

**DERMATOGLYPHIC EVALUATION  
OF METNALLY RETARDED  
ADOLESCENTS FROM CENTRAL  
TRAVANCORE, KERALA**

*Minor Research Project Report*

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**Bangalore**

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## **CERTIFICATE**

This is to certify that this research project work entitled 'Dermatoglyphic Evaluation of Mentally Retarded Adolescents from Central Travancore, Kerala' is an authentic and original report of the research work carried out by me for the UGC Minor Research Project funded as per UGC order number F No. MRP (S)-0823/13-14/KLMG035/UGC-SWRO, dated 28 March 2014, by Southern Western Regional Office, University Grants Commission, Bangalore.

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# Executive Summary

Characterization and baseline data on human non-communicable diseases in general and genetic diseases in particular will lead to better management of patient and the disease. Dermatoglyphics is widely used in very many applications like Medical sciences, Forensic science, Criminology etc. and is a good tool for prognosis of several diseases, malnutrition and general health especially genetic syndromes, in born errors in metabolism and mental retardation. Genetic diseases, mental retardation and other neurological disorders can be characterized dermatoglyphically at the earliest age as possible. Mentally retarded adolescent patients with different syndromes like Down' syndrome, Cerebral Palsy, Microcephaly and general mental retardation were selected randomly and different dermatoglyphic parameters were measured and compared with normal people in the present research project. Several characters show difference among different diseases and with normal people. People with mental retardation showed significant dermatoglyphic variations from normal people. Palmar ridge measurement, which shows significant difference among different diseases, is discussed in detail. From the results of the present study, dermatoglyphic measurements can be taken as an index for various genetic and neurological disorders for tropical adolescent population.

**Key Words:** Dermatoglyphics, Mentally Retarded, Central Travancore Population

# INTRODUCTION AND BACKGROUND

Dermatoglyphics is the study of palmar ridge or finger print measurements in terms of dimension, proportions and ratios. During 19<sup>th</sup> century and early 20<sup>th</sup> centuries dermatoglyphics was considered as pseudoscience used mainly to identify and classify potential criminals by finger prints. The most infamous use of anthropometry and finger prints were by the Nazis, whose Bureau for Enlightenment on Population Policy and Racial Welfare (BEPPRW) recommended the classification of Aryans and Non-aryans on the basis of measurements of skull and other physical features (Gould *et al.*,1993).

Dermatoglyphics is the dermal ridge configurations on the digits, palms and soles. They begin to develop about the thirteenth week of pre-natal life as the foetal mounds on the digit tips, interdigital, thenar and hypothenar areas of the hand and the corresponding areas of the foot. The pattern formation will be completed by the nineteenth week. The patterns on the fingertips are of twenty three different sub-types of six major groups, which are again categorized in to three very basic types, the arches, loops and whorls or mixtures of them, as shown in figure 1.

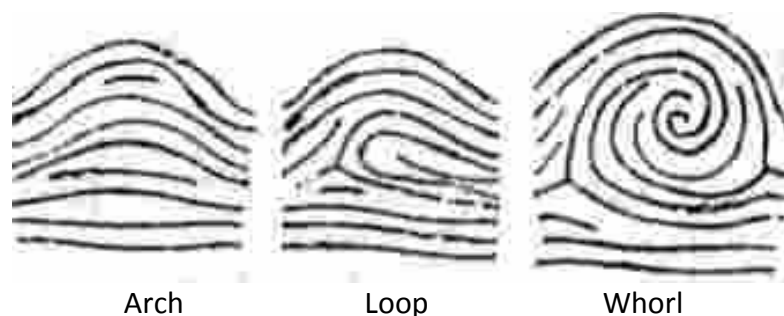


Figure 1. Basic three types of fingerprint patterns of mankind

The loops may be ulnar or radial loops. The patterns of frequencies vary somewhat with the side and sex, with females having slightly more arches and fewer whorls than males. Racial differences too exist with

Oriental having a higher frequency of whorls than European-Americans. A triradius is a three way fork, a confluence of three ridge systems. Arches have no triradii, a loop has one and the whorl has two or more. A triradius is seen at the base of the palm, the axial triradius. This may be displaced distally in certain conditions. In the soles too patterns are defined but not so prominently, except in the hallucial region.

Even though man had been interested in the ridge patterns inside the hands from the prehistoric periods itself, the credit for first scientific study of papillary ridges of the hands and feet goes to Joannes E. Purkinje, a Czech Physiologist in 1823 (Purkinje, 1940). Finger prints had attracted many others like Grew, Bidloo, Malpighius, Schröter and Bell etc. But the first attempt to systematically categorize finger print patterns was found in the work of Purkinje. Little was done following Purkinje's initial paper for a long time. Faulds (1880) and Herschel (1880) recommended the use of finger prints for personal identification.

Sir Francis Galton (1892) published his classic treatise on fingerprints. While much of Galton's work was directed towards fingerprint identification uses, he also pursued the subject as a biologist interested in expanding Purkinje's nine finger patterns in his own classification of the fingerprints and the hand. He coined a number of new terms in the subject. He also explored studies of the hereditary aspects of fingerprints, investigating comparisons of siblings, twins and genetically unrelated individuals and was the first to report concordance of papillary ridge patterns among relatives, which in turn formed a useful tool in anthropology.

Dermal palmar and plantar ridges are highly useful in biological and anthropological studies. Their notably variable characteristics are not duplicated in other people, even in monozygotic twins or even in the same person, from location to location. Because dermal ridges are found on a number of animals, it will be interesting to observe whether dermal patterns are replicated in cloning and if they vary, how they vary. The details of these ridges are permanent. Yet while the individual characteristics are variable, that diversity falls within pattern limits that permit systematic classification.

In the early twentieth century an American, Harris Hawthorne Wilder, pioneered comprehensive studies of the methodology, inheritance and racial variation of palmer and planter papillary ridge patterns as well as fingerprints. He began to publish a series of papers on these subjects in 1902 and continued publication through 1916 (Wilder, 1902; 1904a; 1904b; 1916). These represented the first serious study of palmer and plantar dermatoglyphics. His wife, Inez Whipple-Wilder (1904) published the first serious study of non-human epidermal ridges. Further important genetic studies of fingerprints in the first quarter of the twentieth century were made by the Norwegian philosopher, Bonnevie (1924).

The second quarter of the twentieth century, the field was dominated by Dr. Harold Cummins, sometime professor of Microscopic Anatomy at Tulane University, who was considered as the 'Father of Dermatoglyphics' and in 1926, he coined the word 'Dermatoglyphics' (Greek: *Derma* = skin; *glyph* = carving) and used it at the annual meeting of the American Association of Anatomists in which he presented his paper with his collaborator, Charles Midlo, M.D. (Cummins and Midlo, 1926). That term, dermatoglyphics, is used to this date in describing the scientific fields of study of the palmer and plantar ridges of the hands and feet. In 1929, he together with others, including Midlo and the Wilders, published one of the most widely referenced papers on dermatoglyphic methodology to date (Cummins *et al.*, 1929). Over the years he, alone and with collaborators, published numerous studies in the field as well as his now famous 1943 book, 'Finger Prints, Palms and Soles', considered as bible in the field of dermatoglyphics, which he dedicated to the pioneer Harris Hawthorne Wilder (Cummins and Midlo, 1943).

Cummins was interested in psychology reflected by the hand. By the time of his 1943 publication he was familiar with the work of dactylogists. Dactylomancy (Palmistry) was the practice of predicting the human condition and the future in accordance with the number of whorls and loops on the fingers of the subject. Even, Cummins or Midlo had this practiced during 1930s (Cummins and Midlo, 1943). It is interesting to note our future studies that the dactylogist who read one of those authors related whorls to 'tenacity, stamina and stick-to-it-liveners. The authors



concluded that character and temperament might well be correlated to dermatoglyphic observations. They quote both Takashima and Kojima concerning character traits found in relationship to fingerprints. After Cummins and Midlo (1943), the scientific community seems to have overlooked the input of the fingerprint readers. Palmistry fortune tellers, also known as Cheirologists, were dismissed by Penrose (1973), a giant in the field in the third quarter of the twentieth century, because he believed that they made no use of the fine dermal ridges which formed the basis of the science of Dermatoglyphics.

Those using dermatoglyphics in biology and medicine have long been interested in abnormal psychology and congenital defects. Bagga (1989) surveyed and studied the subject of the dermatoglyphic patterns of schizophrenics. Hirsch (1978) could report that studies had been performed in relationship to mental retardation, congenital heart defects, diabetes mellitus, several child psychiatric groups, retarded growth, and a number of syndromes. Autosomal trisomies, Trisomy 21 (Downs Syndrome), Trisomy 13, 18 and trisomy 8 (Mosaicism) have long been the subjected to studies in relationship to dermatoglyphic patterns. In addition to the trisomy, diabetes mellitus, congenital heart defect and schizophrenia subjects, Loesch (1983a) also reported relationship studies with sexual chromosomal anomalies, cleft lip and palate, leukaemia and other conditions (Loesch, 1983b).

Most congenital cardiovascular anomalies have their genesis early in the gestation during embryogenesis of the individual organs or organ systems. In the majority of cases of congenital heart disease (CHD), no specific etiologic basis has been established. However, a number of such anomalies are clearly of genetic origin resulting either from single gene disorders or gross chromosomal aberrations (McKusick, 1964). Specific environmental influences have also been implicated as causative factors (Campbell 1965; Jackson, 1968). McKusick (1964) stated that polygenic inheritance is an important genetic mechanism in the common forms of congenital heart disease. Other authors have speculated that a large percentage of cardiovascular anomalies are the result of interplay between both genetic and

environmental factors with the relative importance of each factor varying according to the specific lesion involved (Lamy *et al.*, 1957; Campbell, 1968).

Dermatoglyphic configurations formed by the epidermal ridges on fingers, palms and soles begin to develop during the sixth and seventh week of foetal life. Development is completed by the fourth month of gestation and thereafter the patterns remain the same (Arey, 1965). There is wide agreement that the mechanism of inheritance of many dermatoglyphic features also conforms to a polygenic system with each gene contributing a small additive effect. Examples of these dermatoglyphic traits are the transversality of the ridges on the palm (Pons, 1963; Glanville, 1965), the a-b ridge count (Fang, 1949; Pons, 1964), and the ATD angle (Penrose, 1954). Other features such as the calcar patterns appear to be influenced by a single gene. Information as to the loci that influence dermatoglyphics is still speculative, but the various reports have appeared that implicate chromosome 21 in the determination of finger ridge count (Penrose and Delhanty, 1961; Holt, 1964) and the position of the axial triradius (Penrose and Delhanty, 1961). Other chromosomal loci of genes influencing dermatoglyphics include the X chromosome (Alter, 1965; Penrose, 1968a) and chromosome 18 (De Grouchy, 1965).

A lot of literature concerning the value of dermatoglyphics in the diagnosis of different chromosomal anomalies are available (Uclmda and Soltan, 1963; Holt and Lindsten, 1964), such as in disease transmitted as autosomal dominant or recessive traits (Hodges and Simnon, 1962; Goor *et al.*, 1965), and in diseases in which genetic transmission is uncertain (Beckman and Norring, 1963; Alter and Schulenberg, 1966). It has been also reported that exogenous environmental agents, such as rubella, may also alter dermatoglyphic pattern and be useful in providing evidence of such extraneous exposure (Alter and Schulenberg, 1966; Purvls-Smith and Menser, 1968). Individuals with various chromosomal aberrations such as trisomy G, D and E have a high frequency of various cardiovascular malformations in association with other organ system involvement (Rowe, 1962; Smith, 1962) and aberrant manifestations of dermatoglyphic characteristics, which again can be identified with peculiarities of palmar patterns. Those having single gene disorders with cardiovascular involvement

almost all have extra-cardiac malformations including unusual dermatoglyphics (Gall *et al.*, 1966; Goor *et al.*, 1965).

## **MENTAL RETARDATION**

Often emotional and behaviour disorders are associated with mental retardation. Mental retardation can be identified through physical illness or biochemical disturbances of the brain. People with mental retardation shows abnormalities in behaviour such as gait, gesture, poor co-ordinations of body movements, resistance in auxilering duration of response, low IQ etc. (Tierney, 2000). The mental retardation may be due to several factors. Genetic disorders or syndromes, in born errors in metabolism, neurological problems, behavioural problems etc can cause mental retardation.

## **DOWN'S SYNDROME**

This syndrome is commonly called Mongolian Idiocy (Down, 1866). Down's syndrome is caused due to the addition of a single chromosome to the 21<sup>st</sup> pair of autosomal trisomy. The presence of extra set of genes leads to over expression of the involved genes (Lejeune *et al.*, 1959). Over expression of genes involved in Down's syndrome such as superoxide dismutase cause decreased function of immunal system, COL6A on over expression cause heart defects (U.S. National Institute for Down's syndrome Health).

Patients with Down's syndrome have mental and physical retardation flat faces and upward slanting eyes. The nose is small with flat nasal bridge. Tongue protrudes forwards, hands are short and broad. There is a wider gap between the first and second toe. Congenital heart diseases occur in about 40 percent of cases, most common being arterio-ventricular communis - ventricular septal defect and latent ductus arterious (Hexter, 1976). The major cause for early mortality is due to congenital heart diseases. Anthropometry and grip strength were measured by Laubach *et al.* (1981) on a sample of 33 wheel chair dependent patients.

## **AUTISM**

More males than females are affected. People with autism are found, to be severely to mildly handicapped. In its full-blown form, autism involves a triad of impairments (i) severe deficiency in social knowledge and reciprocal social interaction; (ii) abnormality in languages and verbal communication (iii) repetitive and stereotyped patterns of behaviour and activities (Kanner, 1971). Autism consists of disorders and/or development of brain functions. The disorders are life long and there is no known cure (Muhle *et al.*, 2004). Unusual brain growth patterns are seen in early life of autism (Courchesne *et al.*, 2001). Brain volume for autism patients up to 12 years of age is seen to be very large but becomes normal during adolescent due to decreased development than in child hood (Aylward *et al.*, 2002).

## **MICROCEPHALY**

Microcephaly is a rare, neurological disorder in which the circumference of the head, which is smaller than the average for the age and gender of the infant or child (Lancaster, *et al.*, 2013). Microcephaly may be congenital or it may develop in the first few years of life. The disorder may stem from a wide variety of conditions that cause abnormal growth of the brain, and is often a symptom or syndromes associated with chromosomal abnormalities. Infants with microcephaly are born with either a normal or reduced head size. Subsequently the head fails grow while the face continues to develop at normal rate, producing a child with a small head and large face. Fortunately social performance is usually achieved beyond that expected for mental age. Generally they behave as good babies and happy children. Development of motor functions and speech may be delayed. Hyperactivity and mental retardation are common occurrences although the degree of each basic. In general life expectancy for individuals with microcephaly is low and the prognosis for normal brain function is poor.

## **CEREBRAL PALSY**

Cerebral palsy is defined as a non-progressive neuromotor disorder of cerebral origin. Many children with cerebral palsy have a congenital malformation of the brain.

The motor disorder of the brain may be due to disordered development and structure of the brain or injury of the brain, foetal asphyxia and hypoxia, birth trauma etc (Sants and Kandt, 1990). Cerebral Palsy is often associated with abnormal growth and body composition. Physical activity of children with severe Cerebral palsy have linear growth that is often reduced to less than 3<sup>rd</sup> centile with progressively delayed growth with age. A primary contributor to growth retardation is poor feeding skills and neuromotor dysfunction (Cronk and Stallings, 1997). About 65% of patients of cerebral palsy are spastic due to neuromotor disorder. Severely affected children are totally incapacitated and bed ridden requiring custodial care. Based on the type of movement problems (such as spastic etc) or by the body parts involved cerebral palsy can be classified as hemiplegia, diplegia, quadriplegia etc. (Miller *et al.*, 2017)

## **GRADES OF MENTAL HANDICAP**

Mental retardation is defined as sub average intelligence. The child has diminished learning capacity and does not adjust well socially. Intellect comprises perception, memory, recognition, conceptualisation, convergent and divergent reasoning, verbal facility and motor competence (Gahai, 1996). The concept of Intelligence Quotient (IQ) is used to classify the degree of Mental Retardation. The Intelligence Quotient (IQ) is calculated according to the formula: mental age divided by chronological age, multiplied by 100. The IQ scores rest on the assumption that intelligence distribution in general public follow the normal Gaussian curves with a mean of 100. Half of the general population achieves scores above 100% and one half below. The lower 3% or so of the population achieve scores 70 or less. They are generally considered to be mentally retarded. The World Health Organisation (WHO) gives the following classification of mental retardation (Table 1).

The IQ level of 71-90 is designated 'border line intelligence' and is not included in mental handicap. The term 'educable' and 'trainable' are used for mild and moderate mental handicap respectively, while the severe and profoundly handicapped are designated 'custodial' (Gahai, 1996).

Table 1. Classification of mental retardation

<i><b>IQ</b></i>	<i><b>% Score</b></i>
1. Mild Mental Retardation.	50 - 70
2. Moderate Mental Retardation	35 - 49
3. Severe Mental Retardation	20 - 34
4. Profound Mental Retardation	under 20

Data and literature regarding the dermatoglyphic parameters of mentally disabled patients of tropical especially Kerala population is lacking except the work of Jameela (2006). Hence the present study was under taken in view to elucidate the following objectives.

### **AIMS AND OBJECTIVES OF THE STUDY**

1. To characterize dermatoglyphic parameters and its peculiarities of special groups.
2. To compare dermatoglyphics variables of mentally retarded with the normal population.
3. To evaluate the asymmetry of palm dermatoglyphic variables
4. To provide the ground work to support expanded dermatoglyphic survey in future.

# **MATERIALS AND METHODS**

Dermatoglyphic characterisation of mentally retarded people were executed by sampling mentally retarded adolescent people randomly from different districts of Kerala State. Sampling was done during October 2014 to December 2015. The target population was selected from Santhi Bhavan, School for Mentally Retarded and Handicapped, Kollapally, Pala (Kottayam district), Asha Bhavan, Tiruvalla (Pathanamthitta district), Centre for Mentally Retarded, Thrissur (Thrissur district), and School for Mentally Challenged, Thiruvananthapuram (Thiruvananthapuram district), with the prior permission of the Principal/Director and also the written/telephonic consent from available parents/guardian of the subjects, after giving assurance that the data will be used only for research purpose and the data will be kept confidential.

All institutions from where subjects were sampled, admit all types of mentally retarded patients, which include identified as well as non-identified syndromes. Irrespective of gender, the institutions admits all adolescent and young patients under both, residential and non-residential mode of education. The institutions are fully equipped to deal with the mentally retarded students like special education tools and aids, trained faculty and all other amenities for the multidimensional development of students.

## **RESEARCH DESIGN**

The present investigation was designed as a descriptive cross sectional study which involves collecting data in order to test the hypothesis or to answer question concerning the current status of the situation of the problem (Gay, 1990). The descriptive research carried out through survey method of data collection after

preparing a questionnaire like data sheet. Hence all required data were collected from all samples surveyed.

## **SAMPLE SIZE AND COLLECTION**

A total of 165 adolescent subjects, below 45 years of age, including male and female belong to different mental conditions were randomly selected from different institutions for the present study. Certain difference exists in both the qualitative and quantitative dermatoglyphic traits between males and females. Females have narrower ridges than males. Epidermal ridges are less clearly printed in females than males (Okajima and Usukura, 1984), which will be more evident in mentally retarded cases. The ridge property between the sexes seems to be constitutional and hence more females were sampled and only samples with good finger prints were included for analysis, which resulted non-significant variation in sex ratio. Among 165 subjects 109 (66.07%) were having identified ailment and rest were un-identified syndromes and were categorized as general mental retardation. All the cases with diagnosed and un-identified subjects were included in the study. Majority of the tenants were not having a proper medical identity. The common ailments of the 127 subjects recorded were Down's Syndrome, Autism, Cerebral Palsy and Microcephaly and few autism. In order to compare and contrast the dermatoglyphic characters of mentally retarded people with normal adolescent people, 155 normal age and sex matched people, without any mental retardation were randomly selected from different localities near to the sampled institutions and Mar Thoma College, Tiruvalla (Pathanamthitta District) who were willing and given consent to take part in the study. Even though age have no influence in dermatoglyphic analysis (Jameela, 2006), age and sex matched samples were obtained for reduce error at various levels. It is unavoidable in many disabilities to have only a small number of cases, but control should number approximately in tune with the cases group to minimize sampling fluctuations in dermatoglyphic studies (Reed, 1981).

A data sheet was prepared to record all the details/measurements of subjects (Appendix 1). The data sheet was finalised after a pilot dermatoglyphic survey of



mentally retarded children. The measurements, which are difficult to measure, were deleted and the data sheet was finalised and is appended (Appendix 2). Before the measurements, all the subjects were assured that the data will be used only for research purpose and will be kept confidential. All dermatoglyphic counts and other parameters were recorded in the data sheet using standard units. A total of 14 dermatoglyphic variables were taken from all subjects apart from recording socio-demographic variables such as, age, sex, identified syndrome and the severity of syndrome.

## **FINGER PRINT DATA COLLECTION PROCEDURE**

All measurements and identification were taken according to the techniques described by Law Enforcement Agencies (USA). The specific method followed was of that of Saha (1970). Finger and palm prints of both hands were taken for analysis. The palms were thoroughly cleaned with cotton soaked in alcohol/sprit to remove any dirt, perspiration, oil content etc. The finger prints were taken in art paper of high quality, preferably behind the serially numbered/coded questionnaire/data sheet form. Printer's ink, rubber roller, glass/metal inking slab, sponge rubber pad and magnifying glass were used take print and measure various counts.

Little printer's ink was pasted in inking slab and spread evenly with rubber roller to form a thin ink film on the slab. The palm was pressed against the ink pad evenly by gently pushing the middle part of the palm to ink the concave part of the palm, without jerking against the ink slab. The palm then was pressed on the paper to get the print. Again each finger tip was also inked and got the print of all five fingers in order from left to right for left hand and vice versa for the right hand so that the thumb impression will come in the middle. Special care should be taken to get a clear and rolled finger print with out over- or under- inking. Print of both the hands and fingers were taken on same paper and labelled properly. The quality of the prints were checked with the magnifying glass and in case of poor printing of either of the hands or both the hands, the palms were cleaned and the entire process was repeated. Since the cases were mentally retarded subjects, good prints were obtained only after

repeated turns. After obtaining good quality prints, the hands were washed immediately by soap/detergents and again cleaned with spirit/alcohol if ink stain remains after soap washing.

## **SOCIO-DEMOGRAPHY ASSESSMENT**

The general characteristics of the subjects obtained in data sheet were the following:

1. Age of the subject as the physical age in years and the age later grouped in to different age groups such as less than 10 years, 10 to 14 years, 15 to 19 years and 20 years and greater as more than 30 years subjects were expected to be less in cases.
2. Gender of the subject as whether male or female.
3. Religion of subjects as to Hindu, Christian and Islam religions.
4. Education of the subjects as to special education for mentally retarded subjects and control group was categorized in to primary, middle, high school, SSLC/10<sup>th</sup>, PDC/+2, degree and professional/postgraduate.
5. Birth order as first child, second child, third child and four or more, which was pertinent in cases group.
6. Place of residence as corporation/municipality (urban) and village (rural).
7. Occupation of father as skilled, unskilled labourer, government office, private office, agriculture, business, unemployed/sedentary.
8. Socio-economic status as poor, average, high and very high.
9. Type of family as nuclear, broken and joint family.
10. Diagnosed disease of the subject as the different syndromes such as Down's syndrome, autism, cerebral palsy and microcephaly.

## **DERMATOGLYPHIC ASSESSMENT**

Rolled, inked finger and palm prints of both, cases and controls were then read with the help of a magnifier glass and points were marked with pencil. First pattern type and then the ridges were counted in addition to 'a-b' like ridge measurements including 'atd' angle. The interpretation of prints was performed according to

Cummins and Midlo (1961) and by Penrose (1968b) based on certain basic biological principles behind finger print identification such as: (i) Individual epidermal ridges are so highly variable that their characteristics, even in a small area of a finger, palm or sole, are not duplicated either in another region or in a different individual; (ii) The configurations and details of individual ridges are permanent and unchanging; (iii) The configuration types are individually variable, but they are within limits, which makes systemic classification possible. The following ridge patterns and counts were measured in the present assessment.

### **Finger Ridge Pattern (FRP)**

Finger ridge patterns were classified as simple arch (A), tented arch (TA), ulnar loop ( $L^u$ ), radial loop ( $L^r$ ), simple whorl (W), central pocket whorl (cp) and double loop whorl (lp) (Schaumann and Alter, 1976). Pattern asymmetry was assessed by counting pattern matches on their five pairs of homologous fingers. The fingers were identified as left hand small finger (L5), left hand ring finger (L4), left hand middle finger (L3), left hand index finger (L2) and left hand thumb (L1). Similarly right hand fingers were identified as right hand thumb (R1), right hand index finger (R2), right hand middle finger (R3), right hand ring finger (R4) and right hand small finger (R5).

### **Finger Ridge Count (FRC)**

To obtain the ridge count of a pattern a clear finger print is necessary. The finger ridge count consists of the number of ridges which cut or touch a straight line running from the tri radius to the core or centre of the pattern. In a simple arch where there is no tri radius and therefore no ridge count, the score is 0. A loop, with one tri radius has one line count. In whorl, there are typically two counts, one from each tri radius to the corresponding core and if the count is different in each case, the biggest will be considered. Total Finger Ridge Count (TFRC) is the sum of the ridge count in 10 fingers, in which also with two tri-radii, the larger count is taken.

## **Palmar Dermatoglyphic Measurement (PDM)**

Palmar dermatoglyphic measurements are ridge counts between pre-identified points like a, b, c and d in the palmar region. Usually each point will be a ridge coincidence point or a divergence point, which are seen in all human palm but the position and pattern may vary in different kind of people.

### **Ridge Counts (a-b; b-c; c-d)**

The a-b, b-c and c-d ridge counts are measures of the size of the second inter digital area of the hand, between the bases of the index and medium fingers. It is made by the count of the number of ridges between the tri radius A, in the case of the index digit and the tri radius B, in the case of the medium finger. The left and right AB ridge counts were calculated.

### **atd Angle**

The atd points are marked and joined with straight line the 't' angle was measured with a protractor. It was used to measure the relationship between the length of the hand and its width. This angle is influenced by skeletal growth which can continue into adolescents.

## **STATISTICAL ANALYSES**

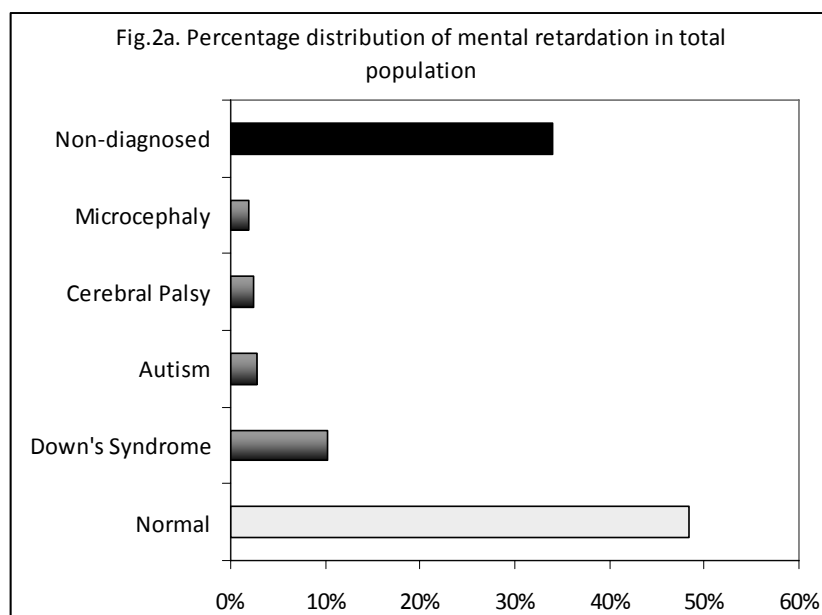
The data obtained from the normal and mentally retarded adolescents were compiled and made in to a master sheet from the individual data sheet. The data was scrutinised and erroneous data were omitted. The finalised data was then entered in to a personal computer for analysis and the data was analysed using 'R' software for statistical and mathematical computations. The results were presented in suitable graphs and tables. The general characteristics of the population are given as frequency (number) and percentage. The dermatoglyphic counts are presented as mean  $\pm$  standard deviation. Student's 't' test was performed to compare between control and mental retardation group as parametric test and non-parametric test, Chi square test was employed to compare ordinal variables (Snedecor and Cochran, 1968). A probability level of  $< 0.05$  was considered significant for all statistical evaluations.

# RESULTS

Dermatoglyphic characterization of mentally retarded adolescents under the age of 40 years was done by sampling mentally retarded people with diagnosed Down's syndrome, autism, cerebral palsy and microcephaly and non-diagnosed subjects. All the dermatoglyphic parameters of mentally retarded people were compared with normal adolescents and comparisons were done for males and females separately and for the total population. A total of 320 adolescents including college students were sampled for the present study of which 155 (48.44%) subjects represented normal population and 165 (51.56%) was mentally retarded representing different diagnosed and non-diagnosed syndromes.

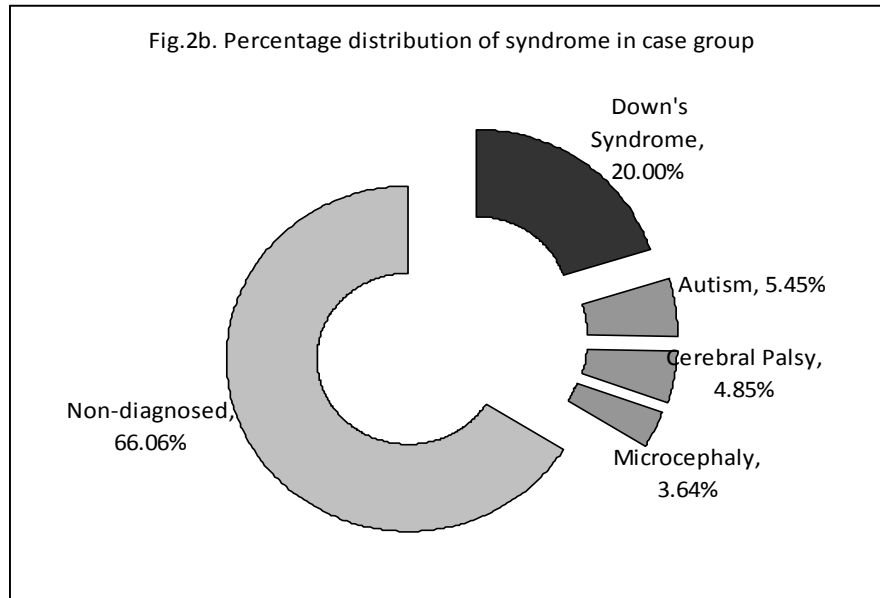
## I. Socio-Demographic Characteristics

### 1. Disease/Syndrome Distribution



Out of the total population, 48.44% were normal and 51.56% were mentally retarded patients (Fig. 2a). Among the mentally retarded group, 20.00% subjects has Down's syndrome, 5.45% were autistic, 4.85% has cerebral palsy and 3.64% has

microcephaly. 66.06% of the case groups were non-diagnosed mental retardation with mild to moderate severity (Fig. 2b). Since majority of the cases were un-identified syndromes, this variable was not taken for further statistical analysis



## 2. Gender Distribution

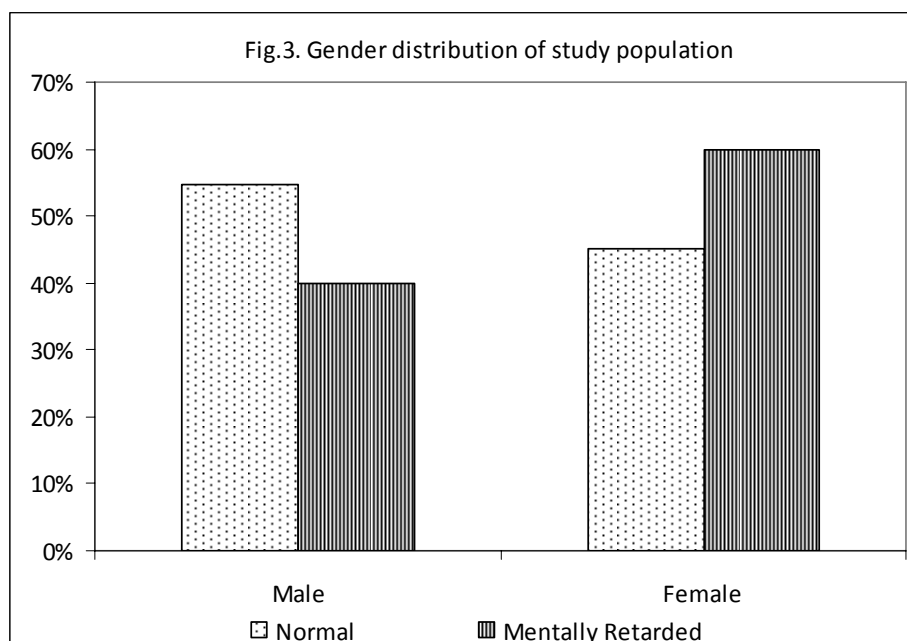
Among the total population of 320 subjects, 169 (52.81%) were females and 151 (47.19%) were males (Table 2) with a sex ratio of 1: 1.1 with more female representation. 66 (40.00%) patients were male and 99 (60.00%) were females among the mentally retarded group. Gender wise group distribution is depicted in figure 3.

Table 2. Gender distribution in total population

Gender	Group		Total
	Normal	Mentally Retarded	
Male	85 54.80%	66 40.00%	151 47.19%
Female	70 45.20%	99 60.00%	169 52.81%
Total	155	165	320

Chi Square: 0.871; P > 0.05

Mental retardation was more seen in female of which cerebral palsy and autism were found more in females. Down's syndrome and microcephaly were found more in males than females. Gender distribution was not statistically significant.



### 3. Age Distribution

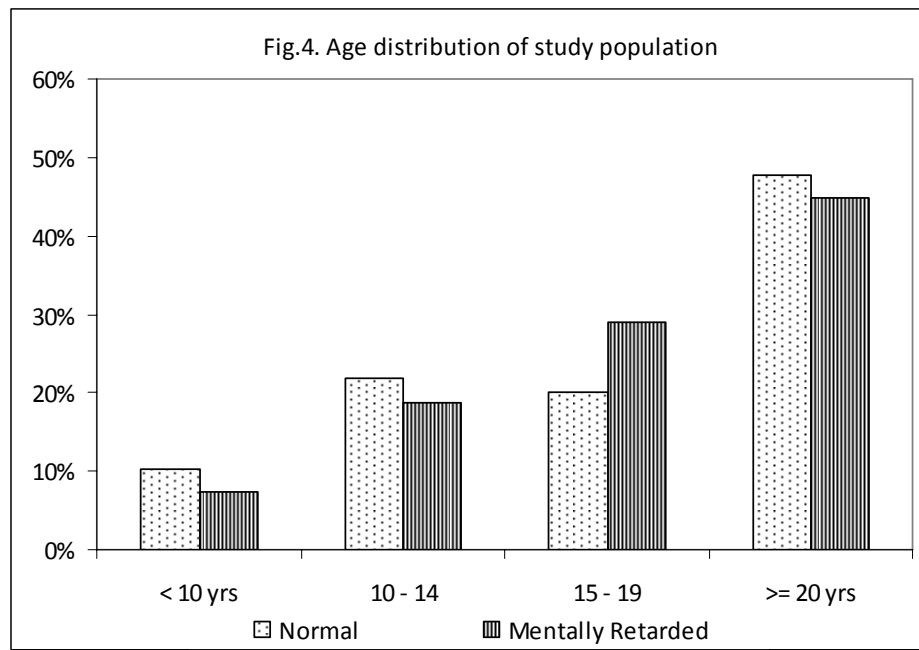
All the subjects were below 45 years old, which ranged from 6 years to 41 years. The population has been grouped according to age as < 10 years, 10 to 14 years, 15 to 19 years and greater than or equal to 20 years. The age distribution of the population is given in table 3. Maximum subjects (46.30%) were came under > 20 years age group, followed by 15 to 19 as well as 10 to 14 years age group, both contained 24.70% and 20.30% respectively and 8.8% cases came under < 10 years age group.

Table 3. Age distribution in total population

Age	Group		Total
	Normal	Mentally Retarded	
< 10 yrs	16 10.30%	12 7.30%	28 8.80%
10 - 14	34 21.90%	31 18.80%	65 20.30%
15 - 19	31 20.00%	48 29.10%	79 24.70%
>= 20 yrs	74 47.70%	74 44.80%	148 46.30%
Total	155	165	320

Chi Square: 4.060; P > 0.05

Most of the diseases encountered in 10 to 14 age group. Down's syndrome was prevalent in most of the age groups (Fig. 4). All other diseases are observed on all age groups equally. There were no ( $P>0.05$ ) statistical difference observed between two groups, which shows that both case and control groups were age matched.



#### 4. Religion

Table 4. Distribution of religion in total population

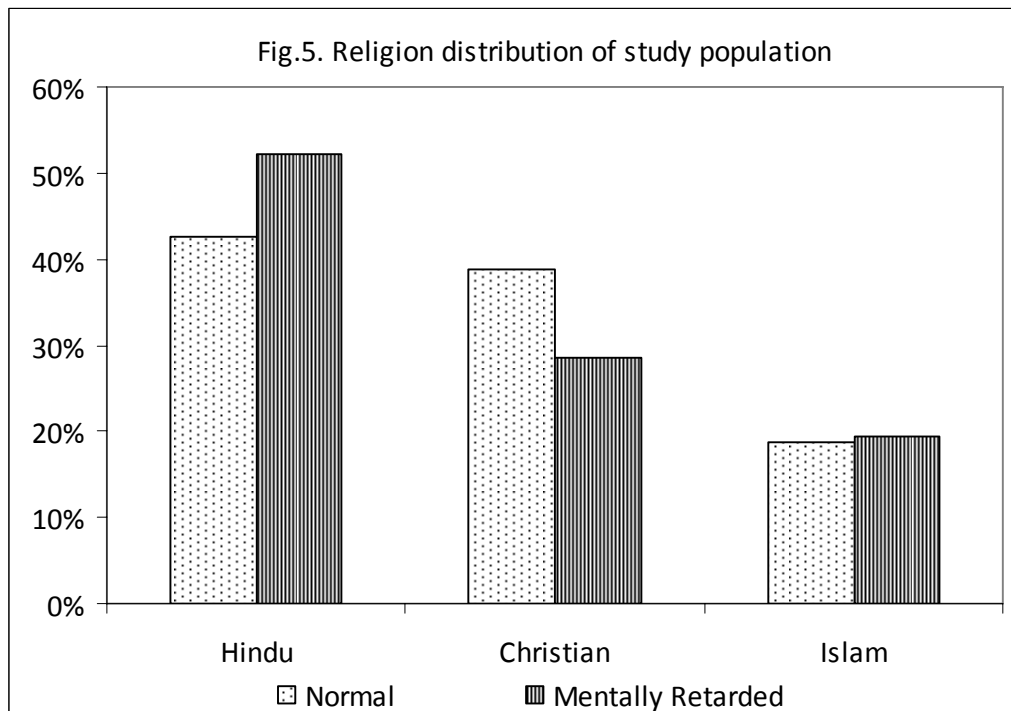
Religion	Group		Total
	Normal	Mentally Retarded	
Hindu	66 42.60%	86 52.10%	152 47.50%
Christian	60 38.70%	47 28.50%	107 33.40%
Islam	29 18.70%	32 19.40%	61 19.10%
Total	155	165	320

Chi Square: 4.050;  $P > 0.05$

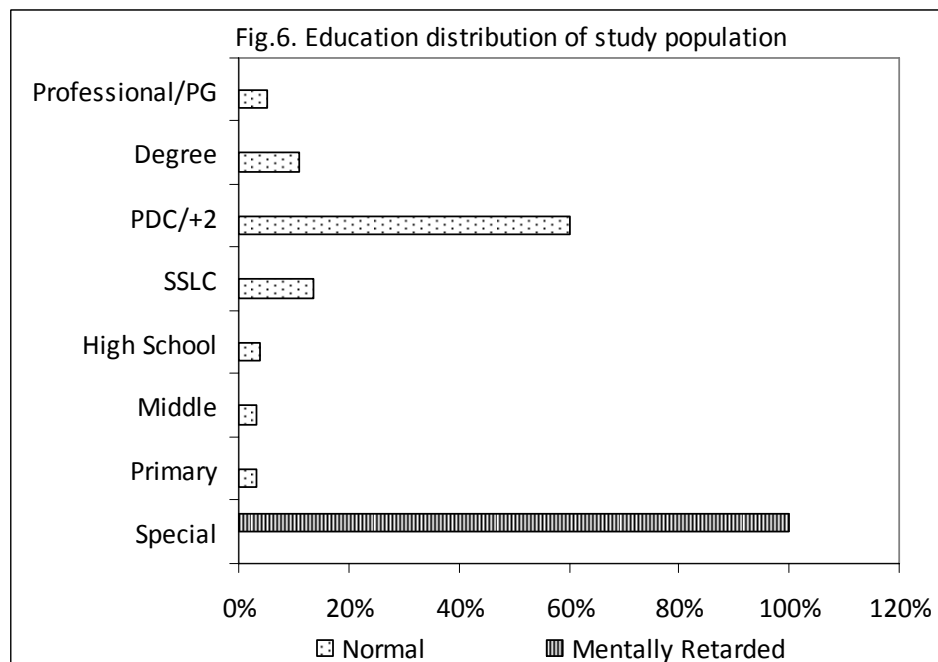
The religion of the subjects was also noted to avoid any significant difference between religions in the recruited population. It also revealed the incidence of mental retardation in any particular religious group. Even though majority (52.10%) of the



mentally retarded group followed Hinduism, the difference between normal and mentally retarded group was not found to be significant (Table 4). Christians followed Hindus in mentally retarded group and least was found in Islam religion (Fig.5).



### 5. Education Status



Education status of the study group was evaluated to assess the education level of the study and control group. None of the study group i.e., mentally retarded

subjects had formal education but have special education. Whereas all normal or control people had varying degrees of education and hence the education status of the control and study population showed significant ( $P < 0.05$ ) difference (Table 5). Majority of the normal people had PDC/+2 level education followed by SSLC (Fig. 6).

Table 5. Education status of the total population

Education	Group		Total
	Normal	Mentally Retarded	
Special		165 100.00%	165 51.60%
Primary	5 3.20%		5 1.60%
Middle	5 3.20%		5 1.60%
High School	6 3.90%		6 1.90%
SSLC	21 13.50%		21 6.60%
PDC/+2	93 60.00%		93 29.10%
Degree	17 11.00%		17 5.30%
Professional/PG	8 5.20%		8 2.50%
Total	155	165	320
Chi Square: 320.000; $P < 0.05$			

## 6. Birth Order

Table 6. Birth order in two groups

Birth Order	Group		Total
	Normal	Mentally Retarded	
First	91 58.70%	72 43.60%	163 50.90%
Second	47 30.30%	72 43.60%	119 37.20%
Third	9 5.80%	15 9.10%	24 7.50%
>= Fourth	8 5.20%	6 3.60%	14 4.40%
Total	155	165	320
Chi Square: 8.943; $P < 0.05$			

Order of birth forms important criteria for expression of mental retardation in human being. Usually first or second order siblings are affected with mental retardation, no exception in the present study results also. First and second order siblings had equal chance of mental retardation and the sampling showed no significant ( $P > 0.05$ ) difference in birth order (Table 6). Even though the difference was insignificant, second order children had more mental retardation than first order children when compared to the normal population (Fig.7).



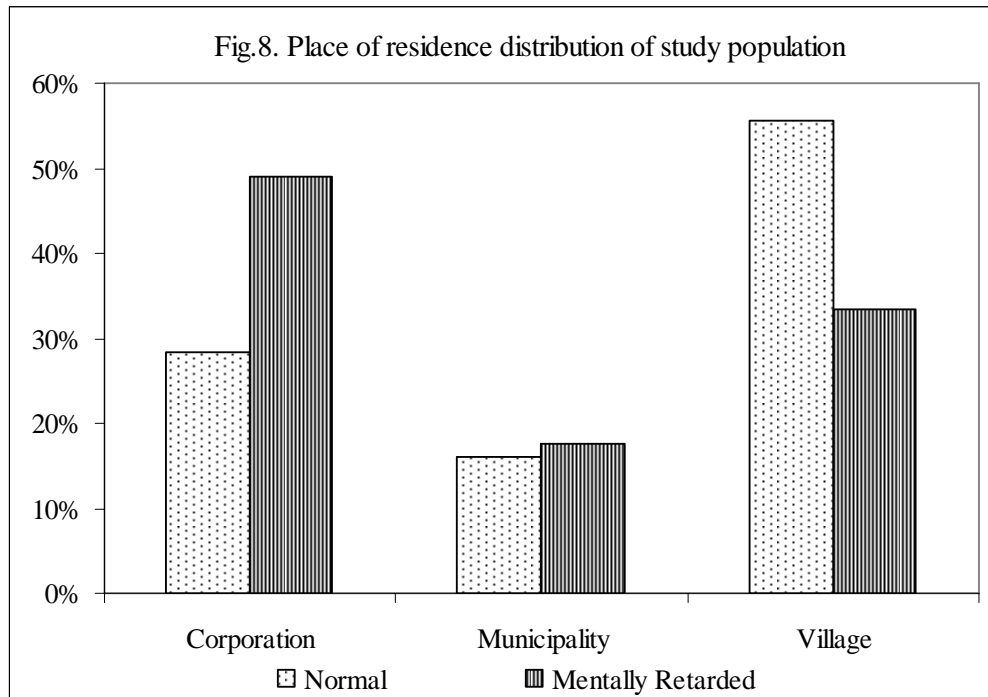
## 7. *Place of Residence*

Residential status of the subjects belongs to both control and mentally retarded group were noted to assess the significant difference between two groups. Table 7 depicts the place of residence of the subjects, which showed significant difference ( $P < 0.001$ ) between normal and mentally retarded group. 49.10% of the mentally retarded subjects were from corporation area followed by 33.30% from village area. Majority of the control people constituted from village area followed by corporation area (Fig. 8).

Table 7. Distribution of place of residence

Place of Residence	Group		Total
	Normal	Mentally Retarded	
Corporation	44 28.40%	81 49.10%	125 39.10%
Municipality	25 16.10%	29 17.60%	54 16.90%
Village	86 55.50%	55 33.30%	141 44.10%
Total	155	165	320

Chi Square: 17.769; P < 0.001



## 8. Occupation of Father

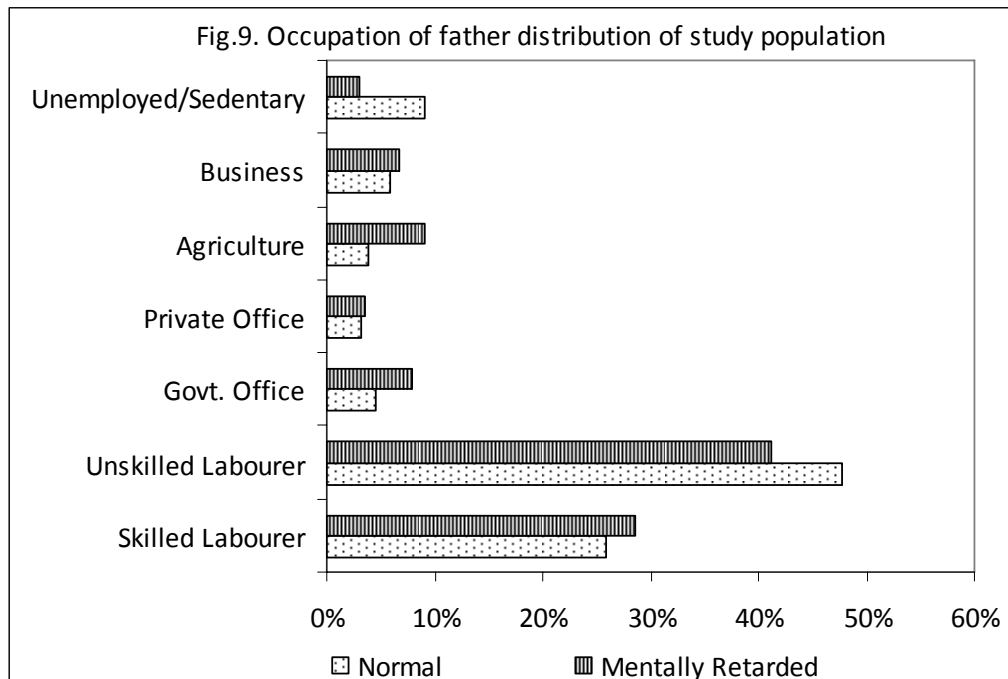
Occupation of father of each subjects from two groups were noted to assess the risk of mental retardation in any occupational hazard and to compare normal and study group. Results showed that there was no ( $P > 0.05$ ) significant difference between two groups (Table 8) with respect to occupation of parent. Majority of the subjects had their father occupation as non-skilled labourer followed by skilled

labourers, which show that middle class people had more mentally retarded offspring (Fig. 9) than other groups of people with varying living standards.

Table 8. Occupation of father in total population

Occupation of Father	Group		Total
	Normal	Mentally Retarded	
Skilled Labourer	40 25.80%	47 28.50%	87 27.20%
Unskilled Labourer	74 47.70%	68 41.20%	142 44.40%
Govt. Office	7 4.50%	13 7.90%	20 6.30%
Private Office	5 3.20%	6 3.60%	11 3.40%
Agriculture	6 3.90%	15 9.10%	21 6.60%
Business	9 5.80%	11 6.70%	20 6.30%
Unemployed /Sedentary	14 9.00%	5 3.00%	19 5.90%
Total	155	165	320

Chi Square: 10.726; P > 0.05



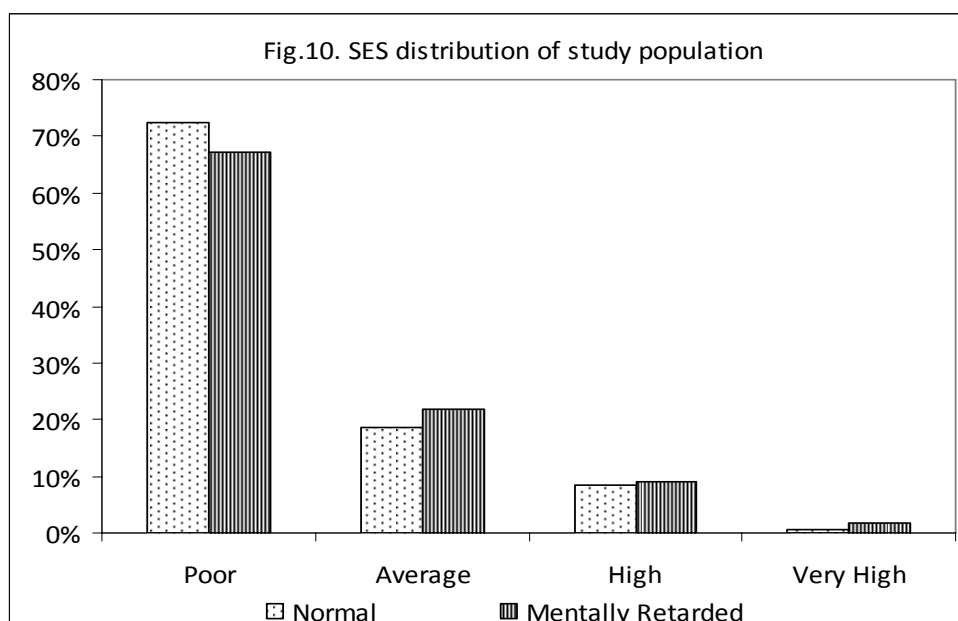
## 9. Socio-Economic Status (SES)

SocioEconomic Status of the family is another important socio demographic variable, very much influential for mentally challenged people. Usually mentally challenged children are more seen in low socio-economic group. The present study also shows the same common pattern in recruiting study group. But the normal group also matched ( $P > 0.05$ ) the study group in having same SES status distribution (Table 9). Socio-economically poor group represented majority of the study total population followed by average group. High SES and very high SES groups were comparatively less represented in both the groups (Fig.10).

Table 9. Socio-Economic Status in two groups

SocioEconomic Status	Group		Total
	Normal	Mentally Retarded	
Poor	112 72.30%	111 67.30%	223 69.70%
Average	29 18.70%	36 21.80%	65 20.30%
High	13 8.40%	15 9.10%	28 8.80%
Very High	1 0.60%	3 1.80%	4 1.30%
Total	155	165	320

Chi Square: 1.590;  $P > 0.05$



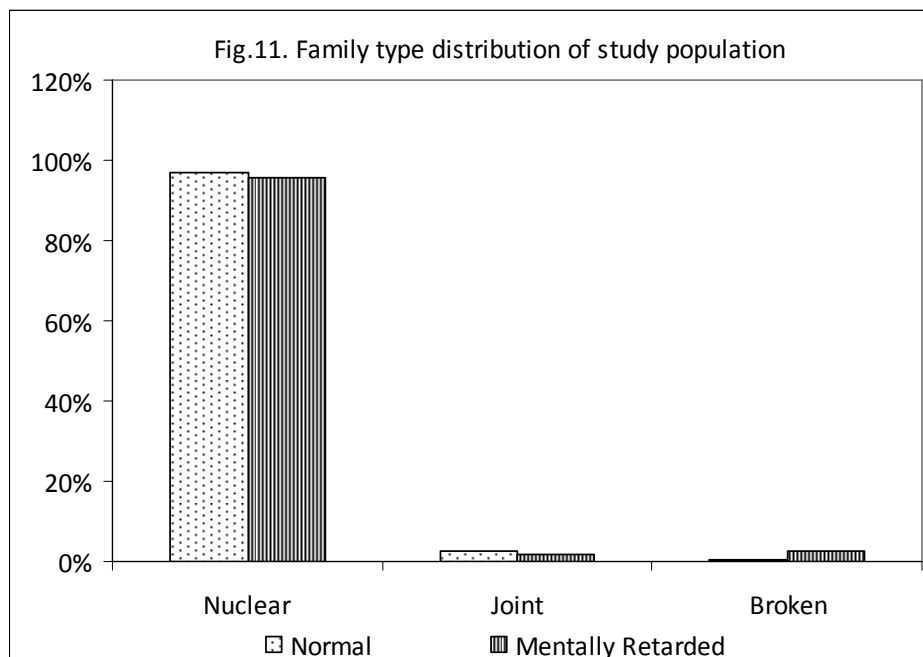
## 10. Family Type

Table 10. Distribution of family type in total population

Type of Family	Group		Total
	Normal	Mentally Retarded	
Nuclear	150 96.80%	158 95.80%	308 96.30%
Joint	4 2.60%	3 1.80%	7 2.20%
Broken	1 0.60%	4 2.40%	5 1.60%
Total	155	165	320

Chi Square: 1.840; P > 0.05

Nuclear family type now become a standard pattern apart from joint family in ancient times, especially in Kerala and this may be attributed one of the reasons for high incidence of mental retardation and taken in to consideration in the present study also. Since majority of the population form nuclear family, number from joint and broken family was not adequate to compare with in group (Fig. 11). Both the groups were matched (Table 10) and there were no significant ( $P > 0.05$ ) difference in distribution of type of family in the present study.



## II. Dermatoglyphic Characteristics

Dermatoglyphic characters like finger ridge pattern (FRP) of five fingers of left and right hands were observed. In addition, finger ridge count (FRC) and palmar dermatoglyphic measurements (PDM) between different ridges like a-b, b-c and c-d were counted and compared between mentally retarded group and normal.

### 1. Finger Ridge Pattern (FRP)

Finger ridge pattern were classified as simple arch (A), tented arch (TA), ulnar loop ( $L^u$ ), radial loop ( $L^r$ ), simple whorl (W), central pocket whorl (cp) and double loop whorl (lp). Pattern asymmetry was assessed by counting pattern matches on their five pairs of homologous fingers. FRP of each finger of five fingers of left (L5 to L1) and right hands (R1 to R5) were noted and compared for asymmetry between two groups.

#### 1 a. Left Hand Fingers

##### 1 a 1. Small Finger Ridge Pattern (L5)

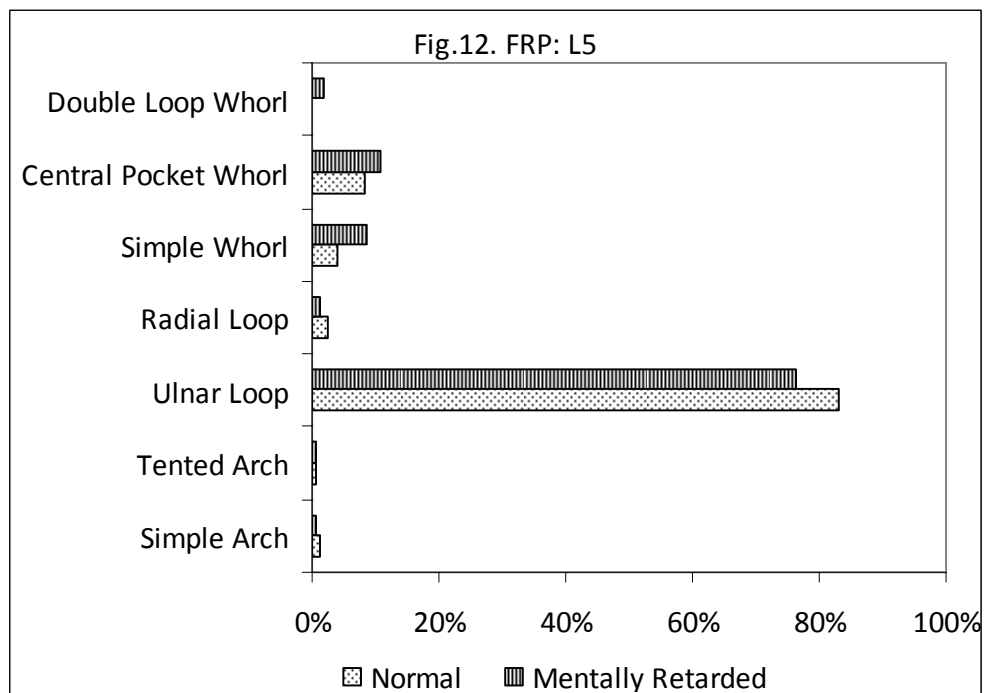
Table 11. Finger ridge pattern in left small finger

FRP: L5	Group		Total
	Normal	Mentally Retarded	
Simple Arch	2 1.30%	1 0.60%	3 0.90%
Tented Arch	1 0.60%	1 0.60%	2 0.60%
Ulnar Loop	129 83.20%	126 76.40%	255 79.70%
Radial Loop	4 2.60%	2 1.20%	6 1.90%
Simple Whorl	6 3.90%	14 8.50%	20 6.30%
Central Pocket Whorl	13 8.40%	18 10.90%	31 9.70%
Double Loop Whorl		3 1.80%	3 0.90%
Total	155	165	320

Chi Square: 7.737; P < 0.05



Left hand small finger (L5) ridge pattern registered simple arch, tented arch, ulnar loop, radial loop, simple whorl, central pocket whorl and double loop whorl patterns. Of which, double loop whorl was registered only in mentally retarded group. Pattern showed significant difference between mentally retarded and normal group ( $P < 0.05$ ) as depicted in table 11. The major pattern manifested was ulnar loop in both the group but ulnar loop was more in normal group than mentally retarded group (Fig.12).



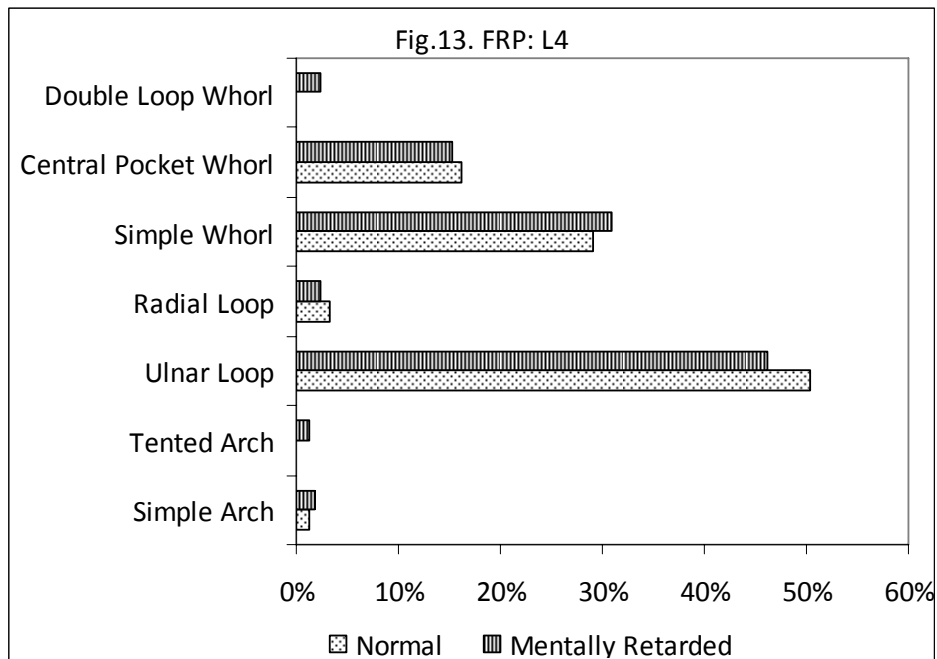
### 1 a 2. Ring Finger Ridge Pattern (L4)

Left hand ring finger (L4) ridge pattern registered simple arch, tented arch, ulnar loop, radial loop, simple whorl, central pocket whorl and double loop whorl patterns. Of which, tented arch and double loop whorl was registered only in mentally retarded group. Pattern showed significant difference between mentally retarded and normal group ( $P < 0.05$ ) as depicted in table 12. Simple whorl and simple arch pattern was more shown by mentally retarded group. The major pattern manifested was ulnar loop followed by central pocket whorl in both the groups but both the pattern were more in normal group than mentally retarded group (Fig.13).

Table 12. Finger ridge pattern in left ring finger

FRP: L4	Group		Total
	Normal	Mentally Retarded	
Simple Arch	2 1.30%	3 1.80%	5 1.60%
Tented Arch		2 1.20%	2 0.60%
Ulnar Loop	78 50.30%	76 46.10%	154 48.10%
Radial Loop	5 3.20%	4 2.40%	9 2.80%
Simple Whorl	45 29.00%	51 30.90%	96 30.00%
Central Pocket Whorl	25 16.10%	25 15.20%	50 15.60%
Double Loop Whorl		4 2.40%	4 1.30%
<b>Total</b>	<b>155</b>	<b>165</b>	<b>320</b>

Chi Square:6.4060; P < 0.05



### 1 a 3. Middle Finger Ridge Pattern (L3)

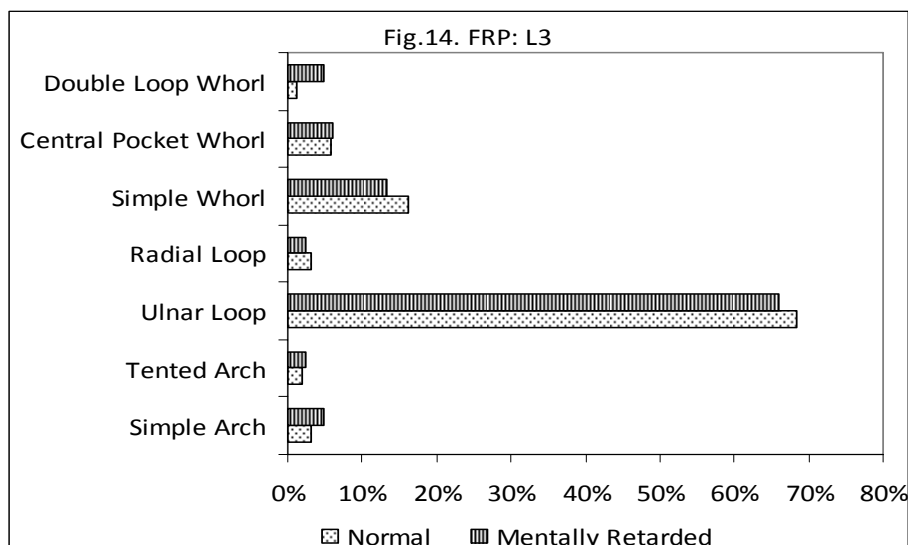
Middle finger (L3) ridge pattern registered simple arch, tented arch, ulnar loop, radial loop, simple whorl, central pocket whorl and double loop whorl patterns. In left

middle finger, all patterns registered in both normal and mentally retarded groups and no patterns was found specific to study group. Pattern showed no significant difference between mentally retarded and normal group ( $P > 0.05$ ) as depicted in table 13. Central pocket whorl and double loop whorl pattern were more shown by mentally retarded group. The major pattern manifested was ulnar loop followed by simple whorl in both the groups but both the pattern were more in normal group than mentally retarded group (Fig.14).

Table 13. Finger ridge pattern in left middle finger

FRP: L3	Group		Total
	Normal	Mentally Retarded	
Simple Arch	5 3.20%	8 4.80%	13 4.10%
Tented Arch	3 1.90%	4 2.40%	7 2.20%
Ulnar Loop	106 68.40%	109 66.10%	215 67.20%
Radial Loop	5 3.20%	4 2.40%	9 2.80%
Simple Whorl	25 16.10%	22 13.30%	47 14.70%
Central Pocket Whorl	9 5.80%	10 6.10%	19 5.90%
Double Loop Whorl	2 1.30%	8 4.80%	10 3.10%
<b>Total</b>	<b>155</b>	<b>165</b>	<b>320</b>

Chi Square: 4.524;  $P > 0.05$

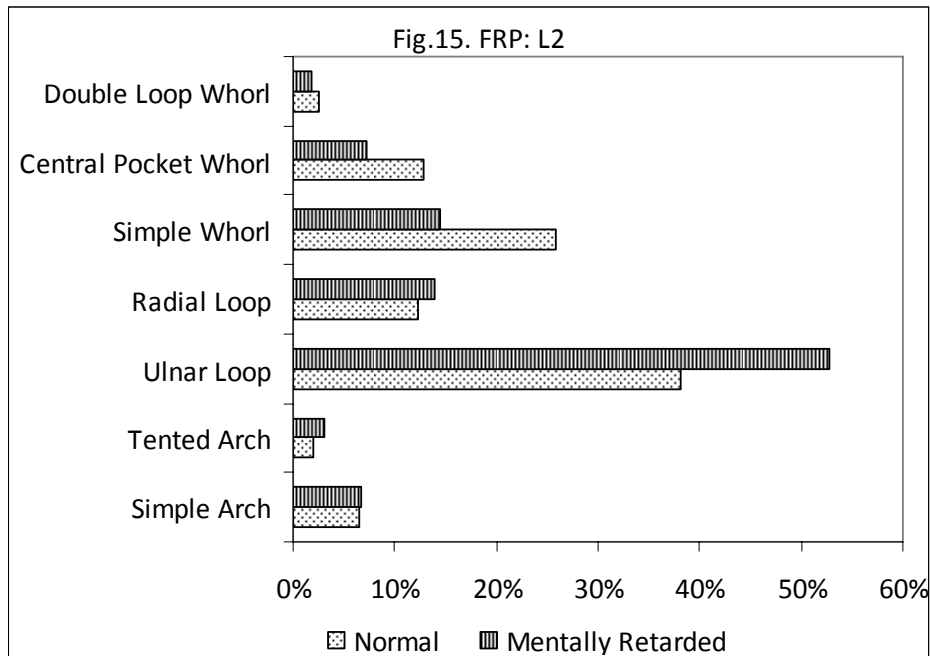


**1 a 4. Index Finger Ridge Pattern (L2)**

Table 14. Finger ridge pattern in left index finger

FRP: L2	Group		Total
	Normal	Mentally Retarded	
Simple Arch	10 6.50%	11 6.70%	21 6.60%
Tented Arch	3 1.90%	5 3.00%	8 2.50%
Ulnar Loop	59 38.10%	87 52.70%	146 45.60%
Radial Loop	19 12.30%	23 13.90%	42 13.10%
Simple Whorl	40 25.80%	24 14.50%	64 20.00%
Central Pocket Whorl	20 12.90%	12 7.30%	32 10.00%
Double Loop Whorl	4 2.60%	3 1.80%	7 2.20%
<b>Total</b>	<b>155</b>	<b>165</b>	<b>320</b>

Chi Square: 12.141; P < 0.05



Index finger (L2) of left hand ridge pattern registered simple arch, tented arch, ulnar loop, radial loop, simple whorl, central pocket whorl and double loop whorl patterns. In left index finger, all patterns registered in both normal and mentally

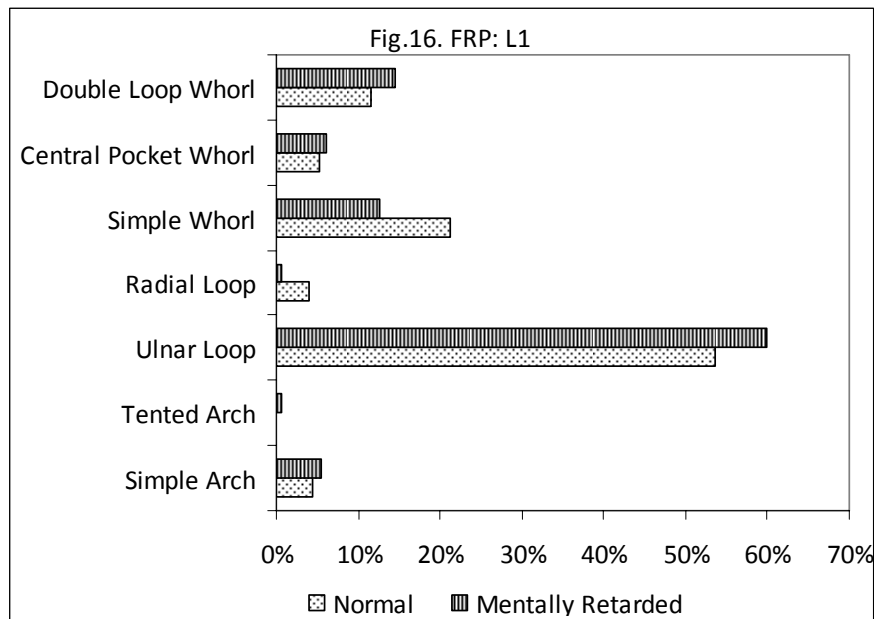
retarded groups and no patterns was found specific to study group. Ridge pattern showed significant difference between mentally retarded and normal group ( $P < 0.05$ ) as depicted in table 14. Radial loop and ulnar loop patterns were more shown by mentally retarded group. The major pattern manifested was ulnar loop followed by simple whorl in both the groups but both the pattern were more in study group than control group (Fig.15).

### 1 a 5. Thumb Finger Ridge Pattern (L1)

Left hand thumb finger (L1) ridge pattern registered simple arch, tented arch, ulnar loop, radial loop, simple whorl, central pocket whorl and double loop whorl patterns. In left thumb finger, all patterns registered in both normal and mentally retarded groups and tented arch was seen only in study group. Ridge pattern showed significant difference between mentally retarded and normal group ( $P < 0.05$ ) as depicted in table 15. Ulnar loop and central pocket whorl patterns were more shown by mentally retarded group. The major pattern manifested was ulnar loop followed by simple whorl in both the groups but both the pattern were more in study group than control group (Fig.16).

Table 15. Finger ridge pattern in left thumb finger

FRP: L1	Group		Total
	Normal	Mentally Retarded	
Simple Arch	7 4.50%	9 5.50%	16 5.00%
Tented Arch		1 0.60%	1 0.30%
Ulnar Loop	83 53.50%	99 60.00%	182 56.90%
Radial Loop	6 3.90%	1 0.60%	7 2.20%
Simple Whorl	33 21.30%	21 12.70%	54 16.90%
Central Pocket Whorl	8 5.20%	10 6.10%	18 5.60%
Double Loop Whorl	18 11.60%	24 14.50%	42 13.10%
Total	155	165	320
Chi Square: 9.671; $P < 0.05$			



## 1 b. Right Hand Fingers

### 1 b 1. Thumb Finger Ridge Pattern (R1)

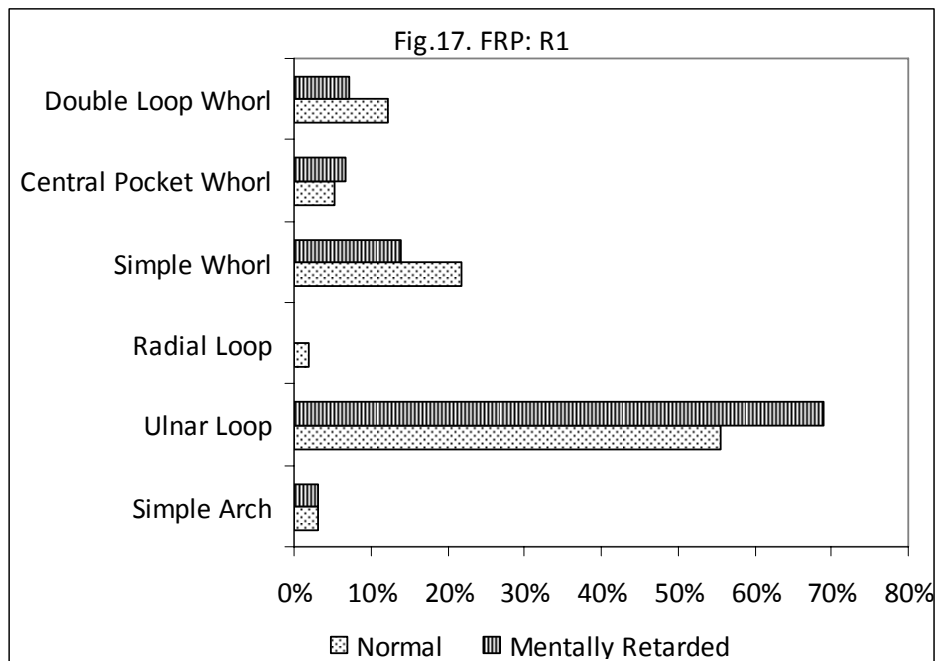
Table 16. Finger ridge pattern in right thumb finger

FRP: R1	Group		Total
	Normal	Mentally Retarded	
Simple Arch	5 3.20%	5 3.00%	10 3.10%
Ulnar Loop	86 55.50%	114 69.10%	200 62.50%
Radial Loop	3 1.90%		3 0.90%
Simple Whorl	34 21.90%	23 13.90%	57 17.80%
Central Pocket Whorl	8 5.20%	11 6.70%	19 5.90%
Double Loop Whorl	19 12.30%	12 7.30%	31 9.70%
<b>Total</b>	<b>155</b>	<b>165</b>	<b>320</b>

Chi Square: 10.795; P < 0.05

Right hand thumb finger (R1) ridge pattern registered simple arch, ulnar loop, radial loop, simple whorl, central pocket whorl and double loop whorl patterns. In right thumb finger, all patterns registered in both normal and mentally retarded

groups except radial loop, which was seen only in normal group. Ridge pattern showed significant difference between mentally retarded and normal group ( $P < 0.05$ ) as depicted in table 16. Ulnar loop and central pocket whorl patterns were more shown by mentally retarded group. The major pattern manifested was ulnar loop followed by simple whorl in both the groups but both the patterns were more in study group and control group (Fig.17).



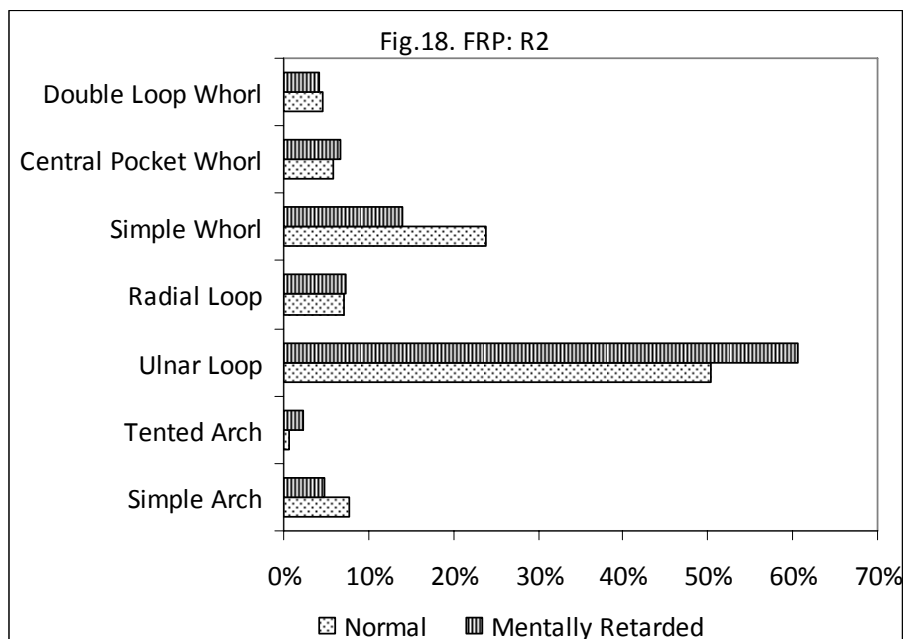
### 1 b 2. Index Finger Ridge Pattern (R2)

Right hand index finger (R2) ridge pattern registered simple arch, tented arch, ulnar loop, radial loop, simple whorl, central pocket whorl and double loop whorl patterns. In right index finger, all patterns registered in both normal and mentally retarded groups. Ridge pattern showed no significant difference between mentally retarded and normal group ( $P > 0.05$ ) as depicted in table 17. Ulnar loop, tented arch and central pocket whorl patterns were more shown by mentally retarded group. The major pattern manifested was ulnar loop followed by simple whorl in both the groups but ulnar loop pattern was more in study group and simple whorl was more in control group (Fig.18).

Table 17. Finger ridge pattern in right index finger

FRP: R2	Group		Total
	Normal	Mentally Retarded	
Simple Arch	12 7.70%	8 4.80%	20 6.30%
Tented Arch	1 0.60%	4 2.40%	5 1.60%
Ulnar Loop	78 50.30%	100 60.60%	178 55.60%
Radial Loop	11 7.10%	12 7.30%	23 7.20%
Simple Whorl	37 23.90%	23 13.90%	60 18.80%
Central Pocket Whorl	9 5.80%	11 6.70%	20 6.30%
Double Loop Whorl	7 4.50%	7 4.20%	14 4.40%
<b>Total</b>	<b>155</b>	<b>165</b>	<b>320</b>

Chi Square: 8.525 > 0.05



### 1 b 3. Middle Finger Ridge Pattern (R3)

Right hand middle finger (R3) ridge pattern registered simple arch, ulnar loop, radial loop, simple whorl, central pocket whorl and double loop whorl patterns. In right middle finger, all patterns registered in both normal and mentally retarded

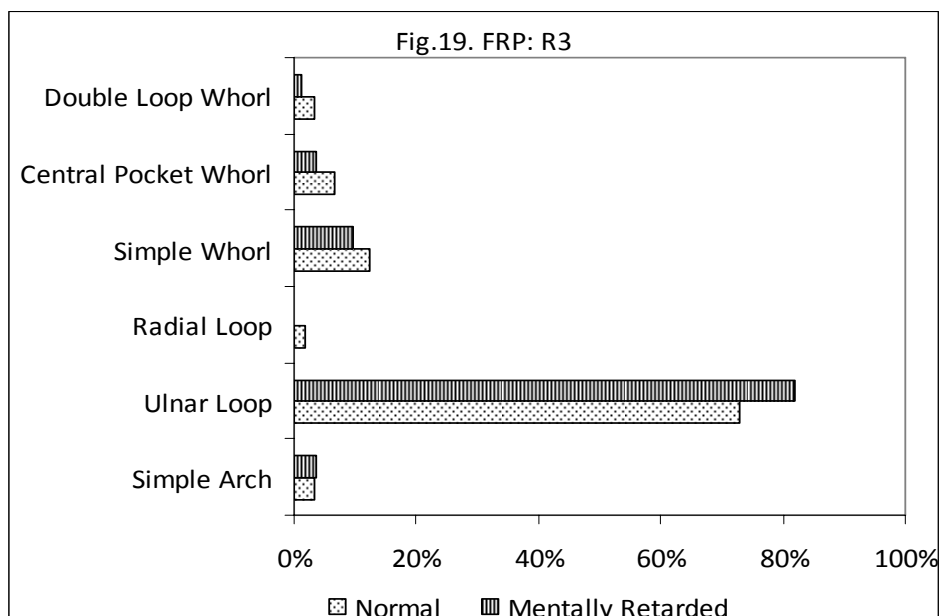


groups except radial loop, which was not seen in mentally retarded group. Ridge pattern showed significant difference between mentally retarded and normal group ( $P < 0.05$ ) as depicted in table 18. Ulnar loop was more shown by mentally retarded group. The major pattern manifested was ulnar loop followed by simple whorl in both the groups but ulnar loop pattern was more in study group and simple whorl was more in control group (Fig.19).

Table 18. Finger ridge pattern in right middle finger

FRP: R3	Group		Total
	Normal	Mentally Retarded	
Simple Arch	5 3.20%	6 3.60%	11 3.40%
Ulnar Loop	113 72.90%	135 81.80%	248 77.50%
Radial Loop	3 1.90%		3 0.90%
Simple Whorl	19 12.30%	16 9.70%	35 10.90%
Central Pocket Whorl	10 6.50%	6 3.60%	16 5.00%
Double Loop Whorl	5 3.20%	2 1.20%	7 2.20%
Total	155	165	320

Chi Square: 7.280;  $P < 0.05$

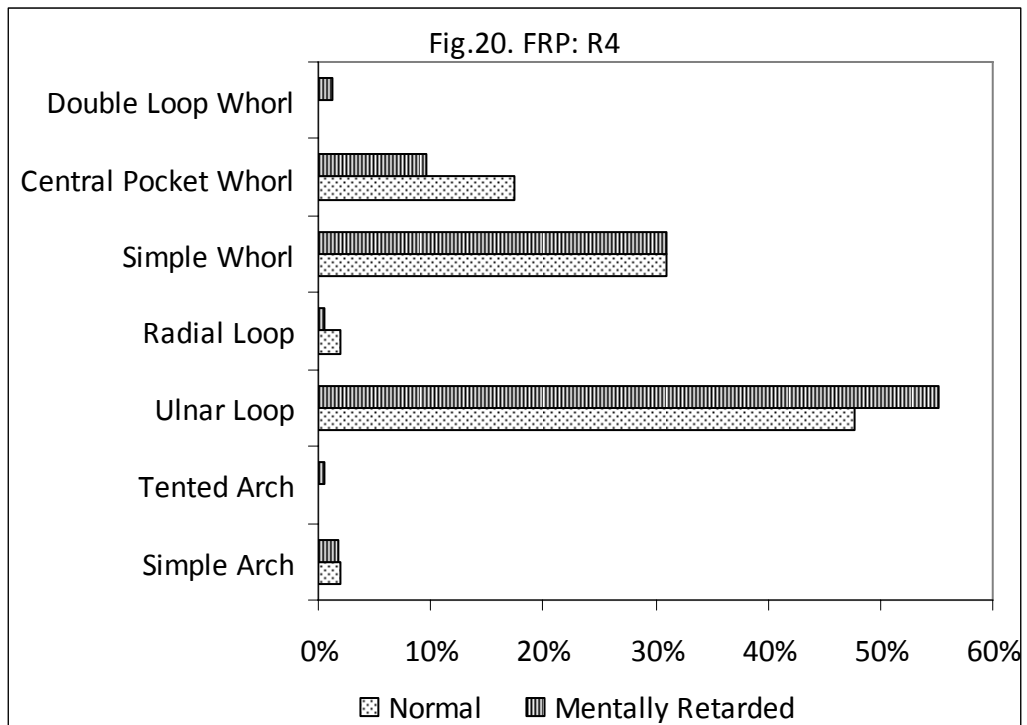


**1 b 4. Ring Finger Ridge Pattern (R4)**

Table 19. Finger ridge pattern in right ring finger

FRP: R4	Group		Total
	Normal	Mentally Retarded	
Simple Arch	3 1.90%	3 1.80%	6 1.90%
Tented Arch		1 0.60%	1 0.30%
Ulnar Loop	74 47.70%	91 55.20%	165 51.60%
Radial Loop	3 1.90%	1 0.60%	4 1.30%
Simple Whorl	48 31.00%	51 30.90%	99 30.90%
Central Pocket Whorl	27 17.40%	16 9.70%	43 13.40%
Double Loop Whorl		2 1.20%	2 0.60%
Total	155	165	320

Chi Square: 8.352; P < 0.05



Right hand ring finger (R4) ridge pattern registered simple arch, tented arch, ulnar loop, radial loop, simple whorl, central pocket whorl and double loop whorl patterns. In right ring finger, all patterns registered in both normal and mentally retarded groups except tented arch and double loop whorl, which was seen only in mentally retarded group and that too in one or two cases. Ridge pattern showed significant difference between mentally retarded and normal group ( $P < 0.05$ ) as depicted in table 19. Ulnar loop was more shown by mentally retarded group. The major pattern manifested was ulnar loop followed by simple whorl in both the groups but ulnar loop pattern was more in study group and simple whorl was more in control group (Fig.20).

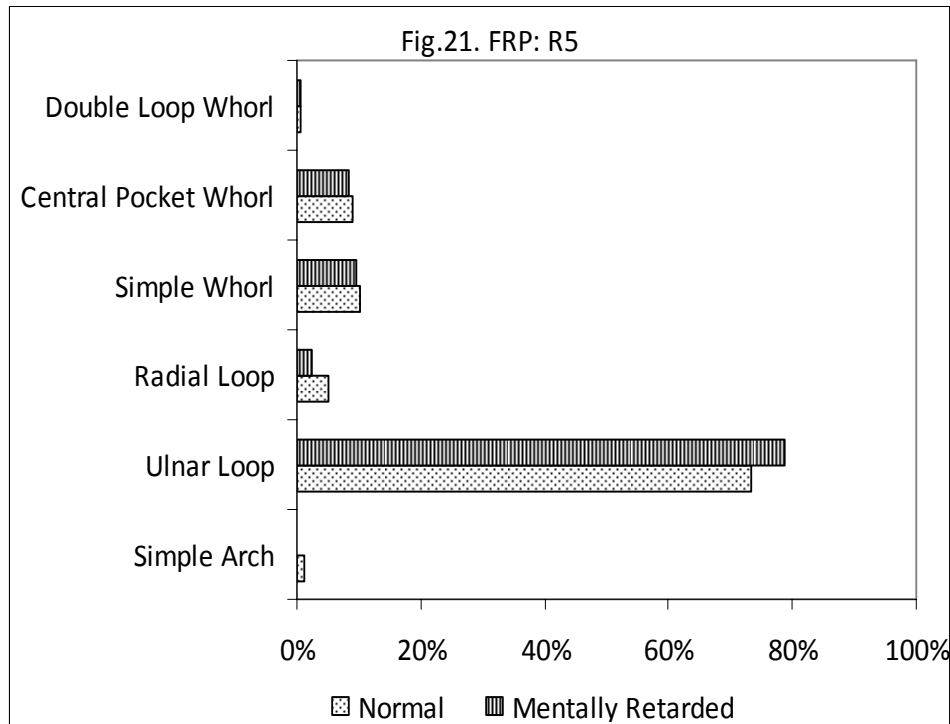
#### 1 b 5. Small Finger Ridge Pattern (R5)

Table 20. Finger ridge pattern in right small finger

FRP: R5	Group		Total
	Normal	Mentally Retarded	
Simple Arch	2 1.30%		2 0.60%
Ulnar Loop	114 73.50%	130 78.80%	244 76.30%
Radial Loop	8 5.20%	4 2.40%	12 3.80%
Simple Whorl	16 10.30%	16 9.70%	32 10.00%
Central Pocket Whorl	14 9.00%	14 8.50%	28 8.80%
Double Loop Whorl	1 0.60%	1 0.60%	2 0.60%
Total	155	165	320
Chi Square: 4.074; $P > 0.05$			

Right hand small finger (R5) ridge pattern registered simple arch, ulnar loop, radial loop, simple whorl, central pocket whorl and double loop whorl patterns. In right small finger, all patterns registered in both normal and mentally retarded groups except simple arch, which was not seen in mentally retarded group and that too in one or two cases. Ridge pattern showed no significant difference between mentally

retarded and normal group ( $P > 0.05$ ) as depicted in table 20. Ulnar loop was more shown by mentally retarded group. The major pattern manifested was ulnar loop followed by simple whorl in both the groups but ulnar loop pattern was more in study group and simple whorl was more in control group (Fig.21).



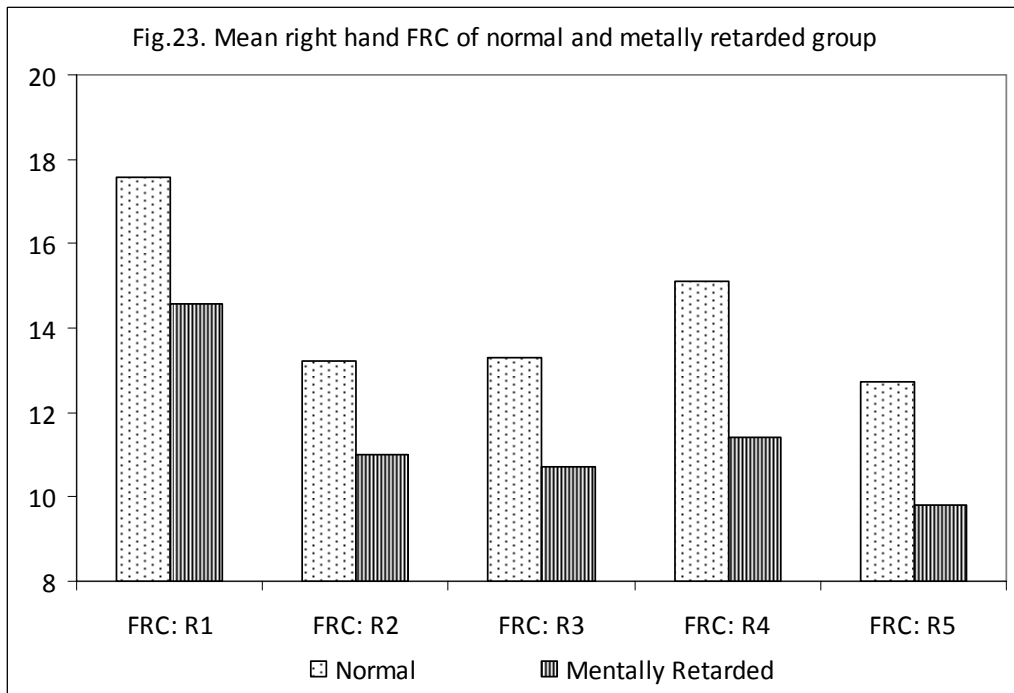
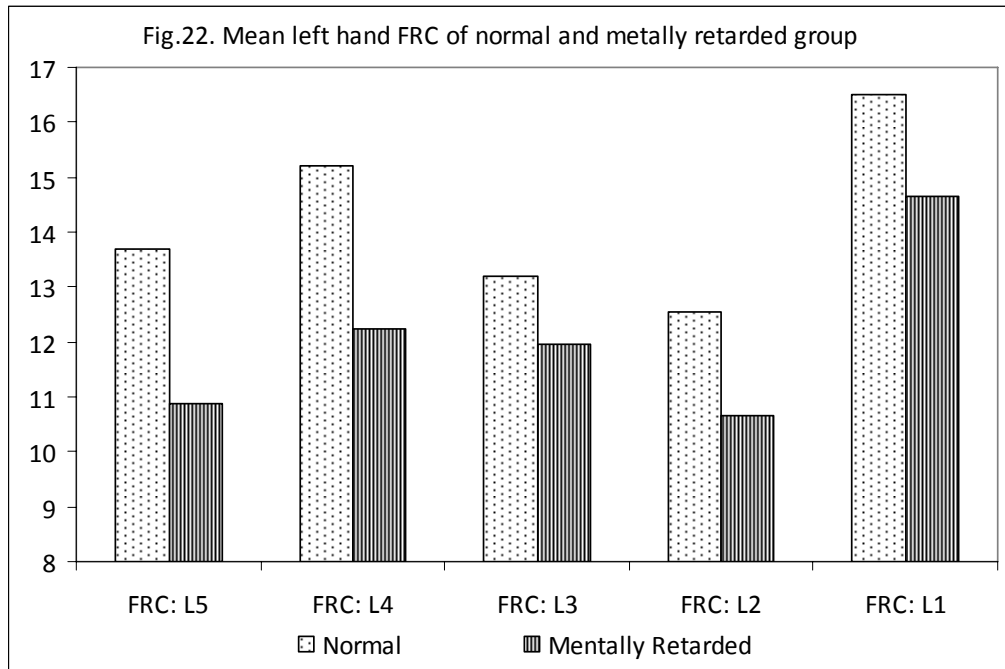
## 2. Finger Ridge Count (FRC)

Finger ridge count of five fingers of both hands each was measured from prints of control and study groups. FRCs of all five fingers of both hands were found to be significantly low than that of respective fingers of normal group. The normal FRC ranged between 12 to 18, whereas FRC of study group ranged between 8 and 15. All fingers showed a count difference of minimum two or more ridges. Comparison of FRC between two groups is given in table 21. High FRC was registered in thumb of left and right hand followed by ring finger. Low FRC was registered in index finger of both the hands and least in right small finger of mentally retarded group. The mean FRC of left and right hand fingers are given in figure 22 and 23 respectively. FRC seems to be one of the important parameter that manifest in mentally retarded group which can be used as a feature to distinguish them from normal people.

Table 21. Mean finger ridge count of left and right hand fingers comparing normal and mentally retarded group

Parameters	Group	Mean	± SD	t value
FRC: L5	Normal	13.69	3.99	6.667***
	Mentally Retarded	10.87	3.56	
FRC: L4	Normal	15.19	4.77	6.197***
	Mentally Retarded	12.24	3.74	
FRC: L3	Normal	13.19	4.58	4.522**
	Mentally Retarded	11.97	4.37	
FRC: L2	Normal	12.55	4.60	4.336**
	Mentally Retarded	10.66	4.04	
FRC: L1	Normal	16.52	5.55	3.947**
	Mentally Retarded	14.64	4.71	
FRC: R1	Normal	17.57	5.64	5.958***
	Mentally Retarded	14.59	5.44	
FRC: R2	Normal	13.23	5.18	4.765**
	Mentally Retarded	11.00	3.84	
FRC: R3	Normal	13.29	4.33	6.04***
	Mentally Retarded	10.70	3.89	
FRC: R4	Normal	15.10	4.72	6.897***
	Mentally Retarded	11.40	3.76	
FRC: R5	Normal	12.71	4.10	6.556***
	Mentally Retarded	9.81	3.12	

\*\* P < 0.01; \*\*\* P < 0.001



### 3. Palmar Dermatoglyphic Measurement (PDM)

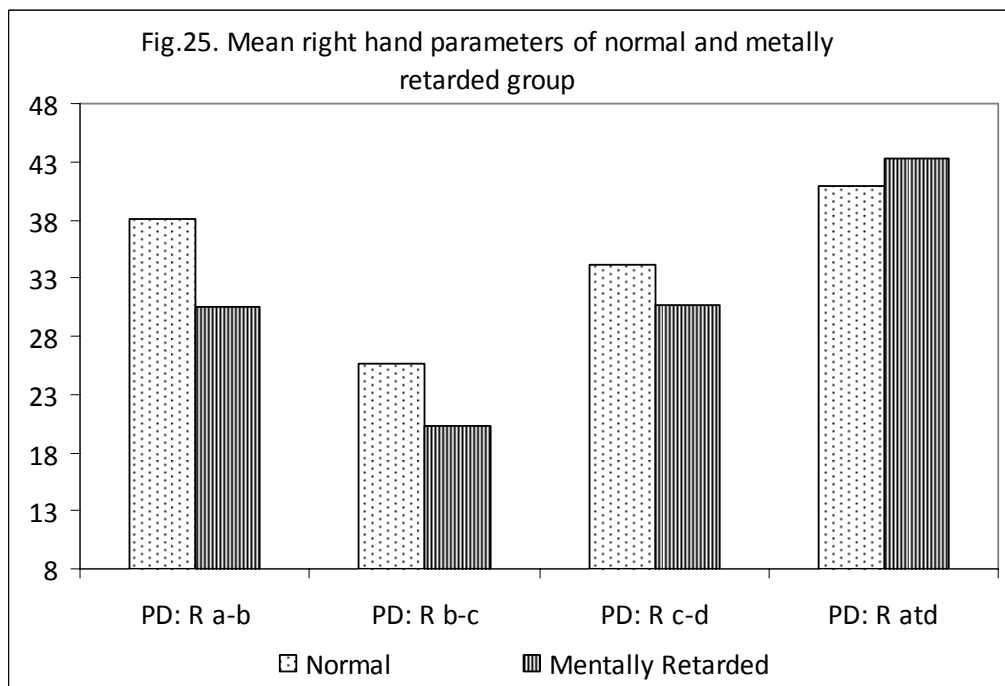
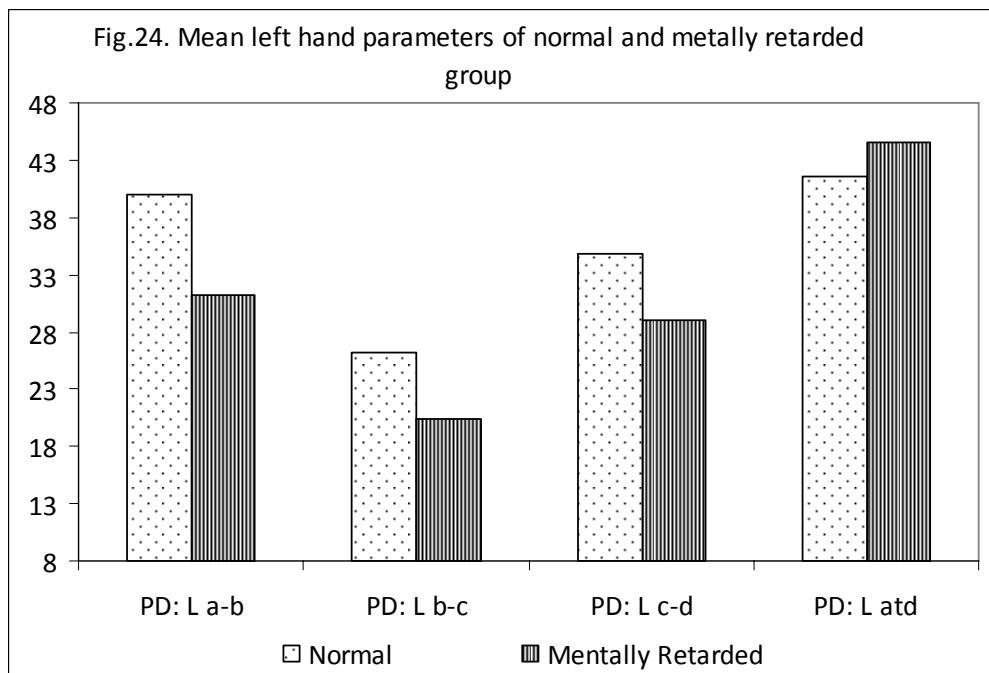
Different palmar dermatoglyphic measurements like a-b, b-c and c-d ridge counts and atd angle were measured to distinguish normal and mentally retarded group. All the parameters of both the palms showed highly significant ( $P < 0.001$ ) difference between the two groups. Mentally retarded group showed very low values

of all the characteristics except atd angle than normal people. The atd angle registered high value in mentally retarded group than normal people, which may be also regarded as a characteristic feature. The comparison of two groups regarding PDM is given in table 22. Among palmar measurements made, a-b ridge count showed maximum value in both the group followed by c-d and least by b-c ridge count. The difference between two study groups was more prominent in a-b ridge count. The mean PDM including atd angle of left and right palm are given in figure 24 and 25 respectively.

Table 22. Mean palmar dermatoglyphic measurements of left and right hand comparing normal and mentally retarded group

Parameters	Group	Mean	± SD	t value
PD: L a-b	Normal	40.05	7.37	11.166***
	Mentally Retarded	31.24	6.74	
PD: L b-c	Normal	26.21	6.21	9.047***
	Mentally Retarded	20.33	5.40	
PD: L c-d	Normal	34.90	7.66	7.229***
	Mentally Retarded	29.00	6.93	
PD: L atd	Normal	41.58	6.32	- 2.949**
	Mentally Retarded	44.47	10.56	
PD: R a-b	Normal	38.03	7.07	9.575***
	Mentally Retarded	30.53	6.93	
PD: R b-c	Normal	25.62	6.54	8.055***
	Mentally Retarded	20.28	5.29	
PD: R c-d	Normal	34.19	7.15	4.352**
	Mentally Retarded	30.68	7.29	
PD: R atd	Normal	40.96	5.60	- 2.568*
	Mentally Retarded	43.33	10.11	

\* P < 0.05; \*\* P < 0.01; \*\*\* P < 0.001



#### **4. Left-Right Asymmetry of Mentally Retarded Group**

The left and right hand asymmetry of dermatoglyphic parameters of mentally retarded group was assessed. Asymmetry between left and right half of normal people was also common in many parameters but the dermatoglyphic characteristics of



mentally retarded people may be peculiar from that of normal people. Hence left and right finger print pattern (FPP), finger ridge count (FRC) and palmar dermatoglyphic (PD) measurements were compared between respective fingers of left and right side of mentally retarded study group.

Finger print pattern score was significantly differed in ring finger and middle finger between left and right side. Other fingers did not showed statistical difference between two sides, which shows symmetry between fingers of left and right hands. The finger print pattern is given in table 23.

Table 23. Comparison of left and right hand finger print pattern (FPP) in mentally retarded group

<b>Finger Pair</b>	<b>Mean</b>	<b>± SD</b>	<b>t value</b>
FPP: L5	3.56	1.16	0.791
FPP: R5	3.50	1.02	
FPP: L4	4.15	1.34	2.418*
FPP: R4	3.92	1.24	
FPP: L3	3.55	1.35	2.795**
FPP: R3	3.28	0.99	
FPP: L2	3.56	1.29	- 0.505
FPP: R2	3.60	1.33	
FPP: L1	3.91	1.67	1.855
FPP: R1	3.71	1.40	

\* P < 0.05; \*\* P < 0.01

Finger ridge count (FRC) of five fingers of left and right side were compared statistically and presented in table 24. FRC of index and thumb did not showed statistical difference which shows that they were symmetrical, whereas all other three fingers like middle, ring and small finger showed highly (P < 0.001) significant difference between left and right side pattern. Right hand counts were lower than the left side except for index finger where right hand registered slight high value than left side even though there were no statistical significance and thumb showed almost equal ridge count.

Table 24. Comparison of left and right hand finger ridge count (FRC) in mentally retarded group

Parameters	Mean	± SD	t value
FRC: L5	10.87	3.56	5.019***
FRC: R5	9.81	3.12	
FRC: L4	12.24	3.74	3.441***
FRC: R4	11.40	3.76	
FRC: L3	11.97	4.37	4.947***
FRC: R3	10.70	3.89	
FRC: L2	10.66	4.04	- 1.131
FRC: R2	11.00	3.84	
FRC: L1	14.64	4.71	0.171
FRC: R1	14.59	5.44	

\*\*\* P < 0.001

Palmar dermatoglyphic (PD) measurements of palms of left and right side were compared statistically and presented in table 25. a-b and b-c ridge counts did not showed statistical difference which shows that they were symmetrical, whereas all other parameter, c-d ridge count and atd angle showed highly (P < 0.01) significant difference between left and right side. Right hand c-d count and atd angle were higher than the left side.

Table 25. Comparison of left and right hand palmar dermatoglyphic (PD) measurements in mentally retarded group

Parameters	Mean	± SD	t value
PD: L a-b	31.24	6.74	1.458
PD: R a-b	30.53	6.93	
PD: L b-c	20.33	5.40	0.141
PD: R b-c	20.28	5.29	
PD: L c-d	29.00	6.93	- 3.116**
PD: R c-d	30.68	7.29	
PD: L atd	44.47	10.56	2.761**
PD: R atd	43.33	10.11	

\*\* P < 0.01

# DISCUSSION

Prognosis and/or diagnosis of diseases in general and genetic diseases in particular will lead to better management of patient and the disease. Dermatoglyphics is widely used in very many applications like medical sciences, forensic science, criminology etc and is a good tool for prognosis of several diseases, malnutrition and general health especially genetic syndromes, in born errors in metabolism and mental retardation. Genetic diseases, mental retardation and other neurological disorders can be characterized dermatoglyphically at the earliest age as possible. Mentally retarded adolescent patients with Down' syndrome, Cerebral palsy, Microcephaly and general mental retardation were selected randomly, pooled together and chosen dermatoglyphic parameters were measured and compared with normal people in the present study. Several characters show difference between mentally retarded group with normal people. From the results of the present study, dermatoglyphic measurements can be recommended to take as an index for various genetic and neurological disorders for tropical adolescent population.

Often emotional and behaviour disorders are associated with mental retardation. Mental retardation can be identified through physical illness or biochemical disturbances of the brain. People with mental retardation shows abnormalities in behaviour such as gait, gesture, poor co-ordinations of body movements, resistance in auxilering duration of response, low IQ etc. (Tierney, 2000). The mental retardation may be due to several factors. Genetic disorders or syndromes, in born errors in metabolism, neurological problems, behavioural problems etc can cause mental retardation.

Dermatoglyphics in biology and medicine have long been interested in abnormal psychology and congenital defects. Bagga (1989) surveyed and studied the subject of the dermatoglyphic patterns of schizophrenics. Hirsch (1978) could report that studies had been performed in relationship to mental retardation, congenital

heart defects, diabetes mellitus, several child psychiatric groups, retarded growth, and a number of syndromes. Autosomal trisomies, Trisomy 21 (Downs Syndrome), Trisomy 13, 18 and trisomy 8 (Mosaicism) have long been the subjected to studies in relationship to dermatoglyphic patterns. In addition to the trisomy, diabetes mellitus, congenital heart defect and schizophrenia subjects, Loesch (1983a) also reported relationship studies with sexual chromosomal anomalies, cleft lip and palate, leukaemia and other conditions (Loesch, 1983b). More recently Jameela (2006) elucidated comprehensively the dermatoglyphic characteristics of different mental retardation groups.

A lot of literature concerning the value of dermatoglyphics in the diagnosis of different chromosomal anomalies are available (Uclmda and Soltan, 1963; Holt and Lindsten, 1964), such as in disease transmitted as autosomal dominant or recessive traits (Hodges and Simnon, 1962; Goor *et al.*, 1965), and in diseases in which genetic transmission is uncertain (Beckman and Norring, 1963; Alter and Schulenberg, 1966). It has been also reported that exogenous environmental agents, such as rubella, may also alter dermatoglyphic pattern and be useful in providing evidence of such extraneous exposure (Alter and Schulenberg, 1966; Purvls-Smith and Menser, 1968). Individuals with various chromosomal aberrations such as trisomy G, D and E have a high frequency of various cardiovascular malformations in association with other organ system involvement (Rowe, 1962; Smith, 1962) and aberrant manifestations of dermatoglyphic characteristics, which again can be identified with peculiarities of palmar patterns. Those having single gene disorders with cardiovascular involvement almost all have extra-cardiac malformations including unusual dermatoglyphics (Gall *et al.*, 1966; Goor *et al.*, 1965).

Even though the entire human population show some 5 to 9 finger print pattern in common and about 20 to 23 rare patterns, manifestation of these pattern and its detailed characters differ individually which is the reason for taking fingerprint to individual identification, more over left right asymmetry. However each population or sub-population shows some common characteristics in palmar ridge pattern. According to Singh *et al.* (1984), the distribution of finger patterns in the Indian

population generally shows a preponderance of loops over whorls, the present study was also corroborates the fact.

Among different racial samples, females show a significant difference from males in having more arches and usually they differ in bearing fewer whorls (Cummins and Midlo, 1961). This kind of difference between various racial groups, gender and medical disorders were reported by Schaumann and Alter (1976), who again reported lower frequencies of whorls and radial loops but a higher number of arches in females. This tendency towards similar patterns in females is practically universal in population samples of all ethnic groups. A comparison of inter-digital pattern in males and females was also evident in present study, Cummins and Midlo (1961) also reported that the frequencies of patterns in the palmar area are unequal in sexes and different group of people. Females present consistently higher frequencies of hypothenar and fourth inter digital area and lesser frequencies in remaining palmar area. On contrast, Igbigbi and Msamati (1999) reported palmar patterns did not show sexual difference significantly in Malawian population. Similarly sex difference in another dermatoglyphic parameter, C-line polymorphism was reported by Francis (1991) and Arrieta *et al.* (1990) reported males had higher total finger ridge count (TFRC) than females, even though the differences were not statistically significant.

The asymmetry in dermatoglyphic pattern in normal population is evident from earlier studies and the genetic difference between right and left hand was also examined (Holt, 1964). She found all familial correlations close to zero and concluded that nearly all variations in asymmetry was environmentally determined. The genetics of asymmetry and diversity of finger ridge counts in man has been examined by Martin *et al.* (1982) and Martin and Manning (1999). Both the studies reported that variation of finger ridge counts are under genetic control, but there are all possibility that certain aspects of this variation are genetically controlled while other (asymmetry) are mainly environmentally determined.

Different genetic abnormalities were dermatoglyphically detailed by different authors. A comprehensive literature survey and analysis of various syndromes like

microcephaly, cerebral palsy, Down's syndrome and autism were discussed by Jameela (2006). The present study results were similar to that of Jameela (2006). In a comparative study by Arreita *et al.* (1990), the frequency of digital pattern types of autistic and controls were discussed. The comparative study of each type of pattern showed significantly more transitional radial loops in autistic boys in finger 2 of the right hand, in the right hand as a whole and in both hands. In the present study, no transitional radial loops were observed and radial loops appeared more on the left side in males. The change in position of the radial loop was significant and radial loop was seen only in second finger of control group. Whorl's are identified as such and no distinction between mono-centric and di-centric whorls is done in the present study as done by Arrieta *et al.* (1990).

The incidence of aberrant palmar creases was higher in mentally retarded children of both sexes than in control group (Arrieta *et al.*, 1990). Increase in frequency of Sydney line was reported in congenital heart defects (Nair, 1986) and in learning disability (Schaumann and Alter, 1976). Arrieta *et al.* (1990) reported significant differences between mentally retarded especially autistic and control group children in the frequency of normal creases for both hands for both male and right hands in females. A significant increase of abnormal palmar creases was reported by Rosa *et al.* (2000) in children with idiopathic intellectual disability. Aberrant creases have been reported in Down syndrome by many investigators. Aberrant creases suggests and abnormal development. Higher frequencies of aberrant creases have been reported in children whose mothers have been exposed to methadone (Oorthuys, 1979). Jameela (2006) also reported similar cases in autistic cases compared with normal group. The present study results also in tune with the earlier works.

Finger pattern concordance was less in mentally retarded group compared to control group. Asymmetrical finger patterns were reported in certain other diseases like schizophrenia and learning disability. The presence of dissimilar pattern across homologous finger was observed in studies reported earlier. More dissimilar pattern has been reported several authors in different disorders including schizophrenic

patients and psychotic twins (Markow and Wandeler, 1986; Markow and Gottesman, 1989; Reilly *et al.*, 2001). Naugler and Ludman (1996a, b) supported the use of this trait as a risk marker for developmental disturbance and Reilly and Gottesman (1999) as a marker of liability towards schizophrenia.

The 'atd' angle character was significantly higher in mental retarded females than control (Arrieta *et al.*, 1990). A reduced a-b ridge count was found associated with schizophrenia patients (Davis and Bracha, 1996; Fananas *et al.*, 1996; Fearon *et al.*, 2001). Arrieta *et al.* (1990) reported no significant difference in a-b ridge count in autistic males and females. But a-b ridge count on the left hand was significant. Recent studies of the a-b ridge count have reported this dermatoglyphic trait to be the most significant and sensitive to environmental influence, due to the extended period of time over which the area at the base of the first and second finger is configured (Fananas *et al.*, 1996). According to Bogle *et al.* (1994), an asymmetric a-b ridge count may identify individuals who are poorly buffered from the so called 'developmental noise'. Jameela (2006) also reported a-b ridge patterns of different types of mentally retarded people and the results of majority studies were similar to the present study.

Walker (1977) reported dermatoglyphic patterns of autistic children compared with normal control group, matched socio-economically and by age and sex. Analysis of dermal ridge patterns and ridge counts showed significant difference between autistic and control group. Differences were more apparent in the reduced number of whorls and increased number of arches in lowered ridge counts and in less distinctiveness in formation of ridge line. Complete absence of transverse crease in this sample was combined with other dermatoglyphic evidences to argue for the separation of autism from other pathological syndromes.

Dermatoglyphic pattern formed during foetal development reflect genetic or early developmental events, which forms a registry of developmental noise and events. These patterns might provide a means for investigation of a biological basis for mental retardation. Consistency among hands, 'atd' angle, total ridge count and pattern, all failed to support a value for dermatoglyphic analysis as a discriminant of

autism (Wolman *et al.*, 1990). Similarly many researchers have reported characteristics of different mental retardation groups certain dermatoglyphic characters to distinguish affected group from control and some other characters similar between two groups. Significant differences were found between the autistic and normal children for distribution of dermal patterns and ridge line disruption, but no significant differences were found for the total mean ridge counts or mean ridge count rankings. Autistic and retarded children differed only in their distribution of dermal patterns, with the autistic children apparently intermediate between retarded and normal groups (Hartin and Barry, 1979). These results indicate that conclusions of unique congenital disturbances in the aetiology of autism inferred from different dermatoglyphics may be ineffective in delineating mentally retarded children from other atypical populations. Chetan (1995) reported increased arches, radial loops and whorls percentage and decreased percentage of ulnar loops in non-specific mentally retarded population. Abnormal palmar creases were also reported in fragile X subjects compared to control.

It is already established that genetics play a pivotal role in determining an individual's dermatoglyphic profile, and the genetic effect varies for different dermatoglyphic traits (Holt, 1964). Intra-uterine environmental factors also affect the manner in which dermatoglyphics are expressed. Maternal infections such as rubella, cytomegalovirus, maternal alcoholism medicine intake during pregnancy etc alter the foetal epidermal ridge pattern (Ross, 1996; Rodier, 2000; Fearon *et al.*, 2001; Steyn and Le Couteur, 2003). The dermatoglyphic findings are interesting when considered with the neurological findings previously reported for mental retardation. Both neurological and epidermal differences have to interpret as evidence of an insult in the early embryonic period. Both brain and skin develop from surface ectoderm and experience rapid development between 12 and 16 weeks estimated gestational age (Rose *et al.*, 1987). Total a-b ridge count would mark the time period up to 16<sup>th</sup> week of gestation (val Oel, *et al.*, 2001). The a-b ridge differences involve the random deviation from perfect bilateral symmetry. This stems from intra-uterine environmental influences that in some way perturb the expression of the genetic program.



The present study identifies few characters as dermatoglyphic salient features for mentally retarded adolescents of central Kerala. Jameela (2006) reported few characteristics features of such mentally challenged Kerala population. The present study results were in tune with earlier reports and delineates the few dermatoglyphic characteristics for the mentally challenged adolescents of central Travancore, Kerala. They have more percentage of ulnar loop in all finger prints, Double loop whorl (left small and ring finger), tented arch (left thumb, right ring finger) patterns were present, where are radial loop (right thumb, right middle) and simple arch (right small finger) absent. Finger ridge count of all ten fingers were lower than that of control and palmar dermatoglyphic measurements like a-b, b-c, and c-d ridge counts and atd angle values registered significantly low values than control population. Left right asymmetry were also significant for c-d count and atd angle. By looking into these parameters, one can distinguish a non-specific mentally retarded subject from normal people in Kerala population.

Dermatoglyphic parameters can be used characterise the mentally retarded adolescents. The characters can be used as prognostic parameters to identify the mental retardation at an earlier age itself. But more studies are warranted to establish the fact with children below 4 years of age since mental retardation shall be confirmed by that age. Moreover, more dermatoglyphic parameters have to be assessed to elucidate more characteristic features of the study group. Similarly, different mentally retarded groups such as Down's syndrome, Klienfilter's syndrome, Cerebral palsy, microcephaly, autism, schizophrenia etc are to be studied separately. So that each syndrome can be diagnosed correctly at an early age enabling early management and special education of such subjects. Hence more studies are warranted in this area to develop the subject and to contribute more knowledge in the field.

# SUMMARY

Dermatoglyphics is widely used in very many applications like Medical sciences, Forensic science, Criminology etc and is a good tool for prognosis of several diseases, especially genetic syndromes, in born errors in metabolism and mental retardation. Genetic diseases, mental retardation and other neurological disorders can be characterized dermatoglyphically at the earliest age as possible. Mentally retarded adolescent people with Down' syndrome, Cerebral Palsy, Microcephaly and non-specific mental retardation were selected (n=165) randomly from different organizations for mentally challenged located at central Kerala, pooled and their palmar prints were obtained. Age, gender and sample size matched control group (n=155) with normal adolescent people were also recruited. Dermatoglyphic parameters were counted and/or measured and compared with normal people and assessed for asymmetry in the present study. The results of the present study can be summarized as follows:

1. 165 Mentally retarded and 155 normal people participated in the study
2. Mentally retarded group represented maximum of non-specific mental retardation followed by Down's syndrome.
3. Female represented more (60%) samples in mentally retarded group
4. > 20 years age group represented the major chunk of the present study population in both the groups.
5. Majority of the study population in both the groups were Hindus, followed by Christian and Muslims
6. Normal group were educated and college going, whereas study group was full of subjects with special education.
7. Mentally retarded subjects were either first or second child of their parents.

8. Mentally retarded subjects were born mainly at corporation area followed by village area.
9. Majority of the mentally retarded subjects were born to unskilled labourers followed by skilled labourers.
10. Both of the study population had poor socio-economic status.
11. Both of the study population had nuclear family type.
12. Finger Ridge Pattern (FRP) for mentally retarded group has following significant characteristics:
  1. Left Small Finger: High ulnar loop percentage; found double loop whorl.
  2. Left Ring Finger: High ulnar loop percentage; found double loop whorl.
  3. Left Middle Finger: High ulnar loop percentage; Not significant.
  4. Left Index Finger: High ulnar loop percentage; High tented arch.
  5. Left Thumb Finger: High ulnar loop percentage; tented arch present.
  6. Right Thumb Finger: High ulnar loop percentage; radial loop absent.
  7. Right Index Finger: High ulnar loop percentage; Not significant.
  8. Right Middle Finger: High ulnar loop percentage; radial loop absent.
  9. Right Ring Finger: High ulnar loop percentage; tented arch present.
  10. Right Small Finger: High ulnar loop percentage; simple arch absent.
13. Finger Ridge Count (FRC) for mentally retarded group has following significant characteristics:
  1. Finger ridge count of all five fingers of each hand was found significantly differ between study and control group.
  2. Finger ridge count was low in mentally retarded group.
  3. High finger ridge count was registered in left small finger and right thumb finger.
  4. The least finger ridge count was seen in right small finger.
14. Palmar Dermatoglyphic Measurements (PDM) for mentally retarded group has following significant characteristics:

1. All palmar dermatoglyphic counts like a-b ridge, b-c ridge, c-d ridge and atd angle of all five fingers of each hand was found significantly differ between study and control group.
  2. Palmar measurements/count was low in mentally retarded group.
  3. High value palmar measurements were a-b ridge count and atd angle.
  4. Least value was registered in b-c ridge count.
15. Left-Right Asymmetry of mentally retarded group has following significant characteristics:
1. Finger print pattern asymmetry was significant only in ring and middle finger.
  2. Finger ridge count asymmetry was significant in small, ring and middle fingers.
  3. Palmar count asymmetry was significant in c-d count and atd angle.

# REFERENCES

- Alter, M. and R. Schulenberg, 1966. Dermatoglyphics in the rubella syndrome. *J. Amer. Med. Assn.*, **197**: 685.
- Alter, M., 1965. Is hyperploidy of sex chromosomes associated with reduced total finger ridge count? *Amer. J. Hum. Genet.*, **17**: 473.
- Arey, L.B., 1965. *Developmental Anatomy*, Ed. 7. Philadelphia, W. B. Saunders Co.
- Arreita, M.I., B. Martinez, B. Criado, A. Simon, L. Slazar and C.M. Lostau, 1990. Dermatoglyphic analysis of autistic Basque children. *American Journal of Medical Genetics*, **35**: 1-9.
- Aylward, E.H., N.J. Minshew, K. Field, B.F. Sparks, N. Singh, 2002. Effects of age on brain volume and head circumference in autism. *Neurology*, **59(2)**: 175-183.
- Bagga, Amrita, 1989. *Dermatoglyphics of Schizophrenics*, Mittal Publications, New Delhi, India.
- Beckman, L. and A. Norring, 1963. Finger and palm prints in schizophrenia. *Acta Genet. (Basel)*, **13**: 170.
- Bogle, A.C., T. Reed and R.J. Rose, 1994. Replication of asymmetry of a-b ridge count and behavioural discordance in monozygotic twins. *Behavioural Genetics*, **24(1)**: 203.
- \*Bonnievie, K., 1924. Studies on papillary patterns of human fingers. *J. Genet.*, **15**: 1-111.
- Campbell, M., 1965. Causes of malformations of the heart. *Brit. Med. J.*, **2**: 895.
- Chetan, G.K., 1995. Systematic survey on the frequency of fragile X chromosome among subjects with non-specific mental retardation – A prospective study. Ph.D. Thesis, NIMHANS, Bangalore.
- Courchesne, E., C.M. Karris, H.R. Davis, R. Zoccardi, R.A. Carper, Z.D. Tigue, H.J. Chisum, P. Moses, K. Pierce, C. Lord, A.J. Lincoln, S. Pizzo, L. Schreibman, R.H. Hass, N.A. Akshoomoff and R.Y. Courchesne, 2001. Unusual brain growth patterns in early life in patients with autistic disorder: An MRI study. *Neurology*, **57(2)**: 245-254.

- Cronk, C.E. and V.A. Stallings, 1997. Growth in children with Cerebral Palsy. *Developmental Disabilities Research Reviews*, **3(2)**: 129-137.
- \*Cummins, H. and C. Midlo, 1926. Palmar and Plantar Epidermal Configurations (Dermatoglyphics) in European Americans. *Am. J. Physiol. Anthropol.*, **9**: 471-502.
- \*Cummins, H. and C. Midlo, 1943. *Finger Prints, Palms and Soles: An Introduction to Dermatoglyphics*. The Blakiston Company, Philadelphia, p.19.
- Cummins, H. and C. Midlo, 1961. *Finger Prints, Palms and Soles: An Introduction to Dermatoglyphics*. Dover Publications, New York.
- \*Cummins, H., H.H. Keith, C. Midlo, R.G. Montgomery, H.H. Wilder and Inez Whipple-Wilder, 1929. Revised methods of interpreting and formulating palmar dermatoglyphics. *Am. J. Physiol. Anthropol.*, **12**: 415-473.
- Davis, J.O. and H.S. Bracha, 1996. Prenatal growth markers in schizophrenia: A monozygotic co-twin control study. *American Journal of Psychiatry*, **153(9)**: 1166-1172.
- De Grouchy, J., 1965. Chromosome 18: A topological approach. *J. Pediatr.*, **66**: 414.
- \*Down, J.L.H., 1866. Observations on an ethnic classification of idiots. *Clinical Lecture Reports, London Hospital*, **3**: 259.
- Fanas, L., J. vanOs, C. Hoyos, J. Mc Grath, C.S. Mellor and R. Murray, 1996. Dermatoglyphic a-b ridge count as a possible marker for developmental disturbance in schizophrenia: Replication in two samples. *Schizophrenia Research*, **20(3)**: 307-314.
- \*Fang, T.C., 1949. A comparative study of the a-b ridge count on the palms of mental defectives and the general British population. *J. Ment. Sci.*, **95**: 401.
- \*Faulds, H., 1880. On the skin furrows of the hand. *Nature*, **22**: 605.
- Fearon, P., A. Lane, M. Airie, J. Scannell, A. McGowan, M. B. Byarne, M. Cannon, D. Cotter, P. Murphy, B. Cassidy, J. Waddington, C. Larkin and E. D'Callaghan, 2001. Is reduced dermatoglyphic a-b ridge count a reliable marker of developmental impairment in schizophrenia? *Schizophrenia Research*, **50**: 151-157.
- Gahai, O.P., 1996. *Essential Pediatrics*, 4<sup>th</sup> Edition, Interprint, New Delhi, 475pp.
- Gall, J.C. Jr., A.M. Stern, M.M. Cohen *et al.*, 1966. Holt-Oram syndrome: Clinical and genetic study of a large family. *Amer. J. Hum. Genet.*, **18**: 187.

- \*Galton, F., 1892. *Fingerprints*. London, Mac Millan & Co.
- Gay, L.R., 1990. *Educational Research Competencies of the Analysis and Application*. 3<sup>rd</sup> Ed., New York, Merrill Publishing Co., pp. 189.
- Glanville, E.V., 1965. Heredity and line A of palmar dermatoglyphics. *Amer. J. Hum. Genet.*, **17**: 420.
- Goor D., Y. Rotem, A. Friedman *et al.*, 1965. Ellis-van Creveld syndrome in identical twins. *British Heart Journal*, **27**: 797.
- Gould, K.A., A.S. Weinberg, A. Schnaiberg, 1993. Legitimizing impotence: Pyrrhic victories of the modern environmental movement. *Qualitative Sociology*, **16(3)**: 207-246.
- Hartin, P.J. and R.J. Barry, 1979. A comparative dermatoglyphic study of autistic, retarded and normal children. *Journal of Autism and Developmental Disorders*, **9(3)**: 233-246.
- \*Herschel, W.J., 1880. Skin furrows of the hand. *Nature*, **23**: 76.
- Hexter, W., 1976. *The Science of Genetics*. Englewood Cliffs, New Jersey, 596p.
- Hirsch, H., 1978. Dermatoglyphics and Creases in Their Relationship to Clinical syndromes: A Diagnostic Criterion. *In*: Jamshed Mavalwala, Editor, *Dermatoglyphics, An International Perspective*, Moulton Publishers, The Hague/Paris. pp. 263-282.
- Hodges, R.E. and J.R. Simmon, 1962. Relationship between fingerprint patterns and Wilson's disease. *J. Lab. Clin. Med.*, **60**: 629.
- Holt, S.B. and J. Lindsten, 1964. Dermatoglyphic anomalies in Turner's syndrome. *Ann. Hum. Genet.*, **28**: 87.
- Holt, S.B., 1964. Finger-print patterns in mongolism. *Ann. Hum. Genet.*, **27**: 279-282.
- Igbigbi, P.S. and Msamati, 1999. Palmar and digital dermatoglyphic patterns in Malawian subjects, *East African Medical Journal*, **76(12)**: 668-671.
- \*Inez L. Whipple-Wilder, 1904. The ventral surface of the Mammalian Chiridium. *J. Morph. Anthropol.*, **49**: 153-221.
- Jackson, B.T., 1968. The pathogenesis of congenital cardiovascular anomalies. *New Eng. J. Med.*, **275**: 25.
- Jameela, T.P., 2006. Dermatoglyphic patterns evident in disability groups, PhD Thesis, Mahatma Gandhi University, Kottayam, p. 423.

- \*Kanner, L., 1971. Follow-up study of eleven autistic children originally reported in 1943. *Journal of Autism and Childhood Schizophrenia*, **1(2)**: 119-145.
- \*Lamy, M., J. De Grouchy and O. Schweisguth, 1957. Genetic and non-genetic factors in the aetiology of congenital heart disease: Study of 1188 cases. *American J. Human Genetics*, **9**: 17.
- Lancaster, M.A., M. Renner, C.A. Martin, D. Wenzel, L.S. Bicknell, M.E. Huries, T. Homfray, J.M. Penninger, A.P. Jackson and J.A. Knoblich, 2013. Cerebral organoids model human brain development and microcephaly. *Nature*, **501**: 373-379.
- Laubach, L.L., R.M. Glaser and A.G. Suryaprasad, 1981. Anthropometry of aged male wheelchair-dependent patients. *Annals of Human Biology*, **8(1)**: 25-29.
- \*Lejeune, J., R. Turpin and M. Gautier, 1959. Mongolism; a chromosomal disease (trisomy). *Bull. Acad. Natl. Med.*, **143(11-12)**: 256-265.
- Loesch, Danuta Z., 1983a. *Quantitative Dermatoglyphics, Classification, Genetics, and Pathology*, Oxford Monographs on Medical Genetics, Hartnoll Print, Bodmin, Cornwall, UK. pp. 220-289.
- Loesch, Danuta Z., 1983b. *Quantitative Dermatoglyphics, Classification, Genetics, and Pathology*, Oxford Monographs on Medical Genetics, Hartnoll Print, Bodmin, Cornwall, UK. pp. 291-330.
- Markow, T.A. and I.I. Gottesman, 1989. Fluctuating dermatoglyphic asymmetry in psychotic twins. *Psychiatry Research*, **29**: 37-43.
- Markow, T.A. and K. Wandler, 1986. Fluctuating dermatoglyphic asymmetry and the genetics of liability to schizophrenia. *Psychiatry Research*, **19**: 323-328.
- Martin, N.G., J.L. Jinks, H.S. Berry and D.Z. Loesch (1982). A genetical analysis of diversity and asymmetry in finger ridge counts. *Heredity*, **48(3)**: 393-405.
- Martin, S.M. and J.T. Manning, 1999. Fluctuating asymmetry, relative digit length and depression in men. *Evolution and Human Behaviour*, **20**: 203-214.
- McKusick, V.A., 1964. Genetical view of cardiovascular disease: Lewis A. Conner Memorial Lecture. *Circulation*, **30**: 326.
- Miller, F., S.J. Bachrach, Cerebral Palsy Centre at Nemours/Alfred I. DuPont Hospital for Children, 2017. *Cerebral Palsy: A Complete Guide for Caregivers*. 3<sup>rd</sup> Ed., Johns Hopkins University Press, Baltimore. Pp 465.



- Muhle, R., S.V. Trentacoste and I. Rapin, 2004. The genetics of autism. *Pediatrics*, **113(5)**: 472-486.
- Nair, R.R., 1986. Dermatoglyphic diversity in congenital heart defects. *Indian Journal of Medical Research.*, **83**: 56-67.
- Naugler, C.T. and M.D. Ludman, 1996a A case control study of fluctuating dermatoglyphic asymmetry as a risk marker for developmental delay. *American Journal of Medical Genetics*, **66**: 11-14.
- Naugler, C.T. and M.D. Ludman, 1996b Fluctuating asymmetry and disorders of developmental origin. *American Journal of Medical Genetics*, **66**: 15-20.
- Okajima, M. and K. Usukura, 1984. Quantitative and genetic features of epidermal ridge minutiae on the palm of twins, *Human Heredity*, **34**: 285-290.
- Oorthuys, A.M., G.A.M. de Vaan, H. Behrendi and S.J. Greetz, 1979. Palmar flexion creases in childhood neoplasia. *Cancer*, **43**: 749-759.
- Penrose, L.S. and J.P.A. Delhanty, 1961. Familial Langdon - Down anomaly with chromosomal fusion. *Amer. J. Hum. Genet.*, **25**: 243.
- \*Penrose, L.S., 1954. The distal triradius t on the hands of parents and sibs of mongolism. *Ann. Hum. Genet.*, **19**: 10.
- Penrose, L.S., 1968a. Medical significance of finger-prints and related phenomena. *Brit. Med. J.*, **2**: 321.
- Penrose, L.S., 1968b. Memorandum on dermatoglyphic nomenclature. *Birth Defects Original Article Series*, **VI**: 1-13.
- Penrose, L.S., 1973. Fingerprints and Palmistry. *The Lancet*, **2**: 1241.
- \*Pons, J., 1963. Genetics of bilateral asymmetry of palmar main line transverseness. *Proceedings of the II International Congress of Human Genetics*, **3**: 1503.
- Pons, J., 1964. Genetics of the a-b ridge count on the human palm. *Ann. Hum. Genet.*, **37**: 273.
- \*Purkinge, J.E., 1940. *Physiological Examination of the Visual Organ and of the Cutaneous System (Commentatio de Examine Physiologico Organi Visus et Systematis Cutanei)* Breslau: Vratisaviae Typis Universitatis, 1823: Translated to English by Cummins, H. and RW Kennedy. *Am. J. Crim. Law. Criminol.*, **31**: 343-356.
- Purvis-Smith, S.G. and M.A. Menser, 1968. Dermatoglyphics in adults with congenital rubella. *Lancet*, **2**: 141.

- Reed, T., 1981. Review: Dermatoglyphics in medicine- Problems and use in suspected chromosomes abnormalities. *Am. J. Med. Genet.*, **8**: 411-420.
- Reilly, J.L. and I.I. Gottesman, 1999. Dermatoglyphic fluctuating asymmetry, homozygosity and liability to schizophrenia. *Biological Psychiatry*, **45(85)**: 303.
- Reilly, J.L., E. Turkheimer, H.S. Bracha, T.F. McNeil, E. Cantor-Graac, D.R. Weinberger, E.F. Torry, I.I. Gottesman, 2001. Developmental instability and intra-pair difference in neuroanatomical volumes in MZ Twins Discordant for Schizophrenia. Presented at the Annual Meeting of the Society for Research in Psychopathology, Madison, WI, Nov. 2001.
- Rodier, P.M., 2000. The early origins of Autism. *Scientific American*, **2**: 38-45.
- Rosa, A., B. Gutierrez, A. Guerra, B. Arias and L. Fananas, 2000. Dermatoglyphics and abnormal palmar flexion creases as markers of early prenatal stress with idiopathic intellectual disability. [www.ncbi.nlm.nih.gov](http://www.ncbi.nlm.nih.gov).
- Rose, R.J., T. Reed and A. Bogle, 1987. Asymmetry of a-b ridge count and behavioural discordance of monozygotic twins. *Behavioural Genetics*, **17**: 225-240.
- Ross, L.J., 1996. Dermatoglyphics in offspring of women given gamma globulin prophylaxis during pregnancy. *Teratology*, **53**: 285-291.
- Rowe, R.D., 1962. Cardiac malformations in mongolism. *Amer. Heart. J.*, **64**: 567.
- Saha, K.C., 1970. Dermatoglyphics. *J. Ind. Med. Assn.*, **54**: 428.
- Schaumann, B. and M. Alter, 1976. *Dermatoglyphics in medical disorders*. Springer-Verlag, New York, pp. 258.
- Singh, K.S., V. Bhalla and V. Kaul, 1984. The biological variation in Indian population people of India – National series volume. Anthropological Survey of India, Oxford University Press, Delhi.
- Smith, D.W., 1962. The no. 18 trisomy syndrome. *J. Pediat.*, **60**: 513.
- Snedecor, G.W. and G.W. Cochran, 1968. *Statistical Methods*. Oxford and IBH Company, Calcutta, p 593.
- Steyn, B. and A. Le Couteur, 2003. Understanding autism spectrum disorders. *Current Pediatrics*, **13**: 274-278.
- Tierney, K.J., 2000. Controversy and consensus in disaster mental health research, *The Role of Public Health in Disaster Medicine*, **15(4)**: 55-61.

- Uclmda, I.A. and H.C. Soltan, 1963. Evaluation of dermatoglyphics in medical genetics. *Pediat. Clin. N. Amer.*, **10**: 409.
- Van Oel, C.J., W.F.C. Bare, H.E.H. Pol, J. Haag., J. Balazs, A. Dingemans, R.S. Kahn and M.M. Sitskoorn, 2001. Differentiating between low and high susceptibility to schizophrenia in twins: The significance of dermatoglyphic indices in relation to other determinants of Brain development. *Schizophrenia Research*, **52**: 181-193.
- Walker, H.A., 1977. A dermatoglyphic study of autistic patients. *Journal of Autism and Child Schizophrenia*, **7(1)**: 11-21.
- \*Wilder, H.H., 1902. Palms and soles. *Am. J. Anat.*, **1**: 423-441.
- \*Wilder, H.H., 1904a. Racial differences in palm and sole configuration. *Am. Anthropologist*, **6**: 244-293.
- \*Wilder, H.H., 1904b. Duplicate twins and double monsters (part only). *Am. J. Anat.*, **3**: 426-472.
- \*Wilder, H.H., 1916. Palms and sole studies. *Biol. Bull.*, **30**: 135-172, 211-252.
- Wolman, S.R., M. Campbell, M.L. Marchi, S.I. Dentsch and T.D. Gershon, 1990. Dermatoglyphic study in autistic children and controls. *Journal of American Academy of Child and Adolescent Psychiatry*, **29(6)**: 878-884.
- \* *Not referred to in original*

# ANNEXURE

1. UGC Order Sanctioning MRP
2. Data Sheet/Questionnaire Format
3. Dermatoglyphic data collected/Master chart  
**LEGEND:**  
Please refer to Questionnaire for codes

Diary No. 6662

MRP(S)-0823/13-14/KLMG035/UGC-SWRO  
The Accounts Officer  
South Western Regional Office  
University Grants Commission  
P.K. Block, Palace Road  
Gandhinagar, Bangalore



विश्वविद्यालय अनुदान आयोग  
नैरुत्य प्रादेशिक कार्यालय

**UNIVERSITY GRANTS COMMISSION**

**SOUTH WESTERN REGIONAL OFFICE**

P.K. Block, Palace Road, Gandhinagar,  
Bangalore-560 009.

Phone : (080) 2228 0380, Fax : (080) 2228 0381

Sub: Release of Grants-in-aid to MARTHOMA COLLEGE, THIRUVALLA, PATHANAMTHITTA for the year 2013-2014 under MRP(S) (Plan) entitled DERMATOGLYPHIC EVALUATION OF MENTALLY RETARDED ADOLESCENTS FROM CENTRAL TRAVANCORE KERALA

Sir/Madam,

I am directed to convey the sanction of the University Grants Commission for payment of grant of Rs.77500/- as first installment for the year 2013-2014 to MARTHOMA COLLEGE, THIRUVALLA, PATHANAMTHITTA under Minor Research Project (Plan) to Principal Investigator KURIAN MATHEW ABRAHAM expenditure to be incurred during 2013-2014.

Items	Amount Allocated Rs.	HEAD OF ACCOUNT	Grant now being Sanctioned	Grant already Sanctioned	Total Grant	Balance
<b>Non-Recurring:</b>						
Books and Journals	15000/-	5(viii)	15000/-	0	15000/-	0
Equipment	30000/-		30000/-	0	30000/-	0
<b>Recurring :</b>						
Contingency including special needs	30000/-		15000/-	0	15000/-	15000/-
Fieldwork and Travel	25000/-		12500/-	0	12500/-	12500/-
Any other	10000/-		5000/-	0	5000/-	5000/-
<b>Total :</b>	<b>110000/-</b>		<b>77500</b>	<b>0</b>	<b>77500</b>	<b>32500/-</b>

- The sanctioned amount is debitable to 5(viii) and is valid for payment during the financial year 2013-2014 only.
- The amount of the Grant shall be drawn by the Accounts Officer/Drawing and Disbursing Officer, South Western Regional Office, UGC, Bangalore on the Grants-in-aid bill and shall be disbursed to and credited to the Principal of the College through Electronic mode as per the following details:
  - Details (Name & Address) of Account Holder: MARTHOMA COLLEGE, THIRUVALLA, PATHANAMTHITTA
  - Account No: 1982101012282
  - Name & address of Bank branch: CANARA BANK, CROSS JUNCTION, TIRUVALA, KERALA-689 101,
  - MICR Code: 689015002
  - IFSC Code: CNRB0001982
  - Type of Account: SB
- The grant is subject to the adjustment on the basis of utilisation certificate in the prescribed proforma submitted by the College.
- The college shall maintain proper accounts of the expenditure out of the grants which shall be utilised only on approved items of expenditure.
- The College may follow the General Financial Rules, 2005 and take urgent necessary action to amend their manuals of financial procedures to bring them in conformity with GFRs, 2005 and those don't have their own approved manuals on financial procedures may adopt the provisions of GFRs, 2005 and instructions/guideline there under from time to time.
- The Utilization Certificate to the effect that the grant has been utilized for the purpose for which it has been sanctioned shall be furnished to UGC as early as possible after the close of current financial year.

Contd.2

8. The assets acquired wholly or substantially out of University Grants Commission's Grant shall not be disposed or encumbered or utilised for the purposes other than those for which the grant was given without proper sanction of the UGC and should at any time the College ceased to function, such assets shall revert to the University Grants Commission.
9. A Register of Assets acquired wholly or substantially out of the grants shall be maintained by the College in the prescribed proforma.
10. The grantee institution shall ensure the Utilization of grants-in-aid for which it is being sanctioned/paid. In case of non-utilization/part utilization thereof, the simple interest @ 10% per annum as amended from time to time on unutilised amount from the date of drawal to the date of refund as per provisions contained in General Financial Rules of Govt. of India will be charged.
11. The College shall follow strictly the Government of India/UGC's guidelines regarding implementation of the reservation of policy [both vertical (for SC, ST and OBC) and horizontal ( for person with disability etc.)] in teaching and non-teaching posts.
12. The College shall fully implement the Official Language Policy of Union Govt. and comply with the Official Language Act, 1963, and Official Languages (Use for Official Purposes of the Union) Rules, 1978 etc.
13. The sanction is issued in exercise of the delegation of powers vide UGC office order No.130/2013[F.No.10-11/12(Admn. IA B)] dated 28/5/2013.
14. The College shall strictly follow the UGC Regulations on curbing the menace of Ragging in Higher Education Institutions, 2009.
15. The College shall take immediate action for its accreditation by National Assessment and Accreditation Council (NAAC).
16. The accounts of the College will be open for audit by the Comptroller and Auditor General of India in accordance with provisions of General Financial Rules, 2005.
17. The annual accounts i.e. balance sheet, income and expenditure statement and statement of receipts and payments are to be prepared strictly in accordance with the Uniform Format of Accounting prescribed by the Government.
18. The funds to the extent are available under the Scheme.
19. This issues with the concurrence of IFD and approval of Secretary vide Diary No. 7900 dated 06-Mar-2014 respectively.
20. An amount of Rs nil out of the grant of Rs.nil sanctioned vide letter No.MRP(S)-0823/13-14/KLMG035/UGC-SWRO dated nil has been utilized by the College for the purpose for which it was sanctioned and noted in Grants-in-aid Register at Page No. \_\_\_\_\_
21. The grant is sanctioned on the basis of the information/documents provided by the college. In case of any discrepancy in the above information and the college is found ineligible for the above grant at the time of expert committee meeting the college is liable to refund the sanctioned grant along with interest.
22. **The college shall ensure involvement of Technical advice on and supervision of specifications and construction standards.**

Yours faithfully

(Dr.N. Gopukumar)

Deputy Secretary

**S. THULASIDHARAN**  
 Education Officer  
 University Grants Commission  
 South Western Regional Office  
 Palace Road, Gandhi Nagar,  
 BANGALORE - 560 009.

Copy to

1. The Principal  
 MARTHOMA COLLEGE  
 THIRUVALLA  
 PATHANAMTHITTA - 689 103  
 (He/She is requested to abide by these instructions/guidelines of sanction order.)
2. SHRI KURIAN MATHEW ABRAHAM  
 ASSISTANT PROFESSOR  
 MARTHOMA COLLEGE  
 THIRUVALLA  
 PATHANAMTHITTA - 689 103
3. Officer of Director General of Audit, Central Revenues, AGCR Building, I.P. Estate, New Delhi
4. The Director  
 Department of Collegiate Education  
 Vikas Bhawan, Thiruvananthapuram - 33
5. The Dean/Director, College Development Council  
 MAHATMA GANDHI UNIVERSITY  
 PRIYADARSHINI HILLS (PO)  
 KOTTAYAM - 686 560
6. Office copy

**POSTGRADUATE AND RESEARCH DEPARTMENT OF ZOOLOGY**  
**Mar Thoma College**  
**Tiruvalla, Pathanamthitta District**

**QUESTIONNAIRE ON DERMATOGLYPHICS (Palmar Print Overleaf)**

*Prepared by: Dr. Kurian Mathew Abraham*

**I. Sociodemographic / Personal Details**

1. Age : ..... Yrs. 1. < 10 2. 10-14 3. 15-19 4.  $\geq$  20
2. Sex : 1. Male; 2. Female
3. Religion : 1. Hindu 2. Christian 3. Islam
4. Education : 1. Special 2. Nursery 3. Primary 4. Middle  
5. Highschool 6. SSLC 7. +2/PDC 8. Degree  
9. Professional/PG
5. Birth Order : 1. One 2. Two 3. Three 4.  $\geq$  Four
6. Food Habit : 1. Vegetarian 2. Non-Veg. 3. Egg Veg. 4. Mixed
7. Place of Residence: 1. Corporation 2. Municipality 3. Village
8. Education of Father: 1. Special 2. Nursery 3. Primary 4. Middle  
5. Highschool 6. SSLC 7. +2/PDC 8. Degree  
9. Professional/PG
9. Education of Mother: 1. Special 2. Nursery 3. Primary 4. Middle  
5. Highschool 6. SSLC 7. +2/PDC 8. Degree  
9. Professional/PG
10. Occupation of Father: 1. Skilled Labourer 2. Unskilled Labourer 3. Govt. Office  
4. Private Office 5. Executive/Professional  
6. Agriculture 7. Business 8. Homestead  
9. Unemployed/Sedentary
11. Occupation of Mother: 1. Skilled Labourer 2. Unskilled Labourer 3. Govt. Office  
4. Private Office 5. Executive/Professional  
6. Agriculture 7. Business 8. Homestead  
9. Unemployed/Sedentary
12. SocioEconomic Status: 1. Poor 2. Average 3. High 4. Very high
13. Monthly Family Income: 1. < Rs. 1000 2. Rs.1000 – 2499 3. 2500 - 4999  
4. 5000 – 7499 4. 7500 – 9999 5.  $\geq$  Rs.10000
14. Type of Family 1. Nuclear 2. Joint 3. Broken

**II. Health Details**

15. Diagnosed Disease: 1. Downs 2. Klienfilters 3. Turners  
4. Cridu Chat 5. Autism 6. Mentally Retarded  
6. Specify: \_\_\_\_\_
16. Degree of MR: 1. Mild 2. Moderate 3. Severe
17. Intelligent Quotient:
18. Age at which MR recognised: 1. < 3 yrs 2. 3-5 yrs 3. 6-8 yrs 4.  $\geq$  9 yrs
19. Any Other Disease: Specify:
20. Physically Handicapped: 1. Nil 2. Legs 3. Hands 4. Body 5. Others
21. Family History of MR: 1. No 2. Father 3. Mother 4. Siblings  
5. Grant Parents 6. Great-grant parents 7. Cousins
22. Learning Ability: 1. Very Poor 2. Poor 3. Moderate 4. Good
23. Impairment 1. Vision 2. Hearing 3. Locomotion 4. Olfaction  
5. Sense 6. Sexual 7. Others

### Data Collected

SOCIODEMOGRAPHIC/ PERSONAL DETAILS											DERMATOGLYPHICS							
Sl. No.	Group (1-Normal; 2-MR)	Age	Sex	Religion	Education	Birth Order	Place of Residence	Occupation of Father	Socioeconomic Status	Type of Family	Finger Print Pattern							
											L5	L4	L3	L2	L1	R1	R2	R3
1	1	9	1	2	3	1	3	2	1	1	3	3	3	3	3	5	3	3
2	1	9	2	2	3	1	3	10	2	1	3	3	3	1	3	3	3	3
3	1	9	1	2	3	3	3	2	1	1	3	3	3	4	5	6	5	3
4	1	9	2	3	3	1	3	7	2	1	3	5	5	3	3	3	5	3
5	1	9	1	2	3	1	3	2	1	1	3	3	1	6	5	5	3	3
6	1	9	1	2	3	1	3	2	1	1	3	6	3	5	4	6	4	5
7	1	9	2	3	3	2	3	2	1	1	3	4	3	3	3	3	1	1
8	1	8	1	2	3	1	3	2	1	1	3	3	3	3	3	3	3	3
9	1	8	2	2	3	2	3	3	2	1	3	3	3	3	4	3	3	3
10	1	8	2	3	3	1	3	10	2	1	3	5	3	1	3	3	1	3
11	1	8	1	2	3	1	3	2	1	1	5	5	3	5	5	3	5	3
12	1	8	1	2	3	2	3	2	1	1	3	5	6	3	3	3	3	3
13	1	8	1	3	3	2	3	7	2	1	3	3	3	3	3	3	5	3
14	1	8	1	2	3	1	3	10	2	1	3	3	3	5	1	3	3	3
15	1	8	2	2	3	2	3	2	1	1	3	3	1	1	4	3	1	1
16	1	8	1	2	3	1	3	2	1	1	3	6	3	5	3	3	5	6
17	1	7	1	2	3	2	3	2	1	1	3	5	3	6	3	1	5	3
18	1	15	1	2	6	1	3	1	1	1	3	5	3	5	3	3	5	3
19	1	15	1	2	6	1	3	9	1	1	3	5	3	3	3	3	3	3
20	1	15	1	2	6	2	3	1	1	1	3	3	3	3	3	3	3	3
21	1	15	1	1	6	1	3	2	1	1	3	1	3	3	3	3	3	3
22	1	14	2	1	5	2	3	2	1	1	3	5	3	5	5	5	3	3
23	1	15	2	1	7	3	3	2	1	1	6	6	5	5	5	7	5	5
24	1	25	2	2	7	1	3	1	1	1	3	3	3	3	3	3	3	3
25	1	25	2	2	3	1	3	9	1	1	4	5	4	5	7	6	5	6
26	1	15	2	1	7	1	3	1	1	1	1	3	3	3	3	3	3	3
27	1	25	2	2	7	1	2	2	1	1	3	5	3	4	1	3	6	3
28	1	21	2	2	7	1	3	2	1	1	3	5	5	5	7	3	5	5
29	1	23	2	2	7	1	1	4	1	1	3	6	5	5	6	6	5	3
30	1	25	2	2	7	2	1	9	1	1	3	5	6	5	3	3	5	6
31	1	21	2	2	7	2	1	1	1	1	3	3	3	3	3	3	3	3
32	1	23	2	2	7	1	2	2	1	1	3	5	5	5	5	5	7	7
33	1	12	2	2	7	1	3	2	1	1	3	3	3	3	3	3	3	1
34	1	25	2	1	7	1	3	2	1	1	6	6	3	3	1	1	1	3
35	1	14	2	1	7	4	3	2	1	2	3	5	3	5	7	7	5	7
36	1	25	2	2	7	1	3	2	1	1	6	5	4	6	5	4	3	5
37	1	23	2	2	7	1	3	1	1	1	4	6	5	6	4	4	6	5
38	1	15	2	1	7	1	3	9	1	1	3	3	3	3	3	3	3	3
39	1	26	2	1	7	1	3	1	1	1	6	6	3	3	3	6	3	3
40	1	15	2	1	7	2	3	2	1	1	3	1	1	3	1	1	3	3
41	1	25	2	1	7	1	3	2	1	1	4	5	4	5	4	4	7	4
42	1	23	2	1	7	1	3	2	1	1	4	4	4	1	1	1	1	4
43	1	12	2	2	9	2	3	2	1	1	3	4	1	1	6	7	3	1
44	1	21	1	1	7	1	3	2	1	1	3	3	2	4	3	3	3	3
45	1	25	1	2	7	2	3	2	1	1	3	3	3	4	5	5	3	3
46	1	25	1	1	7	1	3	2	1	1	6	6	3	3	3	3	3	3
47	1	26	1	1	7	1	3	2	1	2	3	6	3	4	3	3	3	3
48	1	25	1	1	7	1	3	2	1	1	3	3	6	3	5	7	3	3
49	1	24	1	1	8	2	3	1	1	1	3	6	3	3	3	3	3	3
50	1	25	1	1	7	3	3	9	1	1	3	3	3	3	3	3	5	3
51	1	26	1	1	7	1	3	1	1	1	3	3	3	6	3	3	3	3
52	1	24	1	2	7	1	2	2	1	1	6	5	7	5	5	5	5	3



Sl. No.	DERMATOGLYPHICS																			
	Finger Print Pattern		Finger Rigde Count										Palmar Dermatoglyphics							
	R4	R5	L5	L4	L3	L2	L1	R1	R2	R3	R4	R5	L A-B	L B-C	L C-D	L AtD	R A-B	R B-C	R C-D	R AtD
1	3	3	13	17	11	10	18	22	13	15	17	12	44	30	40	40	44	34	37	44
2	3	3	22	19	15	10	18	19	14	18	25	20	64	36	35	48	55	45	46	44
3	5	3	17	9	20	6	21	27	18	15	19	12	51	26	36	40	42	17	28	36
4	3	3	9	14	14	20	20	20	16	16	21	11	35	22	38	35	44	23	34	32
5	6	3	18	19	13	20	28	24	16	5	22	22	47	37	11	45	45	11	39	45
6	3	3	15	20	20	16	9	25	10	17	11	18	60	19	39	41	56	14	39	44
7	1	1	12	9	8	12	11	16	10	17	11	18	43	25	36	33	41	29	25	36
8	3	3	17	22	16	10	23	26	13	16	20	15	55	28	45	40	55	35	50	36
9	3	3	15	14	11	18	16	18	19	18	21	15	51	40	51	40	48	35	39	40
10	5	4	12	13	9	14	16	15	19	11	12	10	40	27	36	36	35	29	34	34
11	5	3	17	14	19	15	18	17	17	16	12	15	47	35	44	48	44	33	45	46
12	5	6	18	18	17	17	24	25	6	19	15	12	50	23	30	33	43	28	39	40
13	5	5	21	17	15	7	13	18	10	19	12	17	45	32	44	38	37	29	35	37
14	5	3	12	15	12	15	14	16	14	13	21	15	43	34	27	40	46	30	44	45
15	4	1	11	15	14	13	11	8	14	13	9	15	52	41	35	36	39	31	38	38
16	5	3	14	13	21	15	18	16	16	15	13	17	39	25	36	42	40	25	34	37
17	5	3	14	13	17	15	20	13	12	8	13	12	41	29	38	37	36	15	30	30
18	3	3	19	18	26	15	28	23	15	16	15	20	49	30	47	44	48	30	32	34
19	3	3	16	14	10	11	16	19	14	11	12	13	49	29	39	36	37	21	40	33
20	3	3	16	21	17	17	25	27	18	24	25	15	36	27	25	16	38	26	34	29
21	3	3	9	14	6	11	19	24	14	10	8	10	48	32	23	37	39	35	24	30
22	5	3	19	17	14	17	22	12	17	15	15	9	34	30	40	43	34	29	30	43
23	5	6	24	19	25	20	26	29	20	20	19	10	42	37	46	38	37	33	33	40
24	3	3	11	13	10	6	11	16	3	8	12	12	35	34	38	44	33	29	35	47
25	6	4	18	16	16	17	20	20	15	14	16	12	37	21	28	36	42	30	35	39
26	3	3	14	2	8	2	8	10	4	9	5	4	35	30	35	50	34	28	29	48
27	3	3	16	12	11	10	8	5	14	13	17	7	31	19	38	35	33	21	38	33
28	3	3	17	22	16	10	21	9	13	14	15	10	34	32	39	39	40	32	45	40
29	6	6	17	22	16	10	15	16	11	16	16	12	32	22	36	40	35	19	40	38
30	6	3	11	13	12	11	17	16	12	12	14	12	47	38	44	52	51	39	31	49
31	3	3	16	22	16	13	20	18	12	17	17	15	45	42	45	45	72	36	32	45
32	5	3	16	21	18	13	16	18	20	11	17	14	50	31	40	40	28	20	37	33
33	3	3	14	3	5	5	16	20	4	11	10	17	54	34	60	40	50	48	52	42
34	6	3	16	12	11	6	16	20	4	8	10	16	41	24	35	42	43	24	36	43
35	3	3	15	20	16	11	14	22	11	21	18	14	39	41	29	39	35	33	34	38
36	4	4	15	15	12	14	14	14	14	13	17	12	35	24	42	48	45	26	37	52
37	6	4	8	11	7	11	10	11	11	13	13	12	28	22	41	32	36	23	20	36
38	3	3	8	7	5	6	11	14	7	7	6	8	42	36	54	53	40	22	52	52
39	3	6	16	13	15	13	18	18	16	12	10	11	51	36	27	49	45	26	47	41
40	1	3	12	13	15	3	18	18	6	5	13	9	33	26	40	31	44	20	55	39
41	6	4	12	18	13	17	18	20	21	13	18	10	48	25	54	37	43	24	48	40
42	6	4	7	10	10	17	18	20	21	8	13	7	56	28	42	42	63	22	45	45
43	3	3	3	6	9	14	17	18	4	8	7	7	57	29	57	40	42	28	43	38
44	3	3	9	7	11	6	9	8	12	10	4	7	30	22	25	34	34	21	30	39
45	3	3	13	16	11	11	8	13	3	6	14	11	49	28	34	38	36	24	28	34
46	6	3	13	16	9	11	8	13	12	12	13	13	29	16	29	55	32	15	33	37
47	3	3	10	14	4	2	16	14	3	8	12	2	35	18	27	38	27	16	27	36
48	3	3	8	17	14	13	24	15	18	17	14	11	36	22	33	37	31	23	29	37
49	5	3	14	20	9	7	19	21	12	12	16	13	28	19	30	42	27	22	27	40
50	6	6	9	15	9	9	6	14	11	11	13	11	38	22	33	44	43	23	29	39
51	3	3	12	11	7	11	9	13	12	12	13	10	36	31	33	40	46	29	35	40
52	5	5	16	20	17	13	21	16	15	14	19	13	43	25	36	42	37	27	33	38

Sl. No.	Group (1-Normal; 2-MR)	Age	Sex	Religion	Education	Birth Order	Place of Residence	Occupation of Father	Socioeconomic Status	Type of Family	L5	L4	L3	L2	L1	R1	R2	R3
53	1	22	1	1	7	1	3	2	1	1	3	5	5	5	5	5	5	5
54	1	12	1	2	7	4	3	2	1	1	3	5	3	6	3	5	3	3
55	1	15	1	2	7	2	2	2	1	1	3	5	3	3	3	3	3	3
56	1	21	1	1	7	2	3	2	1	1	3	3	3	5	6	5	4	3
57	1	15	1	2	7	2	3	2	1	1	3	3	3	3	5	5	3	3
58	1	25	1	2	6	1	1	2	1	1	3	3	3	3	3	3	3	3
59	1	26	2	1	7	1	3	2	1	1	3	5	5	5	6	3	3	3
60	1	26	2	2	9	2	3	2	1	1	2	5	3	4	3	3	3	3
61	1	26	2	1	7	1	3	2	1	1	3	3	3	3	7	3	3	3
62	1	24	2	2	7	2	3	2	1	1	3	3	3	4	3	3	3	3
63	1	25	1	1	7	1	3	2	1	1	3	6	5	5	5	5	5	6
64	1	25	2	1	7	1	3	2	1	1	3	3	3	3	3	3	6	3
65	1	24	2	1	7	1	3	2	1	1	3	5	3	7	5	7	7	3
66	1	26	2	1	8	2	3	1	1	1	3	3	3	7	7	7	7	3
67	1	12	1	1	7	3	3	9	1	1	6	5	5	6	5	5	6	5
68	1	14	1	1	7	1	3	1	1	1	6	5	5	6	6	7	3	7
69	1	15	1	2	7	1	2	2	1	1	5	5	6	3	5	5	7	5
70	1	15	1	1	7	1	3	2	1	1	3	3	4	1	1	1	1	3
71	1	14	2	2	7	4	3	2	1	1	3	5	5	5	5	5	5	5
72	1	12	2	2	7	2	2	2	1	1	3	5	3	4	5	7	5	6
73	1	22	1	1	7	2	3	2	1	1	3	6	3	3	3	3	7	6
74	1	22	2	2	7	2	3	2	1	1	3	6	3	7	3	7	6	5
75	1	26	2	2	6	1	1	2	1	1	3	3	3	5	3	5	4	3
76	1	21	2	1	7	1	3	2	1	1	3	3	3	3	3	3	3	3
77	1	25	2	2	9	2	3	2	1	1	3	6	5	6	3	3	6	3
78	1	25	1	1	7	1	3	2	1	1	3	3	3	4	3	3	4	3
79	1	12	1	2	7	2	3	2	1	1	3	3	3	3	7	3	3	3
80	1	15	2	1	7	1	3	2	1	1	3	5	5	6	5	5	5	6
81	1	14	2	1	7	1	3	2	1	2	3	3	3	4	7	5	6	3
82	1	15	2	1	7	1	3	2	1	1	3	3	3	6	3	3	6	3
83	1	25	2	1	8	2	3	1	1	1	3	5	3	3	7	5	3	3
84	1	21	1	1	7	3	3	9	1	1	3	3	3	3	3	3	3	3
85	1	23	1	1	7	1	3	1	1	1	3	3	3	4	3	3	3	3
86	1	15	1	2	7	1	2	2	1	1	6	5	5	5	3	3	5	5
87	1	14	2	1	7	1	3	2	1	1	3	6	3	5	3	3	3	3
88	1	15	1	2	7	4	3	2	1	1	3	5	5	5	7	7	5	5
89	1	15	1	2	7	2	2	2	1	1	3	3	3	3	3	3	3	3
90	1	15	2	1	7	2	3	2	1	1	3	3	3	4	3	3	3	3
91	1	12	1	2	7	2	3	2	1	1	3	3	2	4	3	3	1	3
92	1	12	1	2	6	1	1	2	1	1	3	5	7	3	7	5	3	7
93	1	14	2	1	7	1	3	2	1	1	3	3	3	3	3	3	3	3
94	1	12	2	2	9	2	3	2	1	1	3	4	3	2	3	3	3	3
95	1	13	1	1	7	1	3	2	1	1	3	4	3	3	7	7	3	3
96	1	13	1	2	7	2	3	2	1	1	3	6	5	5	6	5	5	6
97	1	15	1	1	7	1	3	2	1	1	5	5	5	5	3	3	5	6
98	1	15	1	1	7	1	3	2	1	1	3	3	3	3	3	6	3	3
99	1	11	1	1	7	1	3	2	1	1	5	3	6	6	3	3	3	3
100	1	18	1	1	8	2	3	1	1	1	3	3	3	4	7	7	4	3
101	1	15	1	1	7	3	3	9	1	1	3	3	3	3	5	7	3	3
102	1	12	1	1	7	1	3	1	1	1	3	3	3	6	7	3	3	3
103	1	15	1	2	7	1	2	2	1	1	3	6	3	3	7	3	3	3
104	1	15	1	1	7	1	3	2	1	1	3	3	3	3	7	3	3	3
105	1	21	1	2	7	4	3	2	1	1	3	6	6	5	5	5	5	3
106	1	25	2	2	7	2	2	2	1	1	3	6	3	5	3	7	5	6
107	1	25	2	1	7	2	3	2	1	1	3	5	3	5	6	5	3	3
108	1	26	2	2	7	2	3	2	1	1	3	3	3	5	1	3	3	3

Sl. No.	R4	R5	L5	L4	L3	L2	L1	R1	R2	R3	R4	R5	L A-B	L B-C	L C-D	L AtD	R A-B	R B-C	R C-D	R AtD
53	5	3	13	16	16	16	22	21	14	17	16	14	42	27	24	38	37	23	31	42
54	5	5	18	22	12	21	21	23	15	12	18	10	47	27	50	53	44	23	47	36
55	5	3	14	12	11	7	13	17	10	11	15	12	42	25	37	38	36	26	29	39
56	3	3	20	20	19	16	26	27	18	14	14	11	33	29	31	33	32	32	25	35
57	3	3	18	14	18	15	18	24	19	20	20	13	29	29	34	44	50	21	39	43
58	3	3	6	6	8	4	11	10	14	7	8	7	32	22	32	38	35	23	36	40
59	5	3	9	21	18	20	22	21	21	25	21	19	32	22	34	36	39	29	35	35
60	3	3	11	13	18	7	14	14	9	14	14	9	48	39	34	40	34	24	37	38
61	5	3	18	22	4	15	19	16	19	14	15	13	48	39	43	43	47	35	44	44
62	3	3	10	16	11	12	11	15	11	11	10	13	48	27	44	48	46	27	42	43
63	6	3	18	17	18	18	23	21	18	21	21	21	40	16	35	35	32	16	38	36
64	3	3	12	17	13	13	13	22	15	16	19	18	44	34	18	39	44	26	32	39
65	5	3	19	18	17	18	24	26	20	13	17	14	36	27	31	41	34	23	33	40
66	5	4	14	12	13	13	17	20	14	10	10	16	35	21	39	48	35	22	35	46
67	5	5	15	13	14	15	13	18	11	15	15	15	25	38	31	45	28	34	32	44
68	6	3	16	16	16	18	16	15	13	17	18	14	35	38	31	39	36	35	33	42
69	5	5	18	21	19	14	21	21	19	17	21	15	48	24	38	43	40	26	38	46
70	6	3	13	22	6	14	21	21	19	10	21	15	35	22	18	44	35	32	28	37
71	5	5	14	14	14	17	20	19	17	14	14	11	36	31	40	60	34	25	47	66
72	5	3	12	17	19	9	22	27	15	21	16	10	35	33	35	44	36	27	36	40
73	5	3	15	23	14	5	17	13	17	17	22	16	37	25	33	39	38	25	38	40
74	6	6	16	14	13	18	13	21	11	10	14	13	37	21	32	36	25	26	38	36
75	3	3	10	17	4	11	6	20	4	8	13	15	54	35	37	53	47	33	37	54
76	3	3	10	15	10	5	9	15	12	11	11	10	41	25	33	43	37	24	34	43
77	6	3	8	8	11	9	11	14	16	9	9	9	43	23	39	43	40	28	37	41
78	3	3	8	15	10	4	15	20	6	12	13	8	40	23	32	36	32	31	30	33
79	3	3	20	14	7	8	17	18	10	3	23	13	31	27	31	51	30	21	31	52
80	5	6	16	23	18	16	18	20	14	14	17	16	44	22	34	44	32	27	29	45
81	3	3	17	17	7	15	18	14	12	14	18	17	38	23	28	44	49	21	38	45
82	6	3	12	13	13	15	18	18	10	14	22	16	32	26	37	41	35	23	42	40
83	5	3	17	12	17	16	22	26	15	19	18	17	36	31	39	35	34	30	46	38
84	4	3	12	12	13	10	13	11	10	14	11	7	49	28	37	45	43	31	26	45
85	3	3	11	15	14	4	12	15	3	3	6	6	48	25	42	40	40	34	31	43
86	5	6	22	23	20	15	13	21	17	17	20	13	37	33	37	46	36	32	40	42
87	3	3	8	14	14	15	9	12	14	11	14	8	36	39	28	46	39	29	33	45
88	5	3	13	26	22	17	30	31	20	17	18	14	41	27	33	42	44	32	33	45
89	3	3	12	10	10	10	16	18	11	12	11	12	33	29	29	41	34	27	29	40
90	3	3	11	14	13	7	14	15	10	12	12	8	40	23	32	40	41	21	32	40
91	3	3	5	5	13	2	6	12	10	12	5	7	42	19	38	37	39	27	37	38
92	5	3	14	8	11	3	8	18	20	11	19	9	34	18	29	34	26	18	32	34
93	3	3	10	10	10	10	9	11	18	14	17	11	40	23	36	41	39	27	34	39
94	3	3	18	17	10	12	22	27	18	19	7	8	40	20	28	53	31	21	29	50
95	3	3	11	10	9	3	10	15	5	10	6	13	54	26	33	65	44	24	38	57
96	5	4	14	19	17	15	18	16	16	16	22	11	28	18	23	45	30	11	25	55
97	5	5	14	18	16	12	17	22	15	16	16	14	37	31	43	39	40	31	41	37
98	3	3	11	13	8	5	13	18	7	9	11	12	34	17	35	42	31	21	33	44
99	6	5	17	17	18	14	15	13	14	8	17	18	33	23	30	42	29	17	31	38
100	3	3	15	20	16	7	20	17	9	14	20	12	39	24	37	40	41	29	37	42
101	5	6	8	14	10	13	14	23	12	13	14	10	35	15	20	40	33	16	26	38
102	3	3	12	14	16	17	21	17	16	15	13	10	34	23	35	42	42	22	36	40
103	6	5	8	13	11	7	12	16	6	11	13	6	32	24	35	38	31	21	34	35
104	3	3	14	14	14	10	26	22	7	15	14	16	40	15	30	42	40	20	18	40
105	6	6	16	16	22	14	19	27	17	15	21	16	41	24	33	36	40	19	37	38
106	5	5	15	16	11	14	13	24	18	16	16	16	30	28	33	57	28	26	36	42
107	3	6	14	16	8	12	18	21	9	11	15	11	36	24	27	42	29	19	34	40
108	6	3	14	19	4	11	14	4	8	14	21	17	37	33	25	39	35	30	21	38

Sl. No.	Group (1-Normal; 2-MR)	Age	Sex	Religion	Education	Birth Order	Place of Residence	Occupation of Father	Socioeconomic Status	Type of Family	L5	L4	L3	L2	L1	R1	R2	R3
109	1	26	2	2	6	1	1	2	1	1	3	3	3	6	3	3	3	3
110	1	24	2	1	7	3	3	2	1	1	3	6	2	4	7	3	3	3
111	1	12	2	2	7	1	3	1	1	1	3	3	3	3	3	6	4	3
112	1	15	2	2	3	1	3	9	1	1	3	3	3	3	3	3	3	3
113	1	15	1	1	7	1	3	1	1	1	3	6	6	5	6	3	6	3
114	1	12	2	2	7	1	2	2	1	1	6	5	6	5	3	3	5	5
115	1	12	2	2	7	1	3	2	1	1	3	3	3	3	5	5	4	3
116	1	25	2	2	7	1	1	4	1	1	3	3	3	6	5	3	3	3
117	1	25	2	2	7	2	1	9	1	1	3	3	3	6	3	7	3	3
118	1	24	2	2	7	2	1	1	1	1	6	5	5	5	5	5	5	5
119	1	15	1	2	7	1	2	2	1	1	3	3	3	3	5	6	4	3
120	1	11	1	2	7	1	3	2	1	1	6	6	6	6	7	7	5	5
121	1	12	1	1	7	1	3	2	1	1	6	5	3	6	5	5	3	3
122	1	13	1	1	7	4	3	2	1	1	3	3	3	3	3	3	3	3
123	1	15	1	2	7	1	3	2	1	1	3	6	5	3	5	5	5	5
124	1	26	1	2	7	1	3	1	1	1	3	3	3	2	3	3	3	3
125	1	28	1	1	7	1	3	9	1	1	3	3	3	2	3	3	2	3
126	1	27	1	1	7	1	3	1	1	1	3	6	3	3	3	7	4	3
127	1	29	1	1	7	2	3	2	1	1	3	5	3	7	3	3	7	7
128	1	25	1	1	7	1	3	2	1	1	3	3	3	6	7	7	3	3
129	1	26	1	2	7	1	3	2	1	1	3	3	3	4	3	3	4	3
130	1	25	2	1	7	1	3	2	1	1	3	6	3	3	3	3	3	3
131	1	24	2	1	7	4	3	2	1	1	3	3	3	6	3	3	3	3
132	1	28	2	1	4	2	3	1	2	1	3	3	5	5	3	3	3	3
133	1	25	2	2	4	1	3	1	1	2	3	3	3	4	3	3	1	3
134	1	23	2	2	4	1	3	1	2	1	3	3	3	4	3	3	3	3
135	1	24	2	2	1	1	1	1	1	1	3	3	3	3	3	3	3	3
136	1	16	1	1	1	2	1	9	1	1	5	5	5	5	5	5	5	5
137	1	16	1	2	1	2	1	1	1	1	3	3	3	3	7	5	5	3
138	1	24	2	1	1	1	1	2	1	1	3	3	3	3	3	3	3	3
139	1	26	2	1	1	1	1	9	3	1	3	5	3	4	3	3	3	3
140	1	14	1	1	1	4	1	2	1	1	3	3	3	5	5	5	5	3
141	1	26	2	3	1	1	1	3	3	1	3	3	3	1	3	5	1	3
142	1	16	2	1	1	2	1	4	1	1	3	3	3	1	3	3	3	3
143	1	25	2	1	1	2	1	9	3	1	3	3	1	1	4	5	1	1
144	1	24	1	1	1	3	1	1	1	1	5	5	5	5	5	5	4	4
145	1	26	1	1	1	1	1	7	3	1	1	5	3	3	3	3	3	3
146	1	14	1	1	1	1	1	2	1	1	3	3	3	3	3	3	1	3
147	1	22	2	3	1	1	1	1	1	1	3	3	3	5	3	3	3	3
148	1	14	1	1	1	2	1	2	2	1	3	3	3	3	3	3	3	3
149	1	15	1	3	1	2	1	2	1	1	3	3	5	3	3	3	5	5
150	1	13	1	1	1	1	1	1	2	1	3	5	3	5	5	5	5	3
151	1	22	1	2	1	1	1	1	1	3	3	3	3	3	3	3	3	3
152	1	14	1	3	1	2	1	3	4	1	3	3	3	3	5	3	5	3
153	1	15	1	1	1	1	1	2	1	1	3	3	3	1	3	3	1	3
154	1	21	1	2	1	2	1	3	1	1	3	3	3	3	3	3	3	3
155	1	25	2	1	1	3	1	2	1	1	3	5	5	5	5	5	5	5
156	2	16	1	1	1	1	3	1	2	1	3	6	3	5	7	5	5	5
157	2	15	1	2	4	1	3	1	1	2	3	3	3	3	5	3	3	3
158	2	13	2	2	4	2	3	1	2	1	3	3	3	1	3	3	1	1
159	2	32	2	2	1	4	1	1	1	1	5	5	5	5	7	6	3	3
160	2	15	1	1	1	2	1	9	1	1	3	5	3	3	3	3	1	3
161	2	23	1	2	1	1	1	1	1	1	3	3	3	3	3	3	4	5
162	2	29	1	1	1	1	1	2	1	1	3	3	3	3	3	3	3	3
163	2	28	1	1	1	2	1	9	3	1	3	1	1	1	3	1	1	1
164	2	20	1	1	1	2	1	2	1	1	3	3	3	3	1	3	3	3

Sl. No.	R4	R5	L5	L4	L3	L2	L1	R1	R2	R3	R4	R5	L A-B	L B-C	L C-D	L AtD	R A-B	R B-C	R C-D	R AtD
109	6	3	14	15	12	16	16	12	12	13	15	19	35	25	30	56	35	30	21	38
110	3	3	16	16	12	13	15	15	15	13	13	14	39	23	34	43	30	23	28	40
111	5	5	19	22	17	12	15	15	11	21	18	18	35	15	29	40	39	13	34	43
112	3	3	14	15	13	15	20	19	15	17	24	18	36	23	34	46	38	22	33	45
113	6	6	20	22	14	14	22	8	10	13	20	18	38	30	35	40	34	32	27	45
114	5	3	15	20	16	16	13	16	22	16	21	13	47	25	36	56	43	21	34	53
115	3	3	10	13	11	12	17	20	14	12	13	12	40	26	41	47	40	29	35	47
116	3	3	15	21	16	18	15	13	8	10	17	15	35	22	35	43	37	24	35	41
117	3	3	15	11	11	10	14	19	8	7	11	12	37	28	29	41	36	29	30	41
118	5	6	17	22	12	10	17	16	16	16	18	15	35	22	36	39	32	18	37	38
119	3	5	15	10	5	14	28	23	3	11	14	14	31	22	32	32	28	27	12	32
120	5	3	17	18	19	19	20	21	21	20	20	17	45	26	38	50	32	26	37	46
121	5	6	16	16	13	16	18	19	18	15	19	21	38	21	29	44	35	16	32	44
122	3	3	11	15	14	13	18	18	15	12	13	11	32	17	24	35	32	13	34	35
123	6	3	13	17	13	15	20	17	14	14	14	11	36	20	35	36	33	25	25	36
124	3	3	19	17	8	15	18	12	10	8	8	9	44	26	44	48	34	36	30	45
125	6	3	11	17	16	15	4	7	10	9	15	9	25	18	17	44	21	24	26	45
126	6	3	14	21	18	11	17	25	4	12	24	14	44	20	42	39	41	20	32	38
127	5	7	17	22	15	24	19	22	16	23	21	21	39	24	35	45	31	25	32	43
128	3	3	16	16	12	16	27	33	11	10	15	14	37	32	33	57	33	30	33	39
129	6	3	7	15	12	3	2	4	4	4	16	7	40	16	24	31	30	19	31	33
130	6	3	14	12	12	16	12	5	12	11	15	11	35	21	33	36	36	21	36	39
131	3	3	14	16	11	13	17	14	11	12	15	16	40	28	35	39	37	26	40	42
132	3	3	13	16	15	14	16	13	14	14	20	20	38	35	38	41	38	26	36	39
133	3	3	7	9	9	10	10	10	12	10	9	7	32	18	38	40	31	20	28	40
134	3	3	11	12	15	11	16	13	8	7	9	11	47	30	28	40	40	33	35	39
135	3	3	11	10	16	13	21	20	14	12	13	10	50	20	40	52	40	18	30	56
136	5	5	18	26	16	19	23	22	12	19	21	18	30	21	28	43	41	20	27	43
137	5	3	22	20	23	23	40	29	19	18	23	21	44	30	40	46	45	31	36	50
138	3	3	13	14	13	13	17	17	13	9	10	9	42	27	42	39	34	28	40	45
139	3	3	7	12	7	13	20	20	13	16	17	13	37	16	26	39	40	19	18	41
140	5	5	8	8	20	17	19	20	24	16	19	27	43	25	45	43	42	25	46	44
141	3	3	7	6	4	18	19	21	22	13	11	10	46	27	30	42	45	19	31	40
142	3	3	6	10	7	16	12	16	8	12	18	6	42	28	43	40	42	31	40	40
143	3	3	10	11	12	13	9	15	21	14	11	9	39	22	43	45	36	39	14	47
144	5	5	20	20	21	20	20	23	38	28	25	14	50	26	19	30	40	20	23	32
145	1	3	18	4	17	9	20	18	16	10	21	5	48	23	35	41	35	21	30	44
146	3	3	15	18	19	12	18	15	16	13	13	10	38	26	34	40	37	22	33	36
147	3	3	17	15	15	17	13	12	10	11	14	11	35	25	28	44	38	47	28	45
148	3	3	15	9	5	9	11	5	11	9	10	13	35	24	34	33	35	28	38	36
149	5	3	16	11	15	17	8	10	10	13	16	6	28	28	30	35	31	29	23	39
150	5	3	21	28	20	21	21	31	24	23	24	20	49	25	40	41	36	20	50	39
151	3	3	8	11	9	11	15	16	14	11	9	14	50	24	50	45	35	21	39	49
152	3	3	10	13	14	12	17	14	11	14	11	12	40	31	42	38	28	31	37	37
153	3	3	5	6	2	12	9	4	12	4	4	5	35	20	27	39	33	20	34	42
154	5	3	10	15	13	7	15	18	10	10	8	10	46	18	41	35	46	30	32	37
155	5	5	13	18	15	14	14	16	15	18	14	10	28	12	21	49	31	14	27	47
156	3	4	17	13	18	18	14	16	15	18	13	12	50	26	47	46	43	30	46	55
157	3	3	17	24	17	13	11	14	11	12	13	13	51	18	38	46	30	17	40	29
158	3	3	13	13	6	13	14	11	14	13	16	7	50	17	44	46	50	15	51	51
159	5	5	17	18	20	19	12	24	20	17	16	18	43	30	47	41	44	29	40	44
160	3	3	16	20	19	11	16	14	22	19	20	12	51	26	43	38	45	26	46	38
161	3	3	21	24	20	15	22	23	28	18	16	19	41	31	41	42	43	36	46	40
162	3	3	16	6	3	5	12	10	2	2	4	11	18	19	26	42	31	22	25	37
163	1	3	5	12	14	8	5	13	16	13	9	3	42	38	15	38	37	18	29	37
164	3	3	7	14	13	5	15	15	13	13	7	10	41	14	30	35	36	21	38	33

Sl. No.	Group (1-Normal; 2-MR)	Age	Sex	Religion	Education	Birth Order	Place of Residence	Occupation of Father	Socioeconomic Status	Type of Family	L5	L4	L3	L2	L1	R1	R2	R3
165	2	34	1	3	1	4	1	3	3	1	3	3	1	3	3	3	3	3
166	2	18	2	1	1	2	1	4	1	1	3	5	5	4	3	1	6	5
167	2	27	1	1	1	2	1	9	3	1	3	5	3	3	5	5	3	3
168	2	33	1	1	1	3	1	1	1	1	5	6	3	5	3	3	3	3
169	2	13	1	1	1	1	1	1	2	1	4	5	3	6	5	5	5	3
170	2	10	1	1	1	1	1	7	3	1	3	3	3	3	3	3	3	3
171	2	18	2	3	1	1	1	2	1	1	3	3	3	3	1	3	3	3
172	2	8	1	1	1	1	1	1	1	1	6	5	6	4	5	5	5	5
173	2	14	2	3	1	3	1	2	2	1	3	3	3	3	1	1	2	3
174	2	18	1	3	1	2	1	2	1	1	3	5	3	1	7	7	3	3
175	2	12	1	3	1	2	1	1	2	1	3	5	3	3	3	3	3	3
176	2	14	2	1	1	1	1	1	1	3	4	3	3	3	3	3	3	3
177	2	28	1	2	1	1	1	3	4	1	3	3	3	3	1	3	3	3
178	2	28	1	3	1	3	1	2	1	1	3	6	7	7	3	3	7	3
179	2	28	1	1	1	2	1	3	1	1	3	3	3	3	3	3	3	6
180	2	41	1	2	1	3	1	2	1	1	3	3	1	1	3	5	4	1
181	2	21	1	1	1	2	1	3	3	1	3	3	4	3	3	3	3	3
182	2	16	2	1	1	1	1	2	2	1	3	5	3	3	7	7	3	3
183	2	25	2	2	1	2	1	0	1	1	5	5	7	5	5	7	5	5
184	2	21	2	3	1	3	1	1	1	1	3	5	3	6	3	3	3	3
185	2	28	2	1	1	1	1	1	2	1	3	3	3	4	3	3	3	3
186	2	39	1	1	1	4	1	1	1	1	3	3	3	1	3	3	3	3
187	2	34	1	1	1	4	1	2	1	1	3	3	3	3	7	7	3	3
188	2	24	1	3	1	1	1	1	1	1	3	3	3	3	3	3	3	3
189	2	26	1	1	1	1	1	7	2	1	3	3	2	4	5	5	4	3
190	2	30	1	1	1	3	1	7	1	1	3	3	3	3	3	3	3	3
191	2	19	1	1	1	3	1	1	1	1	3	3	3	3	3	3	6	3
192	2	26	1	1	1	2	1	7	2	1	3	6	3	3	3	3	3	3
193	2	29	2	1	1	3	1	2	2	1	3	3	3	3	3	3	3	3
194	2	12	2	1	1	2	1	2	1	1	3	3	3	3	3	3	3	3
195	2	28	1	2	1	2	1	10	2	1	3	3	3	3	3	3	3	3
196	2	18	2	3	1	2	1	2	1	1	3	3	5	4	7	3	3	3
197	2	31	1	1	1	1	2	2	1	1	3	3	3	3	3	3	3	3
198	2	28	1	3	1	1	3	1	1	1	3	1	1	1	1	3	1	1
199	2	23	1	1	1	1	3	1	1	1	3	6	3	6	5	5	4	3
200	2	20	1	3	1	2	3	10	2	1	3	3	3	4	3	3	6	3
201	2	11	1	3	1	1	3	2	1	1	3	3	5	3	3	3	3	1
202	2	20	1	1	1	2	3	2	1	1	3	4	3	3	7	3	3	3
203	2	16	1	2	1	2	3	2	1	1	3	5	5	5	3	3	7	5
204	2	23	2	3	1	1	3	2	1	1	3	3	3	3	3	3	5	3
205	2	17	2	3	1	3	3	2	1	1	3	3	7	3	3	3	7	3
206	2	16	1	1	1	2	3	2	1	1	3	3	2	5	5	5	5	3
207	2	14	1	3	1	2	3	10	3	1	3	7	7	3	3	3	3	3
208	2	14	1	3	1	2	3	2	1	1	5	5	5	5	3	3	5	5
209	2	16	2	1	1	1	3	2	1	1	3	3	3	3	3	3	3	3
210	2	33	1	3	1	2	3	2	1	1	3	5	3	3	6	3	3	3
211	2	11	1	1	1	2	3	3	2	1	3	3	3	3	7	3	3	3
212	2	11	1	1	1	1	3	2	1	1	6	5	3	5	7	3	5	3
213	2	25	2	1	1	4	3	2	1	1	3	3	3	2	3	3	3	3
214	2	16	2	1	1	2	3	2	1	1	3	6	3	3	3	3	3	3
215	2	10	2	1	1	2	2	2	1	1	3	3	3	3	3	3	3	3
216	2	14	2	1	1	3	3	2	1	1	3	5	3	5	5	3	3	3
217	2	9	1	2	1	1	3	1	1	1	6	6	3	3	6	5	3	3
218	2	18	1	1	1	2	3	2	1	1	3	3	4	4	3	3	4	3
219	2	25	1	2	1	1	3	2	1	1	3	4	3	3	7	3	3	3
220	2	25	1	1	1	2	3	2	1	1	3	6	6	5	6	6	5	5

Sl. No.	R4	R5	L5	L4	L3	L2	L1	R1	R2	R3	R4	R5	L A-B	L B-C	L C-D	L AtD	R A-B	R B-C	R C-D	R AtD
165	3	3	5	5	14	7	20	17	7	10	4	7	41	26	43	46	43	23	35	47
166	6	4	16	17	17	16	27	29	4	16	16	11	33	17	34	36	30	26	35	35
167	5	3	11	12	10	10	14	16	9	15	15	11	29	19	29	37	36	16	19	39
168	5	5	8	13	13	9	8	13	11	10	9	9	26	22	37	78	25	18	36	65
169	6	3	17	17	17	16	27	29	16	16	20	20	39	26	41	49	36	21	38	57
170	3	3	10	11	15	15	20	19	16	13	9	10	37	21	40	42	33	26	40	40
171	3	3	9	14	13	12	23	11	10	11	16	9	40	23	47	98	33	20	41	92
172	3	5	6	17	18	18	27	29	13	13	13	13	39	24	30	42	32	25	27	36
173	3	3	10	7	13	6	27	29	13	7	9	13	35	25	28	44	31	30	33	46
174	5	3	11	10	8	8	13	12	9	11	11	6	20	19	35	42	38	14	22	41
175	5	3	10	12	17	14	9	17	12	15	10	8	32	20	28	54	31	20	34	56
176	6	3	4	14	9	6	14	12	10	8	13	7	36	15	28	48	35	19	33	46
177	3	3	4	12	10	5	11	11	5	5	10	5	37	28	15	45	37	20	33	45
178	5	3	14	17	7	8	8	12	8	2	10	14	36	20	18	36	37	18	35	40
179	6	6	8	11	9	9	15	16	15	5	3	4	30	23	35	43	37	29	35	40
180	1	3	10	9	10	10	20	21	13	6	9	12	32	19	23	39	45	23	28	42
181	3	3	15	14	2	6	21	17	5	4	14	10	39	33	36	35	35	30	40	40
182	5	3	18	12	15	14	19	20	13	13	15	13	32	26	29	56	28	27	34	49
183	5	5	11	12	16	14	14	14	13	13	15	13	30	29	30	38	24	35	31	41
184	3	3	12	9	11	8	12	17	12	14	15	11	36	24	41	57	32	22	41	42
185	3	3	15	13	16	18	15	14	11	11	13	11	38	20	32	40	31	23	42	31
186	2	3	6	2	4	17	9	12	8	2	14	3	37	20	38	41	36	24	39	45
187	3	3	14	11	16	19	26	39	17	16	8	16	40	25	39	52	42	28	47	48
188	3	3	8	17	9	6	12	20	8	12	16	9	48	30	35	45	43	29	30	41
189	3	3	13	11	11	9	15	14	10	6	7	7	28	35	25	39	53	27	19	36
190	3	3	10	11	14	13	22	21	11	14	12	12	50	24	45	98	36	23	35	94
191	3	3	12	13	16	9	12	12	10	14	14	11	32	21	32	40	35	20	39	40
192	6	3	11	16	17	13	14	15	8	14	14	13	37	14	22	35	39	36	35	36
193	3	3	11	9	14	16	22	24	12	13	11	9	30	16	29	47	38	23	35	45
194	3	3	8	12	10	11	11	12	8	9	12	9	29	19	36	40	24	20	31	44
195	3	3	6	8	5	3	9	7	9	6	9	7	21	19	14	37	21	22	33	44
196	3	3	15	13	14	16	10	20	15	12	11	9	27	31	39	41	28	23	32	39
197	3	3	8	10	10	14	17	14	7	8	6	7	21	24	41	40	22	18	39	42
198	3	3	5	8	9	5	8	6	9	8	3	7	29	31	30	38	34	26	35	36
199	3	3	15	8	6	3	14	9	10	7	11	14	28	24	26	37	32	20	31	40
200	3	3	9	9	8	9	16	17	10	10	10	10	28	24	34	38	31	24	25	38
201	3	3	3	7	2	3	7	5	5	12	7	3	31	15	29	36	26	14	26	36
202	3	3	10	8	13	8	18	11	11	11	11	6	22	14	21	36	16	15	27	39
203	5	3	10	18	17	16	16	11	17	14	12	13	28	24	29	45	28	29	30	41
204	3	3	12	16	20	6	9	8	8	7	13	12	30	18	36	45	32	20	37	46
205	5	3	7	11	11	13	15	18	11	14	16	10	26	18	23	33	30	16	25	35
206	3	3	12	14	12	10	14	13	7	8	10	10	26	20	29	44	28	19	29	40
207	3	3	12	12	16	16	21	25	15	14	16	13	29	28	30	42	29	24	38	42
208	5	5	15	18	19	18	20	18	15	17	18	13	27	20	32	36	25	19	38	34
209	5	3	11	13	14	15	10	11	15	12	9	10	27	14	26	40	30	12	39	44
210	5	3	9	11	14	12	19	14	10	13	11	10	37	23	31	46	36	22	34	48
211	3	3	12	13	11	10	14	20	11	11	6	6	36	18	25	49	29	25	31	40
212	5	6	14	16	12	13	12	10	12	9	13	14	25	23	26	42	22	20	37	39
213	3	3	8	9	11	14	7	8	7	10	10	10	35	25	27	44	34	26	27	41
214	3	5	10	14	12	11	12	14	12	11	11	9	23	15	27	38	23	16	27	39
215	3	3	12	11	9	9	14	17	9	8	9	7	32	17	27	47	22	17	37	45
216	3	3	10	10	12	11	13	16	15	15	10	8	26	20	27	42	37	24	24	44
217	5	6	13	10	6	9	20	17	13	9	9	12	31	15	30	43	28	18	28	42
218	3	3	6	9	9	9	12	13	8	12	11	9	33	14	34	36	27	20	33	36
219	3	3	7	9	11	10	22	14	9	10	5	7	33	21	34	38	31	17	40	47
220	3	3	21	20	17	19	22	24	18	21	17	16	23	20	24	44	34	24	18	36

Sl. No.	Group (1-Normal; 2-MR)	Age	Sex	Religion	Education	Birth Order	Place of Residence	Occupation of Father	Socioeconomic Status	Type of Family	L5	L4	L3	L2	L1	R1	R2	R3
221	2	11	1	3	1	1	3	2	1	1	6	6	5	6	5	5	5	5
222	2	13	2	1	1	2	3	2	1	1	3	5	3	3	3	3	3	3
223	2	13	2	2	1	1	3	2	1	1	3	3	3	4	3	3	5	3
224	2	16	1	1	1	1	3	10	2	1	3	3	3	4	3	5	3	3
225	2	26	2	1	1	1	3	4	3	1	5	5	5	5	5	7	6	3
226	2	15	2	2	1	1	3	3	1	1	3	3	3	3	3	3	3	3
227	2	14	2	2	1	2	3	3	3	1	3	5	5	6	3	6	7	3
228	2	10	1	3	1	2	3	2	1	1	6	5	3	3	3	3	3	3
229	2	9	1	1	1	1	3	3	2	1	3	3	3	3	7	3	3	3
230	2	35	1	2	1	2	3	2	1	1	3	3	3	3	3	3	3	3
231	2	11	1	1	1	1	3	3	3	1	3	3	1	1	5	6	3	3
232	2	25	1	1	1	2	3	2	1	1	7	5	3	7	5	5	7	3
233	2	16	2	3	1	2	3	2	1	1	6	7	7	4	7	7	7	3
234	2	28	2	1	1	2	3	2	1	1	3	3	5	6	3	6	5	3
235	2	30	1	2	1	2	1	2	3	1	3	6	5	6	2	3	3	6
236	2	21	1	1	1	2	1	2	1	1	3	3	3	3	7	3	3	3
237	2	19	1	1	1	1	1	2	1	1	5	5	5	6	6	6	6	5
238	2	21	2	3	1	1	1	7	2	1	3	5	3	3	3	3	3	3
239	2	7	2	1	1	2	1	2	2	1	3	3	3	3	1	1	3	3
240	2	17	1	3	1	2	1	2	1	1	3	5	5	5	3	3	6	6
241	2	10	1	1	1	1	1	1	1	1	3	3	3	3	3	3	3	3
242	2	8	1	3	1	1	1	10	3	1	7	5	3	3	3	3	3	3
243	2	12	1	1	1	1	1	8	1	1	6	6	3	3	5	3	3	3
244	2	18	2	2	1	1	1	2	1	1	3	3	3	3	7	5	3	3
245	2	9	2	3	1	1	1	2	1	1	3	5	3	3	3	3	3	3
246	2	11	1	1	1	2	1	1	1	1	5	5	3	4	6	5	5	3
247	2	23	2	3	1	2	1	2	1	1	3	3	3	3	3	3	3	3
248	2	20	2	2	1	1	1	1	1	1	5	5	5	5	5	6	6	3
249	2	21	1	1	1	1	1	1	1	1	3	3	3	2	3	3	2	3
250	2	23	1	1	1	2	1	2	1	1	3	5	5	5	3	3	5	5
251	2	24	1	3	1	1	1	3	1	1	3	3	3	3	3	3	3	3
252	2	18	1	1	1	2	1	2	1	1	3	6	6	3	1	1	3	6
253	2	27	1	2	1	2	1	7	2	1	5	5	7	3	7	7	3	3
254	2	21	1	2	1	1	1	10	2	1	3	6	1	2	3	3	2	3
255	2	12	1	2	1	2	1	1	1	1	3	1	1	1	3	3	1	3
256	2	14	1	1	1	1	1	1	1	1	3	3	3	4	3	3	4	3
257	2	29	2	1	1	3	1	1	1	1	3	5	6	5	5	3	5	3
258	2	15	1	2	1	1	1	1	1	1	3	3	3	3	3	3	1	3
259	2	15	1	2	1	1	1	1	1	1	3	3	1	1	3	3	1	3
260	2	15	1	1	1	1	1	10	2	1	5	5	3	5	3	6	5	3
261	2	18	1	1	1	1	1	4	2	1	3	5	5	4	3	3	4	5
262	2	30	1	3	1	1	1	2	2	1	3	3	3	4	3	3	3	3
263	2	21	1	1	1	1	1	2	1	1	3	3	3	5	3	3	6	3
264	2	21	2	1	1	1	1	2	1	1	3	3	3	3	3	3	3	3
265	2	22	2	1	1	1	1	1	1	1	5	5	5	5	6	6	5	5
266	2	31	2	2	1	4	1	2	1	1	3	6	3	3	7	7	3	3
267	2	29	2	2	1	2	1	1	1	3	3	6	3	3	7	7	3	3
268	2	27	1	1	1	1	1	1	1	1	2	3	3	3	3	3	3	3
269	2	21	1	1	1	2	1	7	2	1	3	3	3	3	3	5	4	3
270	2	13	1	2	1	2	1	1	1	1	3	5	6	3	3	3	3	3
271	2	6	1	1	1	2	1	7	1	1	3	5	3	3	3	3	3	3
272	2	8	1	3	1	1	1	10	4	1	3	6	3	3	3	3	3	3
273	2	16	1	2	1	2	1	1	1	1	6	5	7	5	5	5	6	3
274	2	27	1	1	1	1	1	2	1	1	6	5	4	4	1	3	3	3
275	2	24	1	1	1	2	1	2	1	1	3	3	3	4	3	3	4	3
276	2	16	1	3	1	1	1	2	2	1	3	5	5	5	5	5	5	6



Sl. No.	R4	R5	L5	L4	L3	L2	L1	R1	R2	R3	R4	R5	L A-B	L B-C	L C-D	L AtD	R A-B	R B-C	R C-D	R AtD
221	5	6	13	18	12	12	16	19	9	12	9	7	27	25	27	30	15	19	27	33
222	5	3	11	14	14	8	14	12	12	15	10	7	35	25	27	46	29	24	31	52
223	3	3	12	11	13	12	16	15	8	11	12	9	36	19	31	39	31	17	25	40
224	3	3	10	10	4	5	14	21	8	4	8	8	36	19	31	39	26	14	46	35
225	5	6	10	11	10	11	11	15	11	11	10	10	41	30	29	47	40	23	28	41
226	3	3	11	14	12	12	14	17	14	14	13	10	23	18	32	43	31	18	30	40
227	5	6	11	11	13	13	14	14	8	12	12	11	26	18	28	49	31	18	31	56
228	3	5	9	8	8	11	11	11	14	8	8	7	27	18	24	35	33	14	32	37
229	3	3	7	10	8	5	21	11	8	10	9	6	23	15	28	37	27	14	25	39
230	3	3	9	13	9	7	13	9	9	11	16	14	27	14	17	46	27	18	24	51
231	3	3	11	6	8	9	13	14	4	5	5	15	27	14	17	46	25	14	18	31
232	5	7	15	17	17	23	20	22	16	9	14	16	27	26	28	50	42	28	25	59
233	5	3	11	11	15	15	14	20	14	10	12	8	28	25	27	40	34	20	23	37
234	3	3	15	14	13	8	16	19	10	10	11	9	30	25	27	40	32	20	31	39
235	5	6	15	12	15	15	15	13	16	13	9	14	35	22	32	51	32	20	35	57
236	3	3	11	12	14	12	13	13	10	9	9	9	32	20	34	42	36	23	29	44
237	5	5	13	19	20	19	19	21	18	20	15	15	29	12	33	45	27	22	30	41
238	4	3	8	9	11	11	6	9	9	8	10	7	27	25	33	44	31	18	19	46
239	1	3	5	3	4	2	9	9	6	3	11	6	36	13	26	78	31	18	36	82
240	5	3	12	13	14	10	9	7	14	14	14	10	30	13	30	40	26	14	29	37
241	3	3	10	11	12	6	15	14	6	8	6	8	37	18	26	49	35	20	34	41
242	5	3	15	15	11	13	20	12	10	10	14	12	27	13	28	44	23	12	27	49
243	3	3	10	10	12	10	14	11	11	9	10	9	26	18	24	78	28	21	34	80
244	3	3	11	10	6	6	14	10	7	3	13	6	36	12	27	44	39	17	26	49
245	3	3	12	11	13	11	14	11	12	11	11	10	40	27	29	59	30	17	26	41
246	5	5	8	10	9	9	14	12	9	11	9	8	30	15	12	40	27	23	19	36
247	3	3	10	14	13	7	9	11	11	9	15	11	26	19	27	39	26	16	30	42
248	5	5	11	13	12	11	18	18	15	11	15	12	30	27	30	47	30	29	33	45
249	3	3	9	12	8	11	12	16	15	8	8	9	30	33	33	45	32	29	31	44
250	5	3	14	13	14	13	20	17	14	15	15	17	37	30	32	34	32	36	26	38
251	3	3	6	7	4	7	10	12	9	7	8	6	29	15	21	40	31	23	36	46
252	6	3	9	12	9	4	10	12	6	9	13	8	30	25	22	50	30	12	18	42
253	6	5	12	18	18	8	24	26	8	16	24	13	31	19	27	86	55	17	25	67
254	3	3	12	14	15	6	11	10	6	6	12	10	34	24	38	40	35	23	36	40
255	3	3	3	9	6	5	11	10	5	3	3	4	28	21	13	32	29	18	18	35
256	3	3	14	9	6	5	14	14	5	9	9	8	41	18	30	50	29	22	32	46
257	5	3	13	11	17	12	17	11	13	12	14	11	26	16	23	37	27	18	21	37
258	3	3	12	2	8	7	20	17	13	8	3	7	27	16	23	37	26	19	33	37
259	3	3	6	6	8	7	14	5	16	8	4	4	25	26	20	42	23	16	12	39
260	6	5	11	13	18	16	14	25	16	16	16	11	32	17	24	43	29	15	21	31
261	6	3	16	16	18	6	19	19	11	16	20	16	36	27	35	42	30	28	39	42
262	3	3	13	17	12	12	17	16	13	8	13	12	32	16	20	45	32	21	13	36
263	3	3	14	16	13	14	11	13	14	11	16	10	27	16	33	40	27	17	35	41
264	3	3	6	8	8	8	11	13	10	11	8	6	30	16	29	42	27	16	30	38
265	5	5	11	15	13	12	18	16	12	10	12	8	22	20	26	36	16	17	26	32
266	5	3	13	13	13	9	21	19	7	9	14	11	28	16	38	46	23	15	29	40
267	6	3	12	11	11	8	21	10	8	10	11	12	25	12	30	41	28	20	39	44
268	5	3	12	18	19	9	18	10	9	10	12	14	40	12	30	86	32	20	39	76
269	3	3	13	13	7	12	15	18	11	9	6	8	31	19	33	40	25	19	28	48
270	5	3	8	13	13	12	17	19	11	11	15	9	15	19	25	55	21	19	25	52
271	5	6	9	11	16	8	9	11	10	10	8	8	26	19	28	55	35	26	29	51
272	6	6	11	13	12	10	7	9	7	8	10	11	28	14	19	50	21	10	20	48
273	5	3	10	11	16	16	15	15	16	10	10	9	25	19	33	40	17	14	27	34
274	3	3	8	6	3	10	15	13	8	9	7	6	34	27	27	43	27	18	20	38
275	3	3	6	11	12	14	20	13	8	8	9	8	30	19	24	42	27	19	19	35
276	5	5	13	16	16	12	14	11	9	17	16	11	32	27	14	43	30	28	19	41

Sl. No.	Group (1-Normal; 2-MR)	Age	Sex	Religion	Education	Birth Order	Place of Residence	Occupation of Father	Socioeconomic Status	Type of Family	L5	L4	L3	L2	L1	R1	R2	R3
277	2	19	1	1	1	1	1	10	2	1	6	5	6	5	7	5	6	5
278	2	22	2	1	1	3	1	7	2	1	3	7	3	4	3	3	3	3
279	2	11	1	1	1	1	1	1	2	1	3	3	3	3	3	3	3	3
280	2	18	1	3	1	1	1	10	4	1	1	6	3	3	3	4	3	3
281	2	32	1	1	1	1	1	2	1	1	7	5	4	3	3	3	7	3
282	2	6	2	3	1	2	1	10	1	1	6	7	3	7	3	3	3	3
283	2	15	1	1	1	2	3	1	1	1	3	6	3	6	3	3	3	3
284	2	18	1	1	1	1	2	1	1	1	3	3	3	3	3	3	3	3
285	2	19	1	1	1	2	1	2	1	1	3	5	6	4	7	3	4	3
286	2	26	1	2	1	1	3	10	3	1	3	5	3	1	5	5	3	3
287	2	21	1	2	1	1	1	2	1	1	3	6	3	4	7	5	4	3
288	2	19	1	2	1	2	3	1	2	1	3	3	3	6	3	3	5	3
289	2	18	1	1	1	1	1	1	1	1	3	3	3	5	3	3	7	3
290	2	16	2	2	1	2	3	2	1	1	3	4	3	3	3	3	3	3
291	2	15	2	1	1	1	1	1	1	1	3	3	3	1	3	3	3	3
292	2	10	2	2	1	2	3	5	1	1	3	5	7	3	3	3	3	7
293	2	17	1	2	1	1	3	4	1	3	3	5	6	3	7	5	3	3
294	2	14	1	1	1	2	3	1	2	1	3	3	3	3	7	6	3	3
295	2	14	1	1	1	2	3	2	1	1	5	6	3	3	3	3	3	3
296	2	22	1	2	1	2	3	10	2	1	3	3	3	3	3	3	3	3
297	2	19	1	1	1	2	3	3	2	1	3	3	3	3	3	3	3	3
298	2	21	1	1	1	2	3	1	1	1	3	3	3	3	3	3	3	3
299	2	20	1	1	1	2	3	3	3	1	3	6	5	5	6	5	6	6
300	2	21	1	2	1	2	1	2	2	2	6	3	3	3	3	3	3	3
301	2	22	2	2	1	2	2	1	1	1	3	5	3	3	7	7	3	3
302	2	21	2	2	1	1	3	10	2	2	6	5	5	6	1	3	5	5
303	2	21	1	2	1	2	1	1	2	1	5	6	5	4	4	3	3	3
304	2	16	1	1	1	1	2	5	1	1	3	3	3	3	3	3	3	3
305	2	15	1	1	1	1	1	4	1	1	3	3	3	3	3	3	3	3
306	2	15	1	2	1	2	2	2	1	1	3	6	5	4	3	7	5	3
307	2	17	1	3	1	1	3	7	3	1	3	3	3	3	3	3	3	3
308	2	17	1	2	1	1	1	5	1	1	6	6	6	6	5	3	5	3
309	2	8	1	2	1	3	2	7	1	1	3	5	3	4	7	3	3	3
310	2	7	1	2	1	2	3	5	2	1	3	2	3	3	3	3	3	3
311	2	25	1	1	1	3	3	2	1	3	3	5	6	5	5	6	3	5
312	2	15	1	2	1	1	3	2	1	1	6	3	3	3	6	3	3	3
313	2	14	1	2	1	2	1	1	2	1	6	6	3	2	3	3	2	3
314	2	15	1	1	1	2	2	2	1	1	5	5	3	3	3	3	3	3
315	2	17	1	1	1	2	3	1	1	1	3	3	3	4	3	3	3	3
316	2	36	2	2	1	1	1	2	1	1	3	3	3	3	3	3	3	3
317	2	27	2	2	1	2	3	1	3	1	6	3	2	3	3	3	3	3
318	2	21	1	1	1	3	3	2	1	1	6	5	3	3	3	5	5	3
319	2	17	1	2	1	1	3	1	1	1	3	4	3	3	6	3	3	3
320	2	22	1	1	1	2	3	1	1	1	3	2	2	2	6	7	1	1

Sl. No.	R4	R5	L5	L4	L3	L2	L1	R1	R2	R3	R4	R5	L A-B	L B-C	L C-D	L AtD	R A-B	R B-C	R C-D	R AtD
277	5	6	13	18	18	15	18	18	18	14	16	13	30	16	34	51	36	17	38	50
278	3	3	12	17	2	2	5	3	10	11	13	11	35	16	20	45	30	16	33	40
279	3	3	6	8	9	7	10	9	6	6	6	6	28	16	20	33	28	16	22	31
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