DISCUSSIONS

The present study is based on the analysis of the rolled fingerprints of 800 individuals belonging to four different Indian populations i.e. Jat Sikhs, Scheduled caste, Brahmans and Rajputs.

The study of dermatoglyphic characteristics is very important as during development the formation of epidermal ridges is effected by the maternal environment, gene deviants and chromosomal aberrations, once formed pattern these are age and environment stable (Hootan, 1963).

In the present study the distribution of basic patterns in male Jat Sikhs showed the highest frequency for loops followed by whorls. Composites showed the least frequency. In case of females the loops and whorls were having higher frequency than males counterparts. While the pattern composites and arches were having lower frequency as compared to males. The studies for distributions of basic patterns have been conducted by (Chai 1971; Vishwanath and Vijayalakshmi, 1980) but their work was not in accordance with present study.

The distribution frequencies of various epidermal ridge minutiae showed that in right hand of females Bifurcation and Ending Ridges shows the highest frequency and Trifurcation was observed to be least shows the least frequency. Similar type of trend were obtained in males while the frequencies were slightly greater as compared females.
The left hand of both the sexes also showed the similar type of trend and frequencies was also higher in males.

It is noted that in average area marked as ‘D’ shows the highest frequency (32.08%) followed by ‘C’ (31.89%) and ‘B’. The least number of minutiae were observed in the area ‘B’.

The mean ridge density was 24.62 ridges/cm square for males, and in females was 28.93 ridges/cm square. The test of significance reveals a significant variation in the density of ridges between the two sexes. The findings of the present study support the studies carried out by the other workers (Acree, 1999).

The distribution of basic patterns in male Rajputs shows the highest frequency for loops followed by whorls and arches. The composites pattern shows the least frequency. Similar is true for females but the loops and arches were having greater frequency in comparison to males. While whorls and composites patterns were having lower frequencies.

The distribution frequencies of various epidermal ridge minutiae shows that in right hand of females Bifurcation and Ending Ridges were in the highest frequency and Bridge shows the least. Same was frequency was true in case of males. But in overall the frequency of distribution was lesser as compared to females.

Similarly in left hand of females Bifurcation and Ending Ridge shows highest frequency and Bridge exhibits least frequency. Similar trend
In case of left hand of females Ending Ridge type showed highest frequency followed by Bifurcation. Trifurcation was least common. In case of males in left hand this trend was just reverse.

Among the Scheduled Caste community in average the area marked as ‘D’ showed highest frequency (25.90%) followed by ‘C’ (25.09%). The area marked as ‘B’ exhibit least frequency for the distribution of ridge minutiae in this population.

The mean ridge density was 26.48 ridges/ cm square in males and 30.18 ridges/ cm square for females. The test of significance reveals a significant variation in the density of ridges between the two sexes.

The distribution of basic patterns among male Brahmins shows the highest frequency for loops followed by whorls, arches. The composites types were least common. Similar type of patterns was observed in females but the loops showed slightly higher frequency and whorls and arches were present in lesser frequency in males. It is also interesting to note that no Composites pattern was found in females. Accidental pattern was also absent in this Brahmins community in both the sexes.

Among the distribution frequencies of various epidermal ridge minutiae, the right hand of females showed the highest frequency for Bifurcation followed by Ending ridge. Trifurcation shows the least frequency. Similar is the case with males but it exhibited lower frequencies as compared to females.
In case of left hand of females Bifurcation were in the highest frequency followed by Ending ridge. Trifurcation were also least common in this case. Males also showed the same trend in left hand but exhibited lower frequencies as compared to females.

It is observed that in average the area marked as ‘D’ exhibited highest frequency (25.26%) followed by ‘B’ (25.17%). The area ‘C’ exhibit least frequency for the distribution of ridge minutiae i.e. on the left side of the lower part.

The mean ridge density was 22.50 ridges/ cm square in males and 27.34 ridges/ cm square in females. The test of significance reveals a significant variation in the density of ridges between the two sexes.

Comparison of the results of each population with the other shows that there is no significant variations in the distribution frequencies of various basic patterns as well as epidermal ridge minutiae in both hands of both the sexes.

The examination of fingerprints for ridge ending and forks (Bifurcation) minutiae frequencies have been conducted by various workers (Roxburgh, 1933; Amy; 1946; Santamaria, 1955; Kingston, 1964; Okajima, 1970; Loesch, 1973; Sclove, 1977, Stoney and Thornton, 1986, 1987). They have reported that the frequencies of ridge ending are higher as compared to forks.
Studies on the relative frequency of dot have been made (Kingston, 1964, Okajima, 1970; Sclove, 1977; Stoney and Thornton, 1986, 1987).

Amy (1946) on the examination of fingerprints determined the relative frequency of forks and ending ridges to be 0.40 and 0.60 respectively. He also noted that divergence of ridges was very common.

Gupta (1968) observed that Bifurcation and Ending ridges were encountered with an average frequency of 1/100 in 1000 ulnar loops searched by him. Stoney and Thornton (1987) reported that fingerprints from the right hand show an excess of minutiae that result in the loss of ridges when one follows the ridge from right to left. The opposite is the case for fingerprints from the left hand. They also found that numbers of neighbour minutiae are normally distributed and minutiae orientation frequencies on the right and left hand are unequal to show a mirror image relationship.

According to Cowger (1983) and Hardless (1995) superficial difference in particular detail of one print has different appearance in another because of difference in pressure employed in making ten prints. A free end in one print may have the appearance of fork in another.

In the present investigation the frequencies of minutiae types were found to be slightly different from that reported by earlier workers. The Bifurcation type was found to be the highest in majority of the cases and
Trifurcation to be the least common. The frequency of minutiae types in right hand tend to be more as compared to the left in this investigation except in case of Schedule Caste females. Which is contrary to the findings of other workers (Dankmeijer, 1980) but it is in agreement for bridge (interjunction) types (Banerjee and Sarkar, 1983) the difference in data size, population and location of the sampling regions are the probable cause of the discrepancy from the other studies. The present result support the generalization made by pervious workers that minutiae varies significantly within epidermal ridge pattern.

Further it is evident from the investigation that marked area ‘D’ (Right lower part) of the fingerprints tend to have higher minutiae as compared to the other areas. This indicates that expert can look for more number of minutiae in lower regions of the fingerprints. While similar type of observation have been made by the author in the previous findings (Janjua, et. al. 2004). Stoney and Thornton (1987) observed that the number of neighboring minutiae about a centrally chosen focal minutiae was found to be normally distributed, minutiae type and orientation were found to be virtually prevalent of one another.

In the present investigation the males of all the four communities studies showed the lower ridge density per centimeter square then their female counterparts. This indicates that counting of ridges in a particular
area of fingerprints can be used as a important parameter for the
determination of a sex of an individual from a fingerprints.

Some workers have found that ridge breadth of fingerprints have
specific value for males and females, hence it can be used for sex
determination. Ridges in the females are significantly finer (Cummins and
Midlo, 1961). Adult women have epidermal ridge thickness of 0.40-0.50
mm while adult men have an epidermal ridge thickness of 0.50 mm
(Cummins et al, 1941).

It has been reported that significant differences exist in the
dermatoglyphic pattern of different tribes of town (Chai, 1971). He also
considered sex variation in dermatoglyphics features as genetic in nature.
Some other workers considered them physiological trait. A significant
increase in whorls and decrease in loops patterns have been reported in some
Indian population (Vishwanath and Vijaylakshmi, 1980).

Other fingerprints expert believes that women have finer epidermal
ridge details (Moore, 1991) The studies conducted in the past regarding this
hypothesis had suffered from small sample size or did not utilized empirical
methods which can determine its observed differences statistically
significant within a race and gender (Cummins et al, 1941;Ohler; et al.,
1983). In the recent past sex determination from fingerprints of an individual
from ridge density has been advocated as the most important parameter
(Acree, 1999) and he has observed that males have lesser number of ridges
per millimeter as compared to females. The same characteristics were applied in the present investigation and it also supports these findings.

It is noted that the counting of ridges per centimeter square can be used as a useful parameter to differentiate between the two sexes i.e. males and females. In this regard the test of significance was also found to show significant variation in the density of ridges among the males and females of all the four population examined.

Hence this suggest that this method, ridge density (number or ridges per centimeter square) can be reliably implied for the sex determination of an individual from a fingerprints in order to shorten the time in fingerprints comparison for elimination purposes.

It is derived from the present study that among the various minutiae types present in fingerprints, Bifurcation is more prominent and common and can be looked readily for comparison purpose. Further the mean ridge density count can help successfully in determination of the sex of an individual from a single digit fingerprint for elimination purposes.

A blind trial was also arranged on basis of 400 fingerprints (40 individuals: 20 males and 20 females) to check the validity of the method developed and it was possible to determine the sex of an individual from fingerprints positively in 95 percent cases by the ridge density method.
Since the knowledge minutiae variation is quite insufficient and not much work have done on these two aspects i.e. distribution and variation ridge minutiae types and on sex determination, it is expected that the results of present study will provide useful information to the forensic scientist in investigations of various types forensic cases.