
STUDY OF DERMATOGLYPHIC PATTERNS TO CORRELATE LEFT-HANDEDNESS IN HUMANS- A QUALITATIVE APPROACH

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Abstract

Dermatoglyphics is the scientific study of the pattern of ridges on the skin of the fingers, palms, toes and soles. Dermatoglyphics are of the Interest in anthropology, criminology, and medicine including dysmorphology, and study of chromosome abnormalities such as trisomy 21 (Down's syndrome) [1]. Since the early days of civilization, the feature of the hands have fascinated scholars, doctors and laymen alike. Through decades of scientific research, the hand has come to be recognized as powerful tool in the diagnosis of physiological, medical and genetic conditions [2] The present Study was done to determine the relation between dermatoglyphic patterns and left-handedness and to determine the possible dermatoglyphic pattern differences between Left-handed and Right Handed Individuals. Individuals aged between 8-55 years participated. Both genders were considered for the analysis of finger patterns. These individuals belonged to the North and South regions of India. The Study involved the right-handed and left handed people whose finger prints were collected through Ink finger printing method and studied. The present study suggests that no correlation can be found between the dermatoglyphic patterns and left-handedness in humans. The dermatoglyphic patterns serves as identification of features and also as diagnostic tool which helps us to understand the characteristics. With this focus the present dermatoglyphic study was carried out.

Keywords: Dermatoglyphic patterns, left handedness, Humans, diagnostic tool.

Introduction

The word 'dermatoglyphics' comes from two Greek words (Derma=skin and glyphe=carve) and refers to the epidermal skin ridge formation which appear on the fingers, palm of hands, and soles of feet. This term was coined by Harold Cummins in 1926. It is known that fingers and palm prints are formed during the 6th-7th week of the embryonic period and are completed after 10-20 weeks of gestation [3] There are various unique characters exists around us especially in mammals, such as stripes pattern in zebra or in tiger[1-3]. But these patterns are never the same and it's unique to each of them. Patterns present on palms, soles, and lips are also unique [4]. The palmar and plantar surface is characterized by the presence of ridges. These patterns are present inside the epidermis and are formed during early fetal life; these patterns are permanent and not affected by age and postnatal circumstances, except when the injury is internal [5,6,7]. On the onset of the 12th week of gestation, undulation appears on the inner surface of the

epidermis which forms ridges and furrows. These patterns remain unchanged but the pattern continues to grow in infants [6,7,8]. Mainly, these fingerprints are an impression left by the friction ridges of a human finger. These are areas where hair usually does not grow, and these ridges allow for increased leverage when picking up objects or walking barefoot.

Objectives:

1. To determine the relation between dermatoglyphic patterns and left-handedness.
2. To determine the possible dermatoglyphic differences between Left-handed and Right Handed Individuals.

Review of Literature

Historical Circumstances Of Dermatoglyphics Research In India

Dermatoglyphics patterns are inter-related to disease and in India too it had been studied by scholars like Kumbhani [1994], Patoria [1994], Bansal, *et al.*, [1994], Bagga [1994], Bajangam *et al.*, [1991], Dasgupta *et al.*, [1973], Chandra [1968]. Palm patterns were studied by Biswas [1936] for anthropological studies whereas the finger patterns were studied by Verma [1952], Tiwari [1955], Schlaginhaufen [1906] and Collins [1913] are the scholars who have studied the samples from the population of India.

Genetics Involved In Dermatoglyphics

Elderton in 1920 started the scientific study of dermatoglyphics and its correlation with genes. Bonnevie is the scientist who found that the dominant gene was responsible for the inheritance of some of the patterns in the year 1924 while Mueller in 1930 and Karl in 1934 assigned it to incompletely dominant gene and recessive gene are responsible for the twisting and whorls respectively. Genetic significance can be seen while counting the total ridge count. Twins that have similar genotypes can also be proved by the total ridge count. The quantitative value of ridge count can be determined almost entirely by co-dominant genes. Penrose is the scientist who was able to link up total ridge count and syndromic disorders like Klinefelter's syndrome, Turner's Syndrome, and down's syndrome. [6,8]

Minutiae: If we look carefully at our palms, the epidermal ridges are parallel lines. These parallel lines reveal different types of patterns which can be collectively called minutiae. These are highly polymorphic and they vary in their number, types, patterns from person to person, therefore these are reliable markers for the identification of a person. It varies from one race to another race or else it can be put as it varies from one country region to another. Specifically in India, the range of minutiae is from 6-12, while in other countries it is from 6- 17. [22]

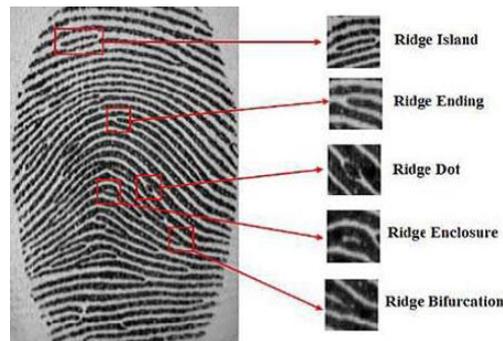


Figure 6: Representation of Minutia

Materials and Methodology

Location of the Study

The present study was conducted majorly in Rajasthan: Jaitaran and various parts of India like in Madhya Pradesh: Bhopal, in Assam: Guwahati, in Bihar: Araria, in Karnataka: Bangalore, Dharwad, in Maharashtra: Amravati. A total of 100 individuals were selected for the study. Most of the samples were collected from Jaitaran, with a population of 22,639 (as per Census 2011). It is located in the district of Pali, Rajasthan.



Figure 7: The study Location in India



Methodology

The study was conducted on 50 randomly selected left-handed people after taking their informed consent and permission. The finger and palm prints were taken on a 100GSM bond sheet by rolling finger technique using ink. Ink fingerprinting is the traditional method of collecting fingerprints that is still used for many reasons today. A person's fingertips are rolled to cover the entire fingerprint area in ink, then, each finger is rolled onto prepared cards from one side of the

fingernail to the other. Ink is used because there is therefore a need for a fingerprinting ink that provides the necessary accuracy to determine an individual's identity, and which is also non- evident on the skin after touching the inked finger or thumb to the recording surface. Ink foils are used for fingerprinting for analysis. Simultaneously 50 samples of controls [right-handed] were also selected which were recorded. The difference of quantitative [dermatoglyphics pattern] data was tested for its significance using the t-test. [21,22]

Results and discussion The mean ridge count in the right hand of the cases was 17.23, whereas it was 21.3 in controls. When the t-test was applied, the difference in the mean ridge count of cases and controls was insignificant in the right hand. The result was the same in the left hand. In the left hand, the cases gave a mean ridge count of 16.8 and control mean ridge count was 21.03 and the t-test showed that the difference was not significant (Table 1).

		Right Hand		Left Hand	
		Case	Control	Case	Control
Ridge count in digits					
	Thumb	22.3	24.3	19.34	22.653
	index	14.085	24.9	14.4255	18.156
	middle	16.765	19.968	15.355	19.906
	ring	14.17	22.49	20.346	19.343
	little	12.319	16.875	14.642	17.0625
Statistics	Mean Rc	17.23	21.3	16.8	21.034
	SD	4.57	2.79	3.612	2.792

Table 1: Quantitative Analysis of Total Ridge Count in Left-Handed (Case) and Right Handed (Control) People

	PATTERN	LEFT_HANDED	RIGHT_HANDED
1	Central Pocket	57	44
2	Plain Whorl	50	43
3	Radial Loop	62	32
4	Plain Arch	23	16
5	Tented Arch	19	7

T-test Result $t = 1.70$ which is $<$ the table value, 2.306 at a significance level of 5% and df of 8, $t = 1.88$ which is $<$ the table value, 2.306 at a significance level of 5%, and df of 8.

Table 2: Comparison of the Fingerprint Pattern in the Left and Right Hand of the Case and Control



Photographic plate 1: Fingerprint of the sample 1



Photographic plate 2: Fingerprint of the sample 2

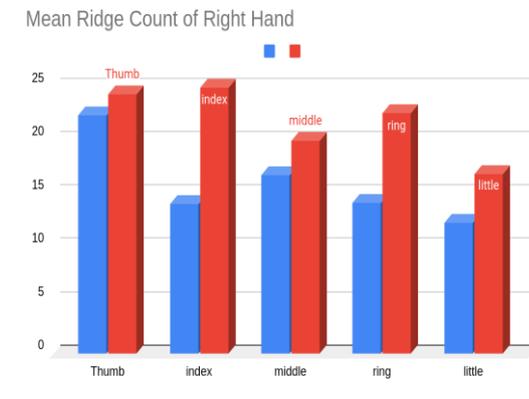


Figure 8: Graph representing mean ridge count of the right hand

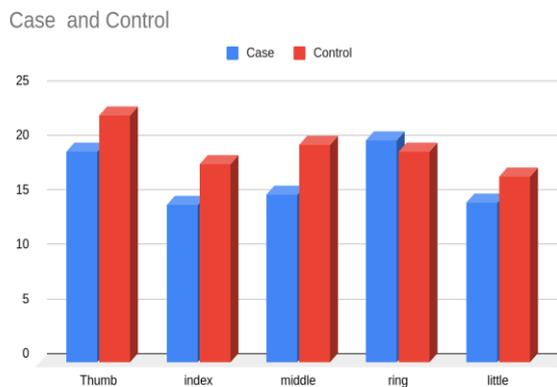
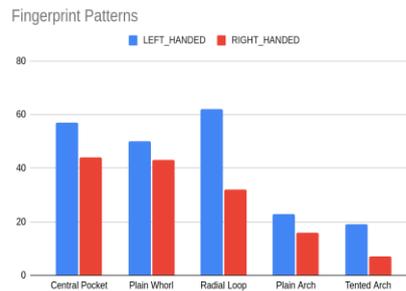


Figure 9: Graph representing mean ridge count of left handFigure 10: Graph representing counts of different dermatoglyphic pattern

Discussion

The comparison of the fingerprint pattern of left-handed people with the right-handed ones revealed that the pattern; Central Pocket, was found more in left-handed people while it was very less common in the control. Ulnar loop and single loop whorl were the other common fingerprint patterns observed in the case, but it was not significantly different from the control as these patterns were commonly found in them too. In comparison between control and case, though less in number, plain arch, and tented arch patterns were more common in the case than control.

Out of the total samples:

1. 99% of subjects showcased an Ulnar loop and pattern.
2. 30% of left-handed individuals showed a Central Pocket pattern whereas only 22% of right-handed individuals showed the same pattern.
3. 38% of the left-handed individuals showed a Plain Whorl pattern and the same pattern was shown by 31% of the right-handed individuals.
4. 35% of the left-handed individuals showed a Radial Loop pattern whereas only 16% of the right-handed individuals showed this pattern.
5. 18% of the left-handed subjects showcased a Tented Arch pattern whereas 7% of the right-handed subjects showed this pattern.
6. 16% of the left-handed subjects showed a Plain Arch pattern whereas only 7% right-handed subjects showed this pattern.

Hence, these pattern differences can be used to identify left-handed individuals over right-handed ones. Since, the overall count of loops, whorls, and arches differ in all the samples it can be concluded that no relation exists between left-handedness and fingerprints.

Summary

In the present study, a total of 100 individuals aged between 8-55 years participated. Amongst them, 58 were females and 42 were males. These individuals belonged to the North and South regions of India. There is reasonable evidence that suggests that the proportion of left and right-handedness has remained relatively unchanged since the paleolithic era or even earlier. Fingerprints are unique

dermatoglyphic patterns, made by friction ridges [raised] and furrows [recessed], which appear on the pads of the fingers and thumbs. Prints from palm, toes, and feet are also unique; however these are used less often for identification, so this guide focuses on prints from the fingers and thumbs

Inference

The present study suggests that no correlation can be found between the dermatoglyphic patterns and left-handedness in humans.

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