A1 Footprint Ridge Density — A New Attribute for Sexual Dimorphism

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After attending this presentation, attendees will be able to recognize that the ridge density in footprints exhibit sexual dimorphism in Indian population.

This presentation will impact the forensic science community by recognizing the sexual dimorphism of the ridge density in footprints that may be used in identification of dismembered human remains in cases where an individual foot is recovered and brought for examination. It can give vital evidence in identification of the perpetrator of the crime in cases where the footprints are left behind at a crime scene.

Determination of sex has a vital role to play in forensic examinations. Footprints are often encountered at crime scenes especially belonging to murder and sexual assailants. From the available footprints at the crime scene, if the sex of the suspect is inferred, the burden of the investigating officer is reduced by half as the search of potential suspects will be restricted to a particular sex. Although researchers have attempted sex determination from fingerprint ridge density, the sex differences from the ridge density in footprints remain unreported. To the best of the authors' knowledge no systematic studies are available on the sex differences from ridge density in footprints worldwide. This preliminary study is done to evaluate the sex differences from ridge density in footprints and study its usefulness in discriminating sex in Indian population using statistical considerations.

The present prospective research was conducted on 106 young adults (56 males and 50 females) at the Department of Forensic Medicine, Kasturba Medical College, Mangalore, India. Healthy individuals aged 20 to 25 years were included in this study after taking informed consent. The subjects with any disease, deformity, injury, fracture, amputation, or history of any surgical procedures of the feet were excluded from the study. Each subject included in the study was asked to wash his/her foot clean with soap and water. A clean plain glass plate was uniformly smeared with black duplicating ink with the help of a roller. The subjects were asked to apply their feet on the smeared plate and then transfer them on to a white paper. Regular pressure was applied on the foot area to obtain the footprints. A 5mm x 5mm square was drawn on a transparent film and placed on the obtained footprint samples in the areas to be analyzed. In order to measure ridge density, the count was carried out diagonally on a square measuring 5mm x 5mm. The epidermal ridges were counted with the help of a hand lens. This count represents the number of ridges in 25mm square area and reflects the ridge density value. The ridge density value was similarly obtained individually from the four designated areas on the footprints that are commonly encountered at the crime scene. The four designated areas included: upper portion of the inner border of the great toe, the ball of the great toe, the ball of the 5th toe below the triradii point, and the central prominent part of the heel. The male female differences in ridge density were statistically analyzed individually for each of the designated areas from the footprints. Ridge density was compared between right and left sides for each of the designated areas. Statistical significance was defined at the standard 0.05 level.

Mean ridge density was significantly higher in females than males in the designated areas in both feet. No right-left differences were observed among males and females. Statistically significant differences exist in the footprint ridge density between different areas in males and females in right and left feet. The likelihood ratio (LR) was calculated to obtain the probability inferences of sex, based on ridge density values. Posterior probabilities was calculated using Bayes' theorem and information obtained from both LR computations and posterior probabilities were used to show favored odds. The present research reveals that footprints in females demonstrate a greater ridge density, hence, finer ridge details than males in Indian population. Thus, the mean ridge densities can be used as a presumptive indicator of sex of an unknown footprint left at a crime scene.

Forensic Science, Sexual Dimorphism, Foot Print Ridge Density

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