

# Finger Dermatoglyphic Variations in Rengma Nagas of Nagaland India

Sudip Datta Banik<sup>1</sup>, Paramita Pal<sup>1</sup> and Deba P. Mukherjee<sup>2</sup>

<sup>1</sup> Department of Anthropology, Vidyasagar University, Midnapore, West Bengal, India

<sup>2</sup> School of Human Genetics and Population Health, Kolkata, India

## ABSTRACT

*The Rengma Nagas are one of the major Mongoloid tribal populations in the North-Eastern state of Nagaland in India. Population variation and sexual dimorphism in respect of finger dermatoglyphic characteristics in 207 adult individuals (104 males and 103 females) are reported in this present context. Frequency distribution of finger pattern types in different digits (both left and right sides combined) showed that whorls were the most prevalent patterns among both males (52.19%) and females (55.69%), followed by loops (47.70% in males and 42.81% in females). Significant sex differences in Dankmeijer Index ( $t=1.47$ ;  $p<0.0001$ ) and finger wise variations of total finger ridge count (TFRC) and absolute finger ridge count (AFRC) in both the sexes were recorded. However, in cases of the frequencies of finger dermatoglyphic pattern types, Pattern Intensity Index in fingers, TFRC and AFRC no significant sex differences were observed.*

**Key words:** fingers, patterns, frequencies, ridge counts

## Introduction

Nagaland is one of the frontier states of North-eastern India. It is named after the term 'Naga' denoting a number of tribal communities residing in that region. Administratively the state comprises seven districts with the capital in Kohima<sup>1</sup>.

The major tribes in the state of Nagaland are the Nagas, Kuki, Kachari, Garo and Mikir. Among the Nagas, there are sixteen sub-tribes. They are: (i) Angami, (ii) Ao, (iii) Chakhesang, (iv) Chang, (v) Chirri, (vi) Khiemnungan, (vii) Konyak, (viii) Lotha, (ix) Makware, (x) Phom, (xi) Rengma, (xii) Sangtam, (xiii) Sema, (xiv) Tikhir, (xv) Yimchungre, and (xvi) Zeliang. Subsequently, in 1991 Census, Pochury Naga was added. So altogether 21 different scheduled tribe populations are recorded in Nagaland. According to 2001 census<sup>2</sup>, total population of the state of Nagaland is 1,990,036 wherein the total number of scheduled tribe (ST) population of the state is 1,774,026, i.e. 89.10% of the total population. Total population of the Nagas (all types) is 1,741,692 and 2.9% of this figure, i.e. 50,966 are represented by the Rengma Nagas<sup>2</sup>. The Rengmas speak the Rengma dialect and the script is Roman. Many of the Rengmas can also speak Angami, Lotha and Sema dialects while the educated class can converse in Hindi and English<sup>1,2</sup>.

The Rengmas are non-vegetarian and their staple food consists of rice and meat. In Rengma community, there is no stratification. They are divided into different clan groups. They are however, grouped in two religious divisions – Christians and non-Christians. Majority of the Rengma follow the American Baptism sect of Christianity<sup>3</sup>.

Data and information on finger and palmar dermatoglyphic variations of the Rengma Nagas were lacking. This made us interested in carrying out investigation in this area. The principal aim of this study was to investigate finger dermatoglyphic variations in both sexes of Rengma Nagas of Nagaland. Digit wise pattern frequencies and pattern intensities of finger dermatoglyphs among them were also examined. Further objective of this investigation was to understand the sexual dimorphism in case of the finger dermatoglyphic pattern types, intensities and sizes.

## Materials and Methods

Finger prints were obtained from 207 adult individuals (104 males and 103 females) of Rengma Nagas in

Nagaland. Frequencies and means of all the finger dermatoglyphics and other computations have been made for both left and right sides combined, following standard methods and equations<sup>4-8</sup>.

Rolled prints were taken of palms and finger tips, using printer's black ink. Statistical comparisons between male and female samples were carried out through percentages and student t test (equal variance not assumed). Frequencies of finger dermatoglyphic patterns in male and female subjects were calculated for each finger and were tested separately (both left and right sides combined). Sexual dimorphism with respect to the frequencies of finger dermatoglyphic patterns (whorls, loops and arches) was examined by chi - square test. The present account dealt chiefly with the following dermatoglyphic traits on fingers: digital pattern types, pattern indices and digital ridge counts.

*Digital pattern type* - All composite patterns including twin loops, lateral pocket loops, central pocket loops and accidentals were combined in the whorl category (with two triradii). Radial loops, ulnar loops and tented arches were counted separately and jointly as loops since all these dermatoglyphic characters have one triradius. The arch had a zero ridge-count without having any triradius.

Pattern indices

$$a. \text{ Pattern Intensity Index} = \frac{2 \times \text{Whorls} + \text{Loops}}{n}$$

where n=the total number of fingers on both sides combined.

$$b. \text{ Dankmeijer's Index} = \frac{\text{Arches} \times 100}{\text{Whorls}}$$

*Digital ridge-counts* - The total finger ridge count (TFRC) is the sum of the single largest counts on all ten fingers of an individual. The ridge counts are recorded separately for each finger, summed by hand, or totaled for both hands and double loop count is absolute finger ridge count (AFRC)<sup>4-8</sup>.

**Results**

The frequency distribution of finger pattern types in different digits (both sides combined) of Rengma Naga

male is shown in Table 1. The most common pattern types found were the whorls (52.19 %) and loops (all types 47.70 %) followed by ulnar loops (43.96 %), while radial loops (3.36 %), tented arches (0.38 %) and arches (0.11 %) were found infrequent. Radial loops, ulnar loops and tented arches were counted separately and jointly in loops because all of these were of one count i.e. of having one triradius. All composite patterns including twin loops, lateral pocket loops, central pocket loops and simple whorls were combined in the whorl category. The pattern distribution on individual digits showed that males had high frequency of whorl patterns (75.00 %) on digit 1 and ulnar loops (76.92 %) on digit 5. The highest frequency of radial loops (12.98 %) was noted to be on digit 2, tented arches (0.96 %) on digit 3 and arches (0.49 %) on digit 5.

The distribution of finger pattern types in different digits of female section is shown in Table 2. The most common pattern type in Rengma Naga females of Nagaland was recorded as whorls (55.69%) and loops (all types 42.81%) followed by ulnar loops (40.58%), while radial loops (1.94%), arches (1.50%) and tented arches (0.29%) were infrequent. The pattern distribution on individual digits displayed that females had highest frequency of whorl patterns (72.82%) on digit 1 and ulnar loops (78.16%) on digit 5. The highest frequency of radial loops (6.80%) tends to be on digit 2, tented arches (0.97%) on digit 2 and arches (2.91%) on digit 1.

Chi-square test based on finger dermatoglyphic pattern type frequencies (whorls, loops and arches of both left and right sides combined) between males and females, as a direct indicator of sexual dimorphism was done. The result revealed that the chi-square value ( $\chi^2=7.02$ ) was not significant at 5%level (probability =  $p<0.05$ ). Therefore, no significant difference between the two sexes with respect to the frequencies of finger dermatoglyphic patterns was observed.

The mean and standard error ( $\pm se$ ) of various indices of fingers of male and female subjects are presented in Table 3. The mean pattern intensity index of fingers was 1.54 ( $\pm 0.03$ ) in males and 1.56 ( $\pm 0.03$ ) in females. The difference between these means was observed not to be statistically significant ( $t=0.47$ ). The mean Dankmeijer's index (arch-whorl index) was 0.14 ( $\pm 0.14$ ) in males and

**TABLE 1**  
FREQUENCY DISTRIBUTION OF FINGER PATTERN TYPES IN DIFFERENT DIGITS AMONG THE MALE RENGMA NAGAS OF NAGALAND (MALE - 104)

Sl. No.	Patterns (%)	Digits					TOTAL
		I ST	II ND	III RD	IV TH	V TH	
1	Whorls	75.00	58.11	46.15	60.10	21.63	52.19
2	Ulnar Loops	24.52	28.43	50.96	38.94	76.92	43.96
3	Radial Loops	0.48	12.98	1.92	0.96	0.48	3.36
4	Tented Arches	0.00	0.48	0.96	0.00	0.48	0.38
5	Loops (2+3+4)	25.00	41.89	53.84	39.90	77.88	47.70
6	Arches	0.00	0.00	0.01	0.00	0.49	0.11

**TABLE 2**  
FREQUENCY DISTRIBUTION OF FINGER PATTERN TYPES IN DIFFERENT DIGITS AMONG THE FEMALE RENGMA NAGAS OF NAGALAND. (FEMALE – 103)

Sl. No.	Patterns (%)	Digits					TOTAL
		I ST	II ND	III RD	IV TH	V TH	
1	Whorls	72.82	68.45	54.66	61.65	20.86	55.69
2	Ulnar Loops	21.84	22.33	43.18	37.38	78.16	40.58
3	Radial Loops	2.43	6.80	0.00	0.00	0.49	1.94
4	Tented Arches	0.00	0.97	0.49	0.00	0.00	0.29
5	Loops(2+3+4)	24.27	30.10	43.67	37.38	78.65	42.81
6	Arches	2.91	1.46	1.67	0.97	0.49	1.50

**TABLE 3**  
PATTERN INDICES OF FINGER DERMATOGLYPHS AMONG THE RENGMA NAGAS OF NAGALAND. (MALE – 104, FEMALE – 103)

Pattern Indices	Male	Female	T	Sig
	X ± SE	X ± SE		
Patern Intensity Index (Fingers)	1.54 ± 0.03	1.56 ± 0.03	0.4670	0.20
Dankmeijer’s Index (Arch-Whorl Index)	0.14 ± 0.14	3.34 ± 2.1834	1.4658	0.0001

X ± SE – mean and standard errors.

3.34 (± 2.18) in females. The difference between these means was however, significant (t=1.47; p<0.0001).

The mean (± se) ridge-counts of dermatoglyphics on fingers in males and females are shown in table 4. The mean Total Finger Ridge Count (TFRC) was 156.39 (± 3.75) in males and 152.85 (± 3.80) in females. The mean of AFRC or Absolute Finger Ridge Count was recorded as 228.30 (± 8.24) in males and 226.67 (± 7.97) in females. The mean values of these two characters were noted to be higher in males compared to the females. Between the sexes, no significant differences in these means were observed.

Finger wise distribution of mean ridge counts (both sides combined) – total finger ridge count (TFRC) and absolute finger ridge count (AFRC) of male and female

sections are presented in Table 5. Finger wise differences of mean ridge counts depict conspicuous variation in both the sexes. Both the ridge counts displayed higher mean values in males on first finger. Mean ridge counts in females however, observed to exceed in other fingers except AFRC on digit 5.

**Discussion**

Variation and sexual dimorphism of finger dermatoglyphs were observed in Rengma Nagas of Nagaland. Pattern frequencies, indices and ridge counts were recorded to have significant variations between the sexes in most of the occasions. Whorls were recorded as the most frequent dermatoglyphic pattern on fingers of both male (52.19%) and female (55.69%) Rengma Nagas. At the same time, highest frequency of loops (all types com-

**TABLE 4**  
VARIATION OF RIDGE – COUNTS OF FINGERS AMONG THE RENGMA NAGAS OF NAGALAND. (MALE – 104, FEMALE – 103)

Ridge Counts	Male	Female	t	SIG.
	X ± SE	X ± SE		
TFRC	156.39 ± 3.75	152.85 ± 3.80	0.66	NIL
AFRC	228.30 ± 8.24	226.67 ± 7.97	0.14	NIL

X ± SE – mean and standard errors.

**TABLE 5**  
FINGER WISE (BOTH LEFT AND RIGHT SIDES COMBINED) VARIATION OF DERMATOGLYPHIC RIDGE COUNTS [MALE – 104, FEMALE – 103; n (fingers / digits) = male – 204 and female – 206]

Finger ridge counts	Sex	Digits				
		I X ± SE	II X ± SE	III X ± SE	IV X ± SE	V X ± SE
Total finger ridge count (tfrc)	Male	18.60 ± 0.40	15.32 ± 0.35	14.87 ± 0.33	16.48 ± 0.32	12.30 ± 0.34
	Female	16.29 ± 0.40	15.33 ± 0.35	15.03 ± 0.35	16.89 ± 0.32	13.29 ± 0.32
Absolute finger ridge count (afrc)	Male	30.33 ± 0.88	23.02 ± 0.77	21.25 ± 0.79	24.79 ± 0.77	15.19 ± 0.55
	Female	25.85 ± 0.84	24.29 ± 0.75	22.47 ± 0.80	25.75 ± 0.81	15.18 ± 0.49

X ± SE – mean and standard errors.

**TABLE 6**  
COMPARATIVE STATEMENT OF FINGER DERMATOGLYPHIC PATTERN TYPES FREQUENCIES IN DIFFERENT NAGA POPULATIONS

Sl. No.	Patterns	Angami Naga <sup>9</sup>		Lotha Naga <sup>9</sup>		Sema Naga <sup>9</sup>		Konyak Naga <sup>9</sup>		Naga Group <sup>11</sup> (All types)		Rengma Naga (Present Study)	
		Male (N=124)	Female (N=122)	Male (N=106)	Female (N=106)	Male (N=156)	Female (N=112)	Male (N=111)	Female (N=112)	Male (N=1248)	Female (N=999)	Male (N= 104)	Female (N=103)
1	Whorls (%)	52.34	45.57	53.77	49.26	54.81	53.57	52.34	42.59	52.48	48.99	52.19	55.69
2	Loops (%)	47.42	52.30	42.83	49.54	44.43	46.07	46.04	55.62	46.52	49.75	47.70	42.81
3	Arches (%)	0.24	2.13	3.40	1.20	0.76	0.36	1.62	1.79	1.00	1.25	0.11	1.50

bined) was observed on digit 5 in both sexes (77.88% in males and 78.65% in females). However, with respect to the frequencies of arches on fingers, females on the other hand, had little higher frequency (1.50%) over the males (0.11%). No significant sex difference was observed in relation with the pattern type frequencies of the finger Dermatoglyphs when examined with chi-square test. Wide variation of ridge counts, both finger wise and in both the sexes were also observed. This finger dermatoglyphic account is important as a record of information with respect to a particular population from this part of the world. The Rengma Nagas represent a Mongoloid ethnic group in north – eastern part of India. Data from other Naga and / or populations of Mongoloid or other ethnicity would help in comparing the results of this present investigation, aiming at studying human variation.

In some other studies, authors reported dermatoglyphic variations in some populations of North-Eastern India, especially among the Nagas of Nagaland<sup>9-12</sup>. In an extensive study<sup>9</sup>, the authors reported dermatoglyphic variations among the different Naga sub-tribes of Nagaland. In another noteworthy study<sup>11</sup> on ethnic diversity in North-Eastern India with special reference to the finger and palmar dermatoglyphic variations in a num-

ber of tribal and non-tribal populations in the region, comparative estimates were made among the Hindu castes, Scheduled Castes (S.C.), Other Backward Classes (O.B.C.), Assamese Muslims, Mongoloids including Boro and allied groups, Khasis, Lushai Kukis, Meities and the Naga groups (all types). Data of pattern type frequencies among the different Naga sub-tribes<sup>9</sup> and Naga group (all types)<sup>11</sup> were compared with the results of this present study in the following table 6.

The overall trends of frequencies of the three patterns in both the sexes were observed to be similar in all the studies including the present one. Higher whorl and lower loop frequencies in males were consistently observed in all previous studies<sup>9,11</sup>, which is not true for the present investigation. The frequencies of whorls in males were further observed to be more than 50% in all cases including the present study, which is factual for the Mongoloid populations<sup>9</sup>. The present study further conformed to the results of the higher frequency of arches in males compared to the female section as reported by the other studies<sup>9,11</sup> (Table 6). These results however, need further verification with new data from different populations among the Nagas and other ethnic groups in Nagaland and adjoining states of North-East India.

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S. Datta Banik

Department of Anthropology, Vidyasagar University, Midnapore – 721 102, West Bengal, India  
e-mail: sdbanik72@yahoo.co.in

## VARIJACIJE DERMATOGLIFA PRSTIJU U POPULACIJI RENGMA NAGAS, INDIJSKE SAVEZNE DRŽAVE NAGALAND

### S A Ž E T A K

Regma Nagas predstavlja jednu od najvećih mongoloidnih plemenskih populacija u sjeveroistočnoj saveznoj državi Nagaland u Indiji. U ovoj studiji analizirana je varijacija unutar populacije i seksualni dimorfizam s obzirom na dermatoglifske karakteristike 207 odraslih pojedinaca (104 muškaraca i 103 žene). Distribucija učestalosti tipova crteža (kombinirajući lijevu i desnu stranu) je pokazala da su vrtlozi najučestaliji crteži i kod muškaraca (52,19%) i kod žena (55,69%), iza kojih slijede petlje (47,70% kod muškaraca i 42,81% kod žena). Zabilježene su značajne spolne razlike prema Dankmeijerovom indeksu ( $t=1,47$ ;  $p<0,0001$ ) te varijacije s obzirom na ukupni broj grebena (TFRC, total finger ridge count) i veći dio grebena (AFRC, absolute finger ridge count), kod oba spola. Značajne spolne razlike s obzirom na učestalost tipova dermatoglifskih crteža, indeks gustoće crteža (Pattern Intensity Index) te s obzirom na TFRC i AFRC nisu ustanovljene.