which articulates proximally with lateral cuneiform bone and medially it articulates by two facets situated at the dorsal angle with fourth metatarsal bone. 4th Metatarsal is smaller; proximal surface of its base bears an oblique quadrilateral facet for articulation with cuboid bone. There is a single facet on lateral side of its base for 5th metatarsal. 5th Metatarsal is identified by a rough eminence termed tuberosity on lateral side of its base.
The blood supply of these bones is derived from diaphyseal nutrient artery and at the growing end by epiphyseal and metaphyseal arteries. The shaft is also supplied by perosteal blood vessels. After completion of growth periosteal arteries are main source of blood supply and may replace nutrient artery which may account for absence of nutrient foramen on the shaft of these bones.

In Metacarpals and Metatarsals there is a single primary center of ossification and a single secondary ossification center at one end only. In 1st Metacarpal and Metatarsal there is a basal epiphysis while in rest of them epiphysis occurs at the distal end. Occasionally a distal epiphysis may occur in first metacarpal and basal epiphysis may occur in second metacarpal. In long bones there is a law of ossification which is commonly known by all medical students. This law states, "From elbow I go and from knee I flee." An additional epiphysis may be present for tuberosity of 5th metatarsal. As in the 1st metacarpal so in the 4th metatarsal there is sometimes a second epiphysis for the head.

Differences between metacarpals and metatarsals:

The heads and shafts of metacarpals are prismoid while they are flattened from side to side in metatarsals. The shafts of metacarpals are of uniform thickness while they taper distally in metatarsals. There is elongated triangular surface on dorsal aspect of metacarpals while dorsal
surfaces of metatarsals are uniformly convex. The base is irregular in metacarpals while it appears obliquely cut in dorso lateral direction in metatarsals. In first metatarsal there is a saddle shaped proximal facet while there is kidney shaped proximal facet with hilum directed laterally. Above differences will help in sorting out of these bones.

Incidence of more than one foramen in metatarsals was detected by Singh I (1960). More than one foramen were common in first and fifth metatarsals. Long bones may not have nutrient foramina (Lutken 1950 and Mysorekar 1967). After completion of the growth the periosteal blood vessels are sole supplies to these short bones and so nutrient artery may be absent which leads to absence of nutrient foramen.

Length of bone and number of nutrient foramina are not related. According to Wood Jones 1946 phalanges may have two nutrient foramina. Moreover number of foramina and number of primary ossification centers are also not related as femur has one primary center of ossification but may have more than one nutrient foramen. Clavicle has two primary centers of ossification but only a single nutrient foramen.

Textbooks describe position of nutrient foramina in metacarpals as on medial surface of first and second while in rest of them on their lateral surfaces. The source of blood supply is usually derived from palmer metacarpal arteries but may be derived from adjoining muscular branches. When both foramina are situated on same surface the source of blood supply is from the same artery, but when foramina were
located on different surfaces the source of blood supply will differ\textsuperscript{12}.

Wood Jones found nutrient foramina in metatarsals\textsuperscript{5} as on lateral surfaces in first, second, third and fourth while on medial surface of fifth metatarsal. In metacarpals the position of nutrient foramen is usually on medial side of first and second metacarpals and on lateral surfaces in rest of them. This reflects more or less reversal of patterns seen in metacarpals as compared to metatarsals. These may be explained on embryological basis as rotation of upper and lower limbs in opposite directions.

Theories for direction of nutrient canal were considered as mentioned under.

1. Growing end and periosteal slip theory of Schwalbe 1876.
3. Asymmetrical muscular development theory of Lacroix 1951.

The most acceptable theory for direction of nutrient canal is growing end hypothesis. It is proved more authentic.
Antero-posterior Radiograph showing proximal epiphysis of first metacarpal (3) and in the rest of them it is at the heads of the other metacarpals (2).