

Palmar Main Line Formula (MLF): A Study on the Finding of Different Ethnic Elements among the Bengalee Hindu Caste Population of West Bengal

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Abstract

This study examines the palmar Main Line Formula (MLF) to trace racial elements within the Bengalee Hindu caste population of West Bengal. Building upon earlier research, 370 unrelated adult males and females were analyzed using bilateral palm prints. MLF classifications by Wilder (1940) and Biswas (1940) were applied, with statistical analysis conducted in SPSS (v18.0). The findings revealed a significant increase in Negroid (9.73%) and American Indian (12.97%) racial elements compared to previous studies, while frequencies of White (34.59%) and Other (42.70%) types declined. These results suggest a transitional phase in the racial composition of the population.

Keywords: Main Line Formula (MLF), Racial Elements, Bengalee population.

INTRODUCTION

Since Cummins (1926) first identified their role in detecting chromosomal aberrations, dermatoglyphic traits—the patterns of ridges on the fingers, palms, and soles—have been widely recognized as valuable markers for studying population variation (Schaumann & Alter, 1976). These traits are highly heritable and show distinct variations across ethnic and geographic groups, making them useful in fields such as anthropology, genetics, forensic science, and medical diagnostics. Bengalees are a linguistic community that speaks Bengali as their mother tongue (Chatterji, 1990). Primarily residing in the eastern part of India, particularly in the state of West Bengal, they form a diverse population with a complex racial history. The racial classification of this linguistic group has been a subject of debate among historians and anthropologists. Based on cranial measurements, the Bengalee population appears to exhibit brachycephalic traits (Hutton, 1963). However, anthropometric studies of nasal and head forms suggest that Bengalees are an admixture of Dravidian and Mongoloid racial elements (Banerjee, 1968; Bandyopadhyay, 2008).

Risley (1915) identified Dravidian, Mongolo-Dravidian, and Indo-Aryan racial elements within the Bengalee population through studies of various anthropometric traits. Additionally, traces of Negrito ancestry have been observed among Bengali-speaking communities (Guiffrida, 1921). In corroboration with Risley's findings, Haddon (1924) also highlighted the predominance of Dravidian racial elements in Bengal.

Beyond anthropometric and physio-morphic studies, dermatoglyphic research has been used to examine population variation and ethnic origins (Banerjee, 1969). In India, this field gained prominence due to colonial interests in studying local ethnic groups (Sarkar, 1954). In Western contexts, dermatoglyphic traits were employed to assess racial elements in specific communities from the late 1980s to the 1990s (Cummins & Midlo, 1961).

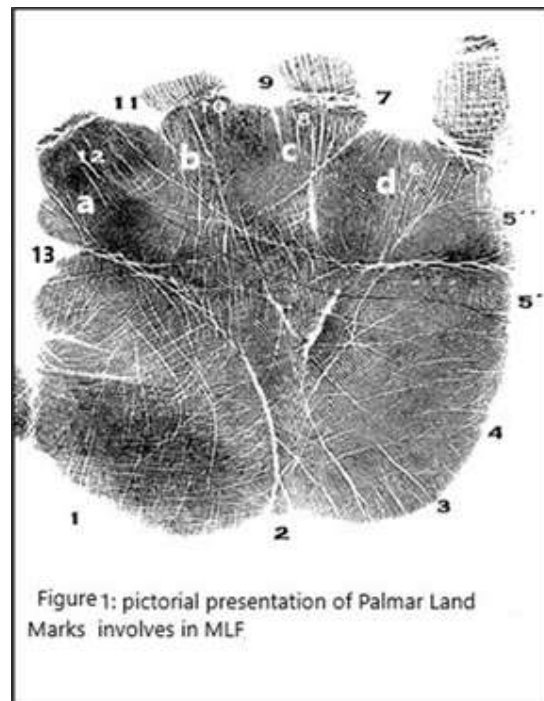
The study of dermatoglyphics dates back to Galton (1892), who first used fingerprint patterns to analyze ethnic variation (Wilder, 1904). Wilder (1904) later introduced ethnic-specific Main Line Formulas

(MLFs) [D C B A], identifying distinct patterns for White [D C B A; 11 9 7 (3-5)] and Negro populations [D C B A; 7 5 5 (3-5)] (Dey et al., 2020).

In India, Biswas (1940) expanded on Wilder's work, introducing an additional American Indian MLF type [D C B A; 9 7 5 (3-5)] and proposing that White, Negro, and American Indian racial elements were present among Bengalees in West Bengal, which was subsequently reported (Dey et al., 2020). In the 1950s and beyond, extensive dermatoglyphic research by Bengal anthropological studies, which includes Chakravarti (1959), Das (1959), Chattopadhyay (1966), Mukherjee & Rao (1975), and Basu (1979). Banerjee and Banerjee (1975) also used dermatoglyphic traits to study inter-caste distances in West Bengal. Earlier, Banerjee (1969) analyzed caste-based variations in West Bengal. Further studies explored caste-based differences (Banerjee, 1969; Banerjee & Banerjee, 1977) and sex-based variations (Banerjee, 1970, 1975; Sarkar, 1998) within the Bengalee Hindu caste population. Sarkar (1998) documented the anthro-po-genetic significance of epidermal ridge minutiae, while Karmakar et al. (2001, 2002) reported sexual dimorphism and asymmetry in five endogamous West Bengal groups. Despite these studies, documentation on dermatoglyphic traits for identifying racial elements among Bengalee Hindus remains limited. Bhasin (2007) reaffirmed the presence of White, Negro, and American Indian MLF types in Bengalees, though later research (Dey et al., 2020) suggests a decline in Negro and American Indian elements. This study aims to reassess the prevalence of these MLF types in the Bengalee Hindu caste population of West Bengal, independent of bimanual and sexual dimorphism.

MATERIALS AND METHODS

The present study incorporated 370 unrelated adults (180 males and 190 females) from the Bengalee Hindu Cast population of West Bengal after the maiden attempt (Dey et al., 2020) to revalidate and recheck the prevalence of ethnic-specific MLF. All participants' bilateral palm prints were obtained following the standard Ink and Roller method (Cummins & Midlo, 1961). All prints were analyzed according to the standard classification (Schaumann & Alter, 1976). To formulate the MLF, the termination points of all four primary palmar Main Lines (Interdigital triradii), A, B, C, and D (Figure 1), were traced and recorded. As per the termination of four primary palmar Main Lines of a single palm, the termination points were sequentially arranged as 'D C B A' to formulate the MLF (Cummins & Midlo, 1961). Since both hands were considered, the computed frequencies were reduced by half in the present study to maintain the actual sample size. The present study was also compared with the previous documentation of PC Biswas (1940), MK Bhasin (2007), and B Dey et al. (2020). SPSS (version 18.0) was used for statistical analysis, and the cutoff value was set as $p=0.05$.



RESULTS

Table 1 comprised of the comparison and eventually revealed confirmed the significant ($p=0.0000$) occurrences of the White, Negro, and American Indian types of MLFs among the studied population. Among the Bengalee Hindus, the first documentation reported the frequency of the White type of MLF was 33.0%, the Negro type of arrangement of the palmar Main Line was 19.00%, and the American Indian types of MLF was 34.00% (Biswas, 1940). Sixty-seven years later, the White types of MLF experienced a sudden decrease of 17.14%, the Negro types of MLF increased to 25.64%, and the American Indian type of MLF also decreased to 20.20% (Bhasin, 2007). The frequency of white types of MLF increased to 34.65% in 2020, while Negro (0.45%) and American Indian (3.38%) were only rarely observed among the Bengalee Hindu Caste population of West Bengal (Dey et al., 2020). This suggested that the Negrito elements had been eliminated among the Bengalee Hindus. However, in the present

attempt, reveal data as frequency of the Negro type (9.73%) and the American Indian type (12.97%) MLF, which is nearly a 9-fold increase compared to that of the earlier documentation.

Table 1: Distribution of the different types of ethnic-specific MLF among the Bengalee population

Studies	n	White Type of MLF: D. C. B. A 11. 9. 7. (3-5)	Negro Type of MLF: D. C. B. A 7. 5. 5. (3-5)	American Indian Type of MLF: D. C. B. A 9. 7. 5. (3-5)	Other Types of MLF	χ^2 (9df)
Biswas (1940)	100	33 (33.00%)	19 (19.00%)	34 (34.00%)	14 (14.00%)	139.933**
Bhasin (2007)	496	85 (17.14%)	127 (25.64%)	100 (20.20%)	184 (37.02%)	
Dey <i>et al.</i> , (2020)	100	34 (34.65%)	1 (0.45%)	4 (3.38%)	61 (61.52%)	
Present Study	370	128 (34.59%)	36 (9.73%)	48 (12.97%)	158 (42.70%)	

*p=0.0000, *Yate's correction n= Number of participants

DISCUSSIONS

Human morphometric studies identify four major racial groups: Caucasoid, Australoid, Mongoloid, and Negroid (Bhasin, 2007). In India, Risley (1915) classified the population into Turko-Iranian, Indo-Aryan, Aryo-Dravidian, Mongolo-Dravidian, Mongoloid, and Dravidian types based on physical traits. Guha (1937) used facial features and skin color to classify the population into Nigrity, Proto-Australoid, Mongoloid, Mediterranean, Western Brachycephalic, and Nordic types. Sarkar (1958) further categorized them by cephalic index into Dolichocephalic, Mesocephalic, and Brachycephalic.

The presence of Negroid/Negrity elements in India is debated. Guha (1928, 1929) and Hutton (1933) suggested Negrity traits among the Kadar of the Naga Hills, but Sarkar (1958) disagreed. Eickstedt (1939) limited Negrity elements to the Andamanese. Recent studies (Rakshit, 1965; Saha *et al.*, 1974) reported such traits due to admixture.

India's complex history of migration led to racial admixture (Chatterji, 1990). Among Bengalees, Brachycephalic (Hutton, 1963), Dravidian (Risley, 1915), Mongoloid (Bandyopadhyay, 2008), Mongolo-Dravidian (Risley, 1915), Indo-Aryan (Risley, 1915), and Nigrity elements (Guiffreda, 1921) have been documented.

Dermatoglyphics, particularly the Main Line Formula (MLF), plays a key role in ethnic identification (Wilder, 1904). The D-line is commonly used for analysis (Weninger, 1973), but the A-line is more effective for racial identification (Weninger, 1963). The C-line is polymorphic, leading to more variation (Plato, 1970; Dey *et al.*, 2017).

Biswas (1940) identified White (33%), Negro (19%), and American Indian (34%) MLF types among Bengalee Hindus, with 14% other types. Bhasin (2007) found similar results: White (17%), Negro (25%), American Indian (20%), and other types (37%). Dey *et al.* (2020) noted a decline in Negro (0.45%) and American Indian (3.38%) elements, with White (34.65%) and other types (61.52%) being more prevalent. The present study confirms the presence of White (34.59%), Negro (9.73%), and American Indian (12.97%) MLF types in Bengalee Hindus of West Bengal, with 42.70% other types.

CONCLUSION

In conclusion, the Main Line Formula (MLF) proves to be a useful dermatoglyphic trait for identifying ethnic elements in specific populations. The presence of Negro and American Indian MLF types is becoming more prominent among the Bengalee population, though the MLF appears to be in a transitional phase, with new types emerging within the Bengalee Hindu Caste group. This study contributes to the ongoing debate about the Negrity elements of India. It is important to note that the terms "race" and "racial element" used in this report are applied from an academic and historical perspective, in line with the UNESCO Declaration on Race (1952).

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AUTHOR CONTRIBUTION

All authors contributed to the design of the research. B.D. and P.D. performed the literature review. B.D. and P.D. did the data collection and analysis. D.C. and A.R.B. were guided to write the paper. B. D. and P. D. wrote the article.

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