A9 A Study of Sex Differences in Fingerprint Ridge Density in a North Indian Population

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After attending this presentation, attendees will understand the usefulness, importance and variability of fingerprint ridge density in distinguishing sex in forensic examinations as this is a recently developed area of research and the literature on this aspect has been scanty.

This presentation will impact the forensic science community by presenting new information on variability of fingerprint ridge density in an Indian population and its use in distinguishing sex of latent fingerprints found at the crime scene.

In the past, fingerprints collected from the crime scene and from the items of evidence of crime have been successfully used to identify suspects, victims, or any other persons who touched the surface in question. The thickness of epidermal ridges varies between individuals; females are supposed to have finer ridges than males and therefore a greater ridge density within a given area. The goal of this research was to test this hypothesis and attempt to infer sex from the fingerprint ridge density in an Indian population. One hundred ninety-four (194) individuals (97 males and 97 females) aged 18 and 25 years were included in the study. The fingerprints were taken from all the fingers. Thus, a total of 1,940 fingerprints were obtained and epidermal ridges were counted in the three defined areas (radial, ulnar, and lower) of each fingerprint. The fingerprint ridge density in the three defined areas and between sexes was compared using one way ANOVA and t-testing, respectively.

The distribution of fingerprint ridge density in radial and ulnar areas is similar with fingerprint ridge density ranging from 12-20 and 13-20 among males and 15-21 and 14-21 among females in the radial and ulnar areas, respectively. A considerably lower fingerprint ridge density is observed in the lower area (9-14 in males and 10-14 in females) than that observed in the radial and ulnar areas. Extent of overlapping was maximum in the lower area; 63.91% males (n=62) and 68.03% females (n=66) had a fingerprint ridge density of either 11 or 12 in the lower area. In the radial area, maximum overlapping was observed for the fingerprint ridge density value of 17, with 20 males and 21 females having a fingerprint ridge density of 17. Extent of overlapping in the male and female values for fingerprint ridge density was minimal in the ulnar area. It is evident that the mean fingerprint ridge density is maximum in the radial area (males=15.84, females=17.94), followed by ulnar area (males=15.51, females=17.11) and minimum in the lower area (males=11.29, females=12.05). Significant sex differences ($p<0.001$) were observed between the fingerprint ridge density values observed in the three areas analyzed. The sex differences are observed to be maximum in the radial area ($t= -11.897$), followed by ulnar ($t= -9.776$) and lower areas ($t= -5.332$). Significant male-female differences ($p<0.001$) were observed in each of the three areas analyzed on each fingerprint.

When each finger was analyzed individually for sex differences in the fingerprint ridge density, it was observed that statistically significant sex differences ($p<0.001$) exist in the fingerprint ridge density of each individual finger in the three designated areas in both hands. It is further observed that fingerprint ridge density varies between different fingers in the three areas analyzed in the study. In the radial and ulnar areas, the fingerprint ridge density was minimum in the thumb and maximum in the ring finger followed by little finger in right and left hands among males and females. In the lower area, the fingerprint ridge density was maximal in the thumb in both hands among males and females whereas, minimum fingerprint ridge density was observed in the middle finger in the right hand and in the little finger in the left hand among males and females.

This study suggests that the fingerprint ridge density can be a relevant and useful parameter in estimating sex of a latent fingerprint of unknown origin from the scene of crime.

Personal Identification, Fingerprint Ridge Density, Sex Determination

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