The present work on 'Chapparband' in Karnataka is based on the field investigation conducted between October 1990 and October 1992. 'Chapparband' inhabit Indi, Sindagi, Bijapur, Basavana-Bagewadi, Muddebihal, Hungund and Bagalkot Talukas of Bijapur district and Gadag, Hubli and Dharwad towns of Dharwad district.

The areas of 'Chapparband' inhabitants were identified in the two districts of Bijapur and Dharwad.

A pilot survey of 'Chapparband' community was conducted by visiting different taluka head quarters and various villages in Bijapur and Dharwad districts. Proper contacts were established with the leaders of the Karnataka State Chapparband Association and the leaders were convinced about the aim of the study. Having fully convinced about the intention of the investigator they agreed to co-operate and gave instructions to all leaders of the community in different villages through postal service. Instructions were also given to the Dharwad, Hubli and Gadag Chapparband community leaders.

For the purpose of demographic study a sample of 606 families of 'Chapparband' comprising 415 'Cheganda Chapparband' families and 191 'Baraganda Chapparband' families
was collected from the above mentioned talukas and towns of Bijapur and Dharwad districts.

For the purpose of dermatoglyphic and serological investigation, a sample of 617 unrelated individuals was collected from the two groups of 'Chapparband' (Baraganda: 163 males + 154 females = 317; Cheganda: 132 males + 168 females = 300).

The data on 'Chapparband' were collected on following aspects which constitute the bases for the present study.

1. Demographic dimensions
2. Dermatoglyphic patterns
3. Serological dimensions
4. Socio-cultural dimensions
5. Criminological dimensions and
6. Rehabilitative programmes.

2.1 Demographic Dimensions

This information was collected with pedegree charts drawn for the purpose which is based on house hold survey. The chart includes the information about religion, age, sex, place of birth, age at marriage, number of individuals in the family and their age, sex, marital status. Elderly men and elderly women were the most suitable informants in most of the cases.
In the absence of any record about the age/date of birth, age of the person was estimated in relation to some important local events. Cross checking of the age was done with more knowledgeable elderly persons to minimise the errors. In the present work most of the adult persons were able to tell their age in terms of years, but in the cases of minors the age was determined by referring to school records in addition to following the above method in order to be more precise.

Demographic data were analysed as per the standard techniques following Barclay (1958).

2.1.1 Sex Ratio : The sex ratio was expressed as the number of males per hundred females.

2.1.2 Fertility : Fertility was expressed in terms of the number of pregnancy terminations and live born offspring per woman and per fertile woman. The fertile women are those who conceived at least once.

2.1.3 The number of surviving offspring was defined as the number of offspring surviving to a given woman.

2.1.4 Mortality : Mortality was expressed both as number per woman and proportion over total pregnancies which includes both pre and post-natal deaths.
2.2 Dermatoglyphic patterns

2.2.1 Method of taking prints:

The finger and palm prints were taken by using simple ink method. The rolled prints of each digits were taken by keeping left edge of the nail perpendicular to the slab and the same was rolled upto 180°. Right thumb was inked and printed first, other fingers were inked and rolled on the slip in the consecutive order.

Field (1959:25) has pointed out that "the thumb is rolled from the inside tip of the nail to the outside of the opposite tip of the nail thus the right thumb is rolled from right to left and left thumb is rolled from left to right and the fingers of the left hand are rolled from right to left".

For taking the palm prints, the ink was applied uniformly throughout the entire palm with the help of a cotton pad, so that the inter digital tri-radii and the triradial termination impressions were clearly visible in the prints.

The prints of both the sexes of 'Chapparband' were taken.

2.3 Classification of patterns

Patterns were classified by using Sir Edward Richard Henry's classification (Cummins and Midlo, 1961).
2.3.1 Plain Arch

A plain arch is simplest of all the patterns, in which the ridges run from one side of the finger to the other, with a slight rise at the centre, making no upward thrust, no backward looping turn or an angle and does not possess any of the basic characteristics of the loop viz., delta core and recurving ridge. "The arrangement of the ridge flow in the plain arch suggests the strands of rope lying over a barrel" (Bridges, 1963:52). Five per cent of all the finger print patterns represent plain arch. Plain Arch is denoted by letter 'A'.

2.3.2 Tented Arch

A tented arch is the pattern of arch type in which most of the ridges enter on one side of the impression and flow or tend to flow, out up on other side, but the ridges at the centre must have pronounced upward thrust arrange themselves and form an angle, or form any two of the three basic characteristics of the loop. There are three types of tented arches.

i) Tented with angle
ii) Tented resembling a loop
iii) Tented with up thrust.

Tented arch is denoted by letter 'T'.

Fig.1 DIFFERENT FINGER PRINT PATTERNS
2.3.3 Loop

A loop is a pattern in which one or more ridges recurve i.e., run back on their previous course, making a half turn or move around the core, having a delta and at least one ridge intervening between the inner and outer termini. The loop patterns constitute about sixty per cent of all prints.

There are two types of loops, the radial and the ulnar. Their names are derived from the two bones of the fore arm, the radius and the ulna.

2.3.3.1 Radial loop

A radial loop is a loop pattern in which one or more of the ridges enter on either side of the impression, recurve, touch or pass an imaginary line drawn from core to delta, and terminate on or toward the same side of the impression. The direction of slope of the ridges is downward from the little finger toward the thumb. The pattern is denoted by letter 'R'.

2.3.3.2 Ulnar loop

An ulnar loop differs from that of radial loop in respect of the slope of ridges. The slope or flow of ridges in ulnar loop is from thumb toward the little finger. The pattern is denoted by letter 'U'.
2.3.4 Whorl

A whorl is a pattern in which the ridges around the core make at least one complete circuit. Whorls may be spiral, oval, circular or some other variant of a circle. The pattern has two deltas and may be having a single or double cores. The pattern is denoted by letter 'W'.

2.3.5 Composites

A composite pattern is the combination of two or more patterns either of the same type or of different type in one finger impression.

There are four main types of composite patterns.

2.3.5.1 Central pocket loop

In the central pocket loop some of the ridges at the centre or core or a loop give the pattern of a whorl. The test for the central pocket is that the line of exit of the ridges or the axis should meet at least one recurving ridge at right angle i.e., if the recurving ridges be circular and not angular, it is central pocket. The central pocket loop is subdivided into four types, viz., i) spiral; ii) hook; iii) ring; iv) concave. The pattern is denoted by letters 'Cp'.

2.3.5.2 Lateral pocket loop

In the lateral pocket one loop serves as a side pocket to the other. The side pocket is formed by the
downward bending on one side of the ridges of the other loop before they recurve. The ridges about the centre, that is those containing the point of core of the loops have their exit same side of delta. As the pattern is called double loop pattern, it has two deltas and two cores. Interlocking of two loops in this pattern are like the two parts of the letter 'S'. The pattern is denoted by letters 'Lp'.

2.3.5.3 Twin loop

Twin loop is also a double loop pattern, and the loops here are interlocked like the two parts of the letter 'S'. In twin loop one loop rests on or encircling the other and the ridges containing the point of core have their exit on different sides of the delta. There are two deltas and two cores. The pattern is denoted by letters 'TL'.

2.3.5.4 Accidental

Accidental pattern is the combination of two or more patterns, representing the types other than the central pocket, lateral pocket and twin loop. The occurrence of accidental pattern is rare, and its examples are loop by loop, whorl resting on loop, loop resting on whorl, whorl resting on whorl, arch with pocket. The pattern is denoted by letter 'X' (Field, 1959).

2.4 Ridge counting

The general rules adopted by Holt (1949) for ridge counting have been used in the present study. These rules are:
1. All ridges which cut or touch a straight line drawn from the triradius to the centre or core of the pattern are counted.

2. Ridges which run close to the line without meeting it are excluded.

3. Two ridges resulting from a bifurcation close to the line are both counted.

4. Patterns with no triradius (i.e. simple arches) have no ridge counts.

5. In the case of whorls (with sub types) two counts are made, one from each triradius, the higher count is taken to represent the size of the pattern.

2.5 Indices

The following three main indices are calculated.

i) Index of Pattern Intensity (IPI)

ii) Furahata's whorl/loop index, and

iii) Dankmeijer's arch/whorl index.

The value of the pattern intensity stated here as the number of triradii per individual (arch having no triradius, the loop one and whorl two).
2.6 **Formulation of 'C' line termination**

Plato (1970) has given the method of describing the termination of palmer C line. According to him line 'C' is the only main line of the palm which is truly polymorphic, since it demonstrates qualitative (directional) as well as quantitative variation manifested in the degree of transversality and size reduction culminating incomplete suppression.

The 'C' line may have an ulnar direction, a radial, a proximal or even be completely be absent when C triradius is present.

In accordance with the polymorphism, the terminations of 'C' line be classified into four modal types depending on the direction of its path. The four modal types are:

i) Ulnar, which includes the terminations 4, 5, 6 and 7;
ii) Radial, with terminations 9, 10, 11, 12 or 13;
iii) Proximal represented by the X, x and 8 terminations;
iv) Absent, where no 'C' triradius is present.

2.7 **Angle atd**

Angle atd is the angle formed by joining the a and d triradii with axial triradius t or t' or t".
Penrose (1949b; 1954) has studied the inheritance of position of the axial triradius, using the atd angle to replace a qualitative differentiation of triradius $t$ and $t''$. A relatively small angle indicates an axial triradius situated near the base of the palm, while a large angle results when the triradius is highly placed. Roughly, an atd angle of over 56° is equivalent qualitatively to scoring the triradius as $t''$, while an angle less than 45° is equivalent to $t$, intermediate angles ranking as $t'$.

The maximal atd angle has proved to be most useful measurement for quantifying the position of the distal axial triradius on both normal and abnormal palms of many kinds. Sometimes we notice a and d triradii to be closer together than are usual and in such cases the angle will be relatively small, even when the $t$ triradius is fairly highly placed. The occurrence of such cases are very rare, together with a misunderstanding of the real value of the maximal atd angle, have lead some times to unwarranted criticism of the methods.

2.8 Statistical methods

The following statistical methods and techniques were employed in the dermatoglyphic analysis.

1) Mean

$$M = \frac{\sum fx}{N}$$
2) **Standard deviation**

\[ \sigma = \sqrt{\frac{\sum fd^2}{N}} \]

3) **Standard error**

\[ SE = \frac{\sigma}{\sqrt{N}} \]

In the above formulae, \( X \) is the mid value, 'f' is the frequency, and 'd' = (\( X - M \)) available from frequency table. 'N' is the sample size.

4) **Chi-Square test** : \( \chi^2 \) test has been used for comparing two populations with regard to dermatoglyphic determinants.

\[ \chi^2 = \frac{(O - E)^2}{E} \]

Where, \( O \) is the observed frequency and \( E \) is the expected frequency.

5) For observing the difference between two groups the following 't' test was used.

\[ t = \frac{M_1 - M_2}{\sqrt{SE \left( \frac{1}{N_1} + \frac{1}{N_2} \right)}} \]

Where, \( M_1 \) and \( M_2 \) are the means of the populations; \( N_1 \) and \( N_2 \) are their samples and \( SE \) is the square root of within group variance.
6) **Mahalanobis D^2 test**

In order to determine the biological distance between the two groups of 'Chapparband' in terms of the dermatoglyphic determinants, the Mahalanobis D^2 test was employed.

The formula used for the purpose is,

\[ D^2 = (x-\bar{x})' S^{-1} (y-\bar{y}) \]

Where, \( x \) and \( y \) are random vectors, \( \bar{x} \) and \( \bar{y} \) are their mean vectors and \( S \) is the sample variance-covariance matrix.

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2.9 **Serological Dimensions**

2.9.1 **Blood grouping techniques**

The blood samples were taken from finger pricks and were collected in numbered sterile tubes with normal saline. The samples were stored in thermos flask containing ice. They were brought to the base camp and analysed. The samples were tested within few hours after collection for A, B, O and Rh blood groups with the help of anti A, anti B and anti D sera, respectively. These sera were supplied by Span Diagnostics, Private Limited (Surat), India. The sera were taken to the field in a thermos flask containing ice. The ABO determination was done by slide technique whereas,
the Rh test was performed in tube by making use of hand centrifuge for immediate reaction.

2.9.2 Statistical Methods

Calculation of gene frequencies

The following formula suggested by Mourant (1976) for calculating ABO gene frequency has been used.

\[ P = 1 - \frac{b}{t + O} \]
\[ q = 1 - \frac{A}{A + O} \]
\[ r = \sqrt{O} \]

\[ p = \text{Frequency of gene A} \]
\[ q = \text{Frequency of gene B} \]
\[ r = \text{Frequency of gene O} \]

\[ p + q + r = 1 \]

These first estimates of \( p \), \( q \) and \( r \) will in general not add up unity, but their sum will differ from it by a quantity \( D \).

Berstein (cited in Mourant, 1976) has devised a simple means of calculating results in which the values of \( p \), \( q \) and \( r \) are added together and then subtracted from the unity to give the difference 'D'.

Viz. \( D = 1 - (p + q + r) \)
'D' may be either positive or negative depending upon whether the observed frequency of group AB is smaller or greater than its expected frequency 2pq and it is necessary that the correct signs be used in the equations which follow. Berstein's corrected values of pc, qc and rc are given by the following equations.

\[ pc = p \left( 1 + \frac{D}{2} \right) \]

\[ qc = q \left( 1 + \frac{D}{2} \right) \]

\[ rc = \left( r + \frac{D}{2} \right) \left( t + \frac{D}{2} \right) \]

Thus \( pc + qc + rc \) will be a unity.

A simple Chi-square (\( X^2 \)) test has been used to study the intersex and intergroup differences.

2.10 Socio-cultural Profile

2.10.1 Ethnographic Profile

The ethnographic data of two categories of 'Chapparband' with regard to their family, marriage, kinship, economic organisation, political organisation, religion, criminality, etc., were collected with the help of key informants in the villages and also from the leaders of the 'Karnataka State Chapparband Association' by in depth interview of the key informants. Observation, participant observation and case study methods were also employed to elicit relevant information regarding their socio-cultural dimensions.
2.11 **Criminological Dimensions**

In order to understand the Criminological dimensions of 'Chapparband', an attempt is made to analyse the nature and causes of their criminality. Data pertaining to criminality of 'Chapparband' were collected from first hand information elicited through indepth interviews with key informants. Information was also obtained by referring to the records available in the police stations in these areas and also by referring to the available literature in various libraries, viz.,

1. The National Library, Calcutta.
2. National Social Science Documentation Centre, Indian Council for Social Science Research, New Delhi.
5. National Police Academy, Hyderabad.
6. Tata Institute of Social Sciences, Bombay.
7. National Law School of India, University, Bangalore.

2.12 **Rehabilitative Programmes**

Data pertaining to the rehabilitative programmes were collected by means of observation and indepth interviews
conducted with the beneficiaries of these programmes and the key informants. The validity of these programmes was cross checked with the records of the social welfare department and also the annual reports in order to understand the extent of success of these programmes.