

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/257561735>

Association between digital dermatoglyphics and handedness among Sinhalese in Sri Lanka

Article in F1000 Research · November 2013

DOI: 10.12688/f1000research.2-111.v3

CITATIONS

0

READS

64

2 authors:



Buddhika Wijerathne

Rajarata University of Sri Lanka

43 PUBLICATIONS 18 CITATIONS

[SEE PROFILE](#)



Geetha Rathnayake

South Western Sydney Local Health District

10 PUBLICATIONS 6 CITATIONS

[SEE PROFILE](#)

Some of the authors of this publication are also working on these related projects:



Dermatoglyphics in Kidney diseases [View project](#)

All content following this page was uploaded by [Buddhika Wijerathne](#) on 16 August 2017.

The user has requested enhancement of the downloaded file.



RESEARCH ARTICLE

REVISED Association between digital dermatoglyphics and handedness among Sinhalese in Sri Lanka [v3; ref status: indexed, <http://f1000r.es/278>]

Buddhika TB Wijerathne¹, Geetha K Rathnayake²

¹Department of Forensic Medicine, Faculty of Medicine and Allied Sciences, Rajarata University of Sri Lanka, Saliyapura, Sri Lanka

²Teaching Hospital Anuradhapura, Anuradhapura, 50000, Sri Lanka

v3 **First Published:** 18 Apr 2013, 2:111 (doi: 10.12688/f1000research.2-111.v1)
Second version: 08 Jul 2013, 2:111 (doi: 10.12688/f1000research.2-111.v2)
Latest Published: 04 Nov 2013, 2:111 (doi: 10.12688/f1000research.2-111.v3)

Abstract

Background The relationship between handedness and digital dermatoglyphic patterns has never been investigated in the Sinhalese population. The goal of this study is to establish the above mentioned relationship, which would positively aid personal identification.

Findings One hundred forty Sinhalese students (70 right-handed and 70 left-handed) were studied for their digital dermatoglyphic pattern distribution. The results show that a statistically significant correlation exists for; digit 5 (Ulnar loop; P= 0.0449 and radial loop; P= 0.0248 by Fisher's exact test) of the right hand in female, digit 1 (radial loop; P=0.0248 by Fisher's exact test) and digit 2 (Ulnar loop; P=0.0306) of the left hand in females, digit 3 (Ulnar loop; P= 0.0486 and whorl; P= 0.0356 by Fisher's exact test) and digit 4 (Ulnar loop; P= 0.0449 and whorl; P= 0.0301 by Fisher's exact test) of the right hand in males, digit 4 (whorl; P=0.0160 by Fisher's exact test) of the left hand in males.

Conclusions Statistically significant differences in handedness and digital dermatoglyphic patterns were evident among Sinhalese people. Further study with a larger sample size is recommended.

Article Status Summary

Referee Responses

Referees	1	2
v1 published 18 Apr 2013	 report 1	
v2 published 08 Jul 2013 UPDATED	 report	 report 1
v3 published 04 Nov 2013 REVISED		

- 1 Esperanza Gutierrez Redomero,**
University of Alcalá Spain
- 2 Matea Zajc Petranović,** Institute of
Anthropology Croatia

Latest Comments

No Comments Yet

Corresponding author: Buddhika TB Wijerathne (buddhikatbw@gmail.com)

How to cite this article: Wijerathne BT, Rathnayake GK (2013) Association between digital dermatoglyphics and handedness among Sinhalese in Sri Lanka [v3; ref status: indexed, <http://f1000r.es/278>] *F1000Research* 2013, 2:111 (doi: 10.12688/f1000research.2-111.v3)

Copyright: © 2013 Wijerathne BT et al. This is an open access article distributed under the terms of the [Creative Commons Attribution Licence](#), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited. Data associated with the article are available under the terms of the [Creative Commons Zero "No rights reserved" data waiver](#) (CC0 1.0 Public domain dedication).

Grant information: The author(s) declared that no grants were involved in supporting this work.

Competing Interests: No relevant competing interests were disclosed.

First Published: 18 Apr 2013, 2:111 (doi: 10.12688/f1000research.2-111.v1)

First Indexed: 09 Oct 2013, 2:111 (doi: 10.12688/f1000research.2-111.v2)

UPDATED Changes from Version 2

We would like to thank the reviewers for their valuable time and comments. We have corrected the typographical error in the method section; it is now clarified that 70 right- and 70 left-handed people were evaluated in the study rather than 50.

See referee reports

Introduction

Fingerprints (digital dermatoglyphics) are a unique form of evidence that greatly contribute towards personal identification in forensic science¹. Because they are unique for each individual and are strongly influenced by genetics, they also perform a significant role in anthropology, human genetics, ethnology and medicine. They are characterized by alternating strips of raised friction ridges and grooves present in a variety of patterns². These patterns start to develop between the 5th and 6th week of intrauterine life, and are fully formed by the 21st week³. These patterns do not change throughout postnatal life and their development is determined by several genes⁴.

Handedness (i.e. hand dominance) is defined as the uneven distribution of fine motor skills between the left and right hand⁵. Determination of the handedness of both the assailant and the victim are important in various aspects of forensic science, including personal identification⁶. Hence, establishing the relationship between handedness and digital dermatoglyphics will aid forensic identification.

To date, scarce amount of studies⁷⁻¹³ have investigated whether there is a correlation between handedness and digital dermatoglyphics. In 1940 Cummins discovered a slight association in the sex differences of asymmetrical occurrence of dermatoglyphic patterns⁸. Cromwell and Rife in 1942 found that left-handers are characterized by slightly less bimanual asymmetry than right-handers among on Caucasian school children in southwestern Ohio⁹. In 1943 Rife found associations characteristic of autosomal linkage between the whorl frequencies on the fingers and handedness among descended from northern European stock¹⁰. In 1994 Coren reported an increased number of arches, fewer whorls in left-handers as compared to the right-handers among Canadians¹¹. Cho in 2010 found significant difference of dermatoglyphics patterns on digit 3, 4 and 5 among Koreans¹². None have investigated this association in a Sinhalese population (an Indo-Aryan ethnic group who are native to the island of Sri Lanka¹⁴). The main goal of the current study is to determine the relationship between handedness and digital dermatoglyphics in a sample of Sinhalese population.

Methods

The study was conducted at the Department of Forensic Medicine, Faculty of Medicine and Allied Sciences, Rajarata University of Sri Lanka. Ethical clearance for this study was obtained from the Ethical Clearance Committee of the institute. Total of hundred forty Sinhalese students (70 females, 70 males) who gave informed written consent were included in the study. Ages of females ranged between 21 and 28 years (mean \pm s.d. = 24.40 \pm 1.82 years) and males ranged from 22 and 28 years (mean \pm s.d. = 24.67 \pm 1.92 years). Firstly,

handedness was assessed using the Edinburgh Handedness Inventory¹⁵. This required participants to demonstrate 10 unimanual tasks (preferred hand for writing, drawing, throwing, striking a match, opening a box, holding scissors, holding a toothbrush, holding a spoon, holding a broom and holding a knife). These tasks are common to Sri Lankans and they were advised to state the degree of preference for the hand used in each case as either strong (two points) or weak (one point). The handedness measure was calculated by subtracting the score for the left hand from the score for the right hand, dividing by the sum of both, and multiplying it by 100, providing an absolute range from -100 (completely left-handed) to +100 (completely right-handed). We recruited 70 predominant right-handers and 70 predominant left-handers after evaluating handedness.

All eligible students were asked to wash their hands thoroughly to remove dirt and dry them before obtaining fingerprints. Rolled prints were obtained by the ink and paper method as described by Cummins and Midlo². The subject was asked to roll their finger from the radial side to the ulnar side on an ink pad and then transfer their fingerprints in the same manner onto the allocated area of a double sheet of plain A4 paper (Figure 1). In this way, fingerprints for all the ten fingers were obtained for each individual. Digits are numbered as follows; digit 1 (thumb), digit 2 (index finger), digit 3 (middle finger), digit 4 (ring finger) and digit 5 (little finger).

Digital dermatoglyphic patterns (Figure 2) were classified as follows; ulnar loop, radial loop, whorl (double loop whorl, plain whorl, central pocket loop and accidental whorl were counted as whorl) and arch (plain arch and tented arch were counted as arch). In this way, fingerprints of all the ten fingers were obtained for each individual.

Analysis was carried out using GraphPad Prism 5 software (version 5.03 for Windows; GraphPad Software, San Diego California USA). Descriptive statistics were used to express the data. Correlations between handedness and digital dermatoglyphics were evaluated by a two-sided Fisher's exact test. P values less than 0.05 were considered statistically significant.

Results

In this study we observed the handedness-wise digital dermatoglyphics pattern distribution of 140 individuals (70 left-handed [35females, 35males] and 70 right-handed [35males, 35females]).

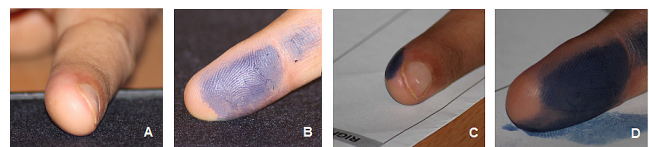


Figure 1. Method for obtaining fingerprints. A and B show the rolling of the finger from the radial side to ulnar side on an ink pad. C and D show the transference of fingerprints onto the allocated area of the paper.

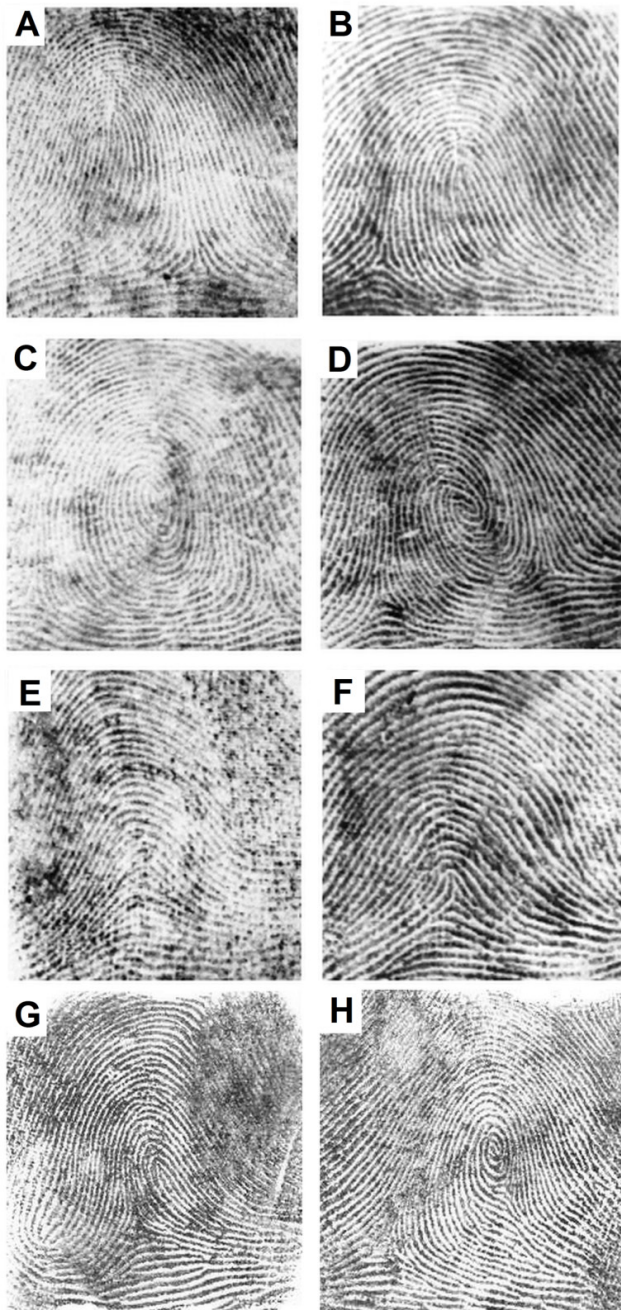


Figure 2. Different types of fingerprints. A: Ulnar loop, B: Radial loop, C: Plain Whorl, D: Double loop whorl, E: Plain arch, F: Tented arch, G: Accidental whorl, H: Central pocket loop.

Handedness wise differences of digital prints in females

Right hand. Table 1 shows the digital dermatoglyphic pattern distribution of the right hand in females. On the digit 3 of right hand of right-handed students found to have more ulnar loop (74%) compared to left handers (57%) and on the digit 5 of right hand of right-handed students found to have more ulnar loop (77%) compared to left handers (51%). On the digit 5 of right hand of left-handed

students found to have more radial loop (17%) compared to right handers (0%). Whorl and arch patterns have not shown significant difference. A statistically significant correlation was observed in digital dermatoglyphic patterns between right and left-handed people for digit 5 (Ulnar loop; $P = 0.0449$ and radial loop; $P = 0.0248$ by Fisher's exact test).

Left hand. Table 2 shows the digital dermatoglyphic pattern distribution of the left hand in females. On the digit 3 of left hand of right-handed students found to have more ulnar loop (71%) compared to left handers (54%) and on the digit 5 of left hand of right-handed students found to have more ulnar loop (69%) compared to left handers (49%). On the digit 2 of left hand of left-handed students found to have more ulnar loop (63%) compared to left handers (34%), followed by 40% whorl on right handed compared to 23% whorl in left handed. On the digit 1 of left hand of right-handed individuals found to have more whorl (46%) compared to left handers (29%), followed by 17% radial loop on left handed compared to 0% radial loop in right handed. A statistically significant correlation was observed in digital dermatoglyphic patterns between right and left-handed people for digit 1 (Radial loop; $P = 0.0248$ by Fisher's exact test) and digit 2 (Ulnar loop; $P = 0.0306$ by Fisher's exact test).

Handedness wise differences of digital prints in males

Right hand. Table 3 shows the digital dermatoglyphic pattern distribution of the right hand in males. On the digit 3 of right hand of right-handed students found to have more ulnar loop (74%) compared to left handers (49%) and on the digit 4 of right hand of right-handed students found to have more ulnar loop (49%) compared to left handers (23%). On the digit 3 of right hand of left-handed students found to have more whorl (43%) compared to right-handers (17%) and on the digit 4 of right hand of left-handed students found to have more whorl (69%) compared to right handers (40%). Radial loop and arch pattern have not shown significant difference. A statistically significant correlation was observed in digital dermatoglyphic patterns between right and left-handed people for digit 3 (Ulnar loop; $P = 0.0486$ and whorl; $P = 0.0356$ by Fisher's exact test) and digit 4 (Ulnar loop; $P = 0.0449$ and whorl; 0.0301 by Fisher's exact test).

Left hand. Table 4 shows the digital dermatoglyphic pattern distribution of the right hand in males. On the digit 2 of left hand of left-handed students found to have more ulnar loop (63%) compared to right handers (43%) and on the digit 4 of left hand of right-handed students found to have more ulnar loop (60%) compared to left handers (37%). Radial loop, whorl and arch pattern have not shown significant difference. A statistically significant correlation was observed in digital dermatoglyphic patterns between right and left-handed people for digit 4 (0.016 by Fisher's exact test).

The percentage of digital dermatoglyphics pattern distributions for both hands in male and female Sinhalese are shown in Figure 3 and Figure 4.

Discussion

It has been affirmed that the digital dermatoglyphic pattern of the skin is unique and unchallengeable for an individual¹. This is valuable as a means of identification. In this study, effort has been made

Table 1. Digital dermatoglyphic pattern distribution of right hand in females.

Digit	Handedness	Ulnar Loop				P value‡	Radial Loop				P value‡	Whorl				P value‡	Arch				P value‡
		(+)		(-)			(+)		(-)			(+)		(-)			(+)		(-)		
		n	%	n	%		n	%	n	%		n	%	n	%		n	%	n	%	
Digit 1	Right	23	66	12	34	0.6238	0	0	35	100	0.2391	12	34	23	66	1	0	0	35	100	1
	Left	20	57	15	43		3	9	32	91		11	31	24	69		1	3	34	97	
Digit 2	Right	21	60	14	40	1	0	0	35	100	0.4928	11	31	24	69	1	3	9	32	91	0.6139
	Left	22	63	13	37		2	6	33	94		10	29	25	71		1	3	34	97	
Digit 3	Right	26	74	9	26	0.2076	2	6	33	94	0.4283	7	20	29	83	0.5798	0	0	35	100	1
	Left	20	57	15	43		5	14	30	86		9	26	26	74		1	3	34	97	
Digit 4	Right	19	54	16	46	1	1	3	34	97	1	15	43	20	57	0.6238	0	0	35	100	0.4928
	Left	19	54	16	46		2	6	33	94		12	34	23	66		2	6	33	94	
Digit 5	Right	27	77	8	23	0.0449*	0	0	35	100	0.0248*	8	23	27	77	0.7851	0	0	35	100	1
	Left	18	51	17	49		6	17	29	83		10	29	25	71		1	3	34	97	

‡ = Two sided fishers exact test, * P=<0.05.

Table 2. Digital dermatoglyphic pattern distribution of left hand in females.

Digit	Handedness	Ulnar Loop				P value‡	Radial Loop				P value‡	Whorl				P value‡	Arch				P value‡
		(+)		(-)			(+)		(-)			(+)		(-)			(+)		(-)		
		n	%	n	%		n	%	n	%		n	%	n	%		n	%	n	%	
Digit 1	Right	17	49	18	51	0.8112	0	0	35	100	0.0248*	16	46	19	54	0.2159	2	6	33	94	0.4928
	Left	19	54	16	46		6	17	29	83		10	29	25	71		0	0	35	100	
Digit 2	Right	12	34	23	66	0.0306*	5	14	30	86	0.7096	14	40	21	60	0.1975	4	11	31	89	0.6733
	Left	22	63	13	37		3	9	32	91		8	23	27	77		2	6	33	94	
Digit 3	Right	25	71	10	29	0.2159	1	3	34	97	0.3565	7	20	28	80	0.5781	2	6	33	94	1
	Left	19	54	16	46		4	11	31	89		10	29	25	71		2	6	33	94	
Digit 4	Right	18	51	17	49	1	1	3	34	97	0.3565	16	46	19	54	0.3261	0	0	35	100	1
	Left	19	54	16	46		4	11	31	89		11	31	24	69		1	3	34	97	
Digit 5	Right	24	69	11	31	0.1449	1	3	34	97	0.3565	9	26	26	74	0.4403	1	3	34	97	1
	Left	17	49	18	51		4	11	31	89		13	37	22	63		1	3	34	97	

‡ = Two sided fishers exact test, * P = <0.05.

Table 3. Digital dermatoglyphic pattern distribution in right hand of males.

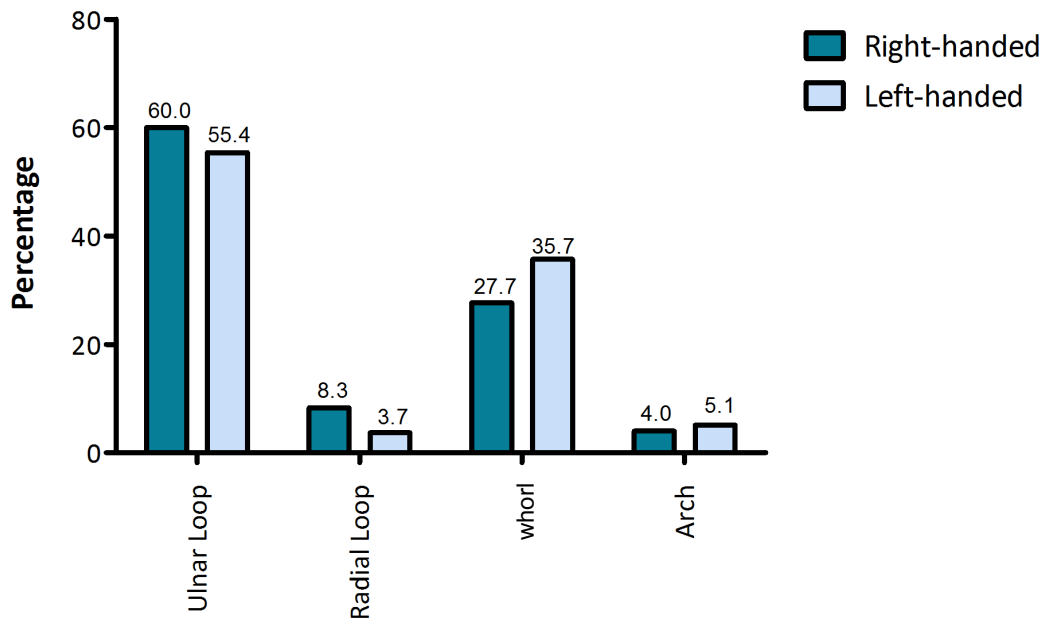
Digit	Handedness	Ulnar Loop				P value‡	Radial Loop				P value‡	Whorl				P value‡	Arch				P value‡
		(+)		(-)			(+)		(-)			(+)		(-)			(+)		(-)		
		n	%	n	%		n	%	n	%		n	%	n	%		n	%	n	%	
Digit 1	Right	20	57	15	43	1	2	6	33	94	0.4928	13	37	22	63	1	0	0	35	100	0.4928
	Left	19	54	16	46		0	0	35	100		14	40	21	60		2	6	33	94	
Digit 2	Right	19	54	16	46	1	3	9	32	91	1	9	26	26	74	1	4	11	31	89	1
	Left	18	51	17	49		4	11	31	89		9	26	26	74		4	11	31	89	
Digit 3	Right	26	74	9	26	0.0486*	1	3	34	97	1	6	17	29	83	0.0356*	2	6	33	94	1
	Left	17	49	18	51		2	6	33	94		15	43	20	57		1	3	34	97	
Digit 4	Right	17	49	18	51	0.0449*	4	11	31	89	0.6733	14	40	21	60	0.0301*	0	0	35	100	1
	Left	8	23	27	77		2	6	33	94		24	69	11	31		1	3	34	97	
Digit 5	Right	26	74	9	26	1	4	11	31	89	0.1142	5	14	30	86	0.3707	0	0	35	100	1
	Left	26	74	9	26		0	0	35	100		9	26	26	74		0	0	35	100	

‡ = Two sided fishers exact test, * P = <0.05.

Table 4. Digital dermatoglyphic pattern distribution of left hand in males.

Digit	Handedness	Ulnar Loop				P value‡	Radial Loop				P value‡	Whorl				P value‡	Arch				P value‡
		(+)		(-)			(+)		(-)			(+)		(-)			(+)		(-)		
		n	%	n	%		n	%	n	%		n	%	n	%		n	%	n	%	
Digit 1	Right	20	57	15	43	0.3185	2	6	33	94	1	13	37	22	63	0.2968	0	0	35	100	1
	Left	25	71	10	29		1	3	34	97		8	23	27	77		1	3	34	97	
Digit 2	Right	15	43	20	57	0.1503	4	11	31	89	0.6733	11	31	24	69	0.1535	5	14	30	86	1
	Left	22	63	13	37		2	6	33	94		5	14	30	86		6	17	29	83	
Digit 3	Right	21	60	14	40	0.6307	3	9	32	91	1	8	23	27	77	0.4279	3	9	32	91	1
	Left	18	51	17	49		2	6	33	94		12	34	23	66		3	9	32	91	
Digit 4	Right	21	60	14	40	0.0935	3	9	32	91	0.2391	11	31	24	69	0.016*	0	0	35	100	1
	Left	13	37	22	63		0	0	35	100		22	63	13	37		0	0	35	100	
Digit 5	Right	25	71	10	29	0.5781	3	9	32	91	0.2391	7	20	28	80	1	0	0	35	100	1
	Left	28	80	7	20		0	0	35	100		7	20	28	80		0	0	35	100	

‡ = Two sided fishers exact test, * P = <0.05.



Digital dermatoglyphic patterns

Figure 3. Digital dermatoglyphics pattern distributions in both hands of males.

to study the relationship between dermatoglyphic and handedness in 140 Sinhalese students.

The results showed that a statistically significant correlation exists in digit 5 of the right hand while digit 1 and digit 2 of left hand in female. In males digit 3 and digit 4 of right hand and digit 4 of left hand showed a statistically significant correlation.

In the past, few studies have been conducted on different ethnic groups with the idea of establishing a relationship between handedness and

dermatoglyphic pattern. Results of some studies are in line with the present study.

In their study on Caucasian school children in southwestern Ohio, Cromwell and Rife (1942)⁹ observed a slightly higher frequency of whorls (1.3%) on left ring fingers (digit 4) of left-handers than of right-handers. Whorls were absent on the right ring finger of both right- and left-handers. They further observed that the incidence of arches only on digit 3 of right hands shows highly significant differences between left-handers and right-handers (P<0.001).

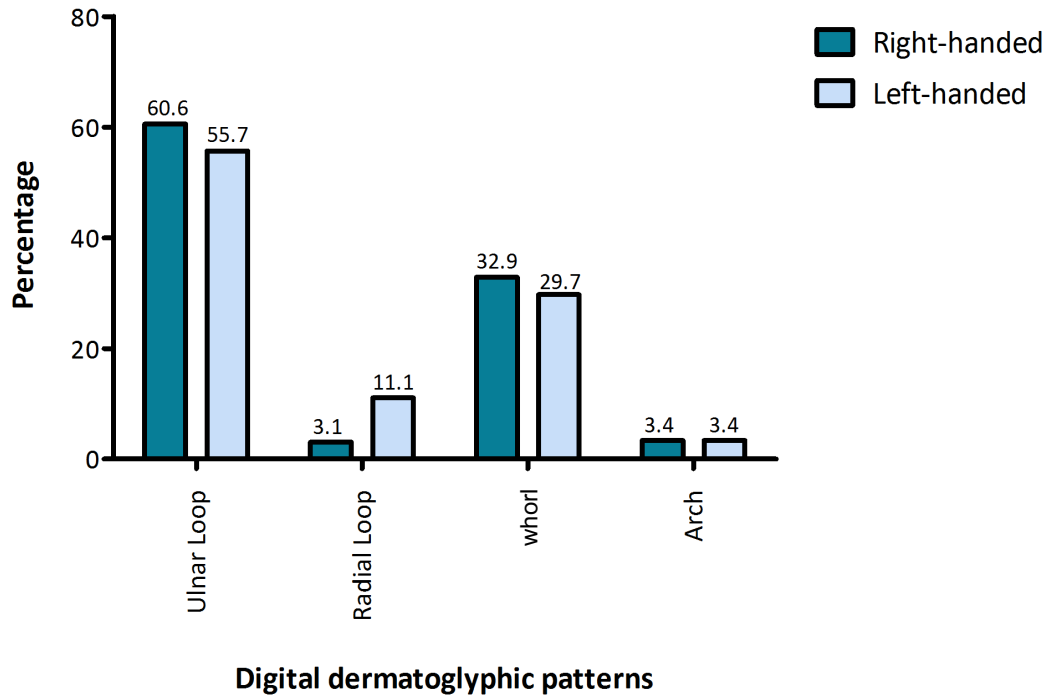


Figure 4. Digital dermatoglyphics pattern distributions in both hands of females.

Coren (1994)¹¹ in his study on Canadians found that left-handers were more likely to have arches and radial loops, while fewer whorls than right-handers. The correlation of handedness and digital dermatoglyphics was most marked on the left hand, which showed significant differences on four digits except digit 1. On the right hand, handedness was associated with a digital dermatoglyphics patterns only on digit 4.

Cho (2010)¹², in their study on Koreans, found that both hands of left handers exhibited more arch and ulnar loop types than the right-handers and less whorl and radial loop types than the right-handers. The digital dermatoglyphic pattern of digit 3, digit 4 and digit 5 of the left hand showed a statistically significant relationship between left- and right-handed people.

In Karev's study on Bulgarian individuals¹³, he found that whorls were significantly less frequent, and ulnar loops significantly more frequent in all digits for right-handed people when compared to left-handed people. The ulnar fluctuating asymmetries of digits 1 and 4 showed a highly significant relationship with handedness.

Rife (1955)¹⁶, in his study on students at Ohio State University, USA, observed that arches were more common on the left middle finger of right-handed students than left-handed students. Left-handedness has a frequency of about 10% in the general population with a

slightly higher frequency in the male population compared to the female population^{17,18}. In our study we analyzed dermatoglyphics pattern of 70 left hander's (35 males, 35 females) and compared it with right hander's (35 males, 35 females). Gender wise differences in digital dermatoglyphics patterns have been established for now and then¹⁹. We compared handedness wise difference of dermatoglyphics pattern in right and left hand of both male and female Sinhalese separately.

The major limitation of our study is the small sample size. Despite the small sample size, it exhibited a significant handedness wise difference of dermatoglyphics among Sinhalese. Additional research involve large sample are needed to further confirm current findings

Conclusion

The present study supports the hypothesis that handedness and digital dermatoglyphics are correlated in members of the Sinhalese population. Our results show that there is a statistically significant difference in fingerprint patterns between right- and left-handed people for digit 5 of the right hand and for digits 1 and 2 of the left hand in females, and digit 3 and digit 4 of the right hand and digit 4 of the left hand in males. The results of this study support the relationship between handedness and digital dermatoglyphics in the Sinhalese population. The results can be used as supporting evidence for personal identification.

Authors contributions

BTBW was involved in study conception and design. BTBW and RMGK assisted with data collection, study coordination and data analysis. Both authors were involved with drafting the manuscript. Both authors read and approved the final manuscript.

Competing interests

No relevant competing interests were disclosed.

Grant information

The author(s) declared that no grants were involved in supporting this work.

References

- Girard J: **Criminalistics: Forensic science and crime**. Illustrated ed. USA: Jones & Bartlett Learning; 2007; 128–152.
[Reference Source](#)
- Cummins H, Midlo C: **Finger prints, palms and soles: An introduction to dermatoglyphics**. Illustrated Ed. New York: Dover Publications; 1961.
[Reference Source](#)
- Miličić J, Pavičević R, Halbauer M, *et al.*: **Analysis of qualitative dermatoglyphic traits of the digito-palmar complex in carcinomas**. In *The State of Dermatoglyphics: The Science of Finger and Palm Prints*. Illustrated Edition. Edited by Norris M Durham, Kathleen M Fox, Chris C Plato: Pennsylvania State University; Edwin Mellen Press; 2000; **29**(2): 637–42.
[Reference Source](#)
- Bonnevie K: **Studies on papillary patterns of human fingers**. *J Genet*. 1924; **15**(1): 1–111.
[Publisher Full Text](#)
- Raymond M, Pontier D: **Is there geographical variation in human handedness? Laterality: Asymmetries of Body, Brain and Cognition**. 2004; **9**(1): 35–51.
[PubMed Abstract](#) | [Publisher Full Text](#)
- Stark MM: **Clinical forensic medicine: a physician's guide**. Humana Press; 2011; p. 473.
[Reference Source](#)
- Cummins H, Leche S, McClure K: **Bimanual variation in palmar dermatoglyphics**. *Am J Anat*. 1931; **48**(1): 199–230.
[Publisher Full Text](#)
- Cummins H: **Fingerprints correlated with handedness**. *Am J Phys Anthropol*. 1940; **26**(1): 151–66.
[Publisher Full Text](#)
- Cromwell H, Rife DC: **Dermatoglyphics in relation to functional handedness**. *Hum Biol*. 1942; **14**(4): 517–526.
[Reference Source](#)
- Rife DC: **Genetic interrelationships of dermatoglyphics and functional handedness**. *Genetics*. 1943; **28**(1): 41–8.
[PubMed Abstract](#) | [Free Full Text](#)
- Coren S: **Are fingerprints a genetic marker for handedness?** *Behav Genet*. 1994; **24**(2): 141–8.
[PubMed Abstract](#) | [Publisher Full Text](#)
- Cho KJ, Kim SI: **Characteristics of Fingerprints According to Type of Handedness**. *Korean J Phys Anthropol*. 2010; **23**(1): 21–31.
[Reference Source](#)
- Karev GB: **Finger dermatoglyphics and their asymmetry in Bulgarian right-, mixed- and left-handers**. *Anthropol Anz*. 2008; **66**(3): 281–93.
[PubMed Abstract](#)
- Minahan JB: **Ethnic Groups of South Asia and the Pacific: An Encyclopedia**. ABC-CLIO, 2012.
[Reference Source](#)
- Oldfield RC: **The assessment and analysis of handedness: the Edinburgh inventory**. *Neuropsychologia*. 1971; **9**(1): 97–113.
[PubMed Abstract](#) | [Publisher Full Text](#)
- Rife DC: **Hand prints and handedness**. *Am J Hum Genet*. 1955; **7**(2): 170–9.
[PubMed Abstract](#) | [Free Full Text](#)
- Gilbert AN, Wysocki CJ: **Hand preference and age in the United States**. *Neuropsychologia*. 1992; **30**(7): 601–608.
[PubMed Abstract](#) | [Publisher Full Text](#)
- Coren S, Halpern DF: **Left-handedness: a marker for decreased survival fitness**. *Psychol Bull*. 1991; **109**(1): 90–106.
[PubMed Abstract](#) | [Publisher Full Text](#)
- Gutierrez-Redomero E, Alonso C, Romero E, *et al.*: **Variability of fingerprint ridge density in a sample of Spanish caucasians and its application to sex determination**. *Forensic Sci Int*. 2008; **180**(1): 17–22.
[PubMed Abstract](#) | [Publisher Full Text](#)

Current Referee Status:

Referee Responses for Version 2



Esperanza Gutierrez Redomero

Department of Zoology and Physical Anthropology, Faculty of Biology, University of Alcalá, Alcalá de Henares, Madrid, Spain

Approved: 09 October 2013

Referee Report: 09 October 2013

In the Methods section, the authors say: "We recruited 50 predominant right-handers and 50 predominant left-handers after evaluating handedness" but in the Results section they say "In this study we observed the handedness-wise digital dermatoglyphics pattern distribution of 140 individuals (70 lefthanded [35 females, 35 males] and 70 right-handed [35 males, 35 females])". The error should be corrected

I have read this submission. I believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Competing Interests: No competing interests were disclosed.



Matea Zajc Petranović

Institute of Anthropology, Zagreb, Croatia

Approved: 08 July 2013

Referee Report: 08 July 2013

The article is clearly laid out and all the key elements are present. It was significantly improved after including previous reviewers' comments.

I have read this submission. I believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Competing Interests: No competing interests were disclosed.

1 Comment

Author Response

Buddhika Wijerathne, Faculty of Medicine and Allied Sciences, Rajarata University of Sri Lanka, Sri Lanka, Sri Lanka

Posted: 01 Aug 2013

We would like to thank Matea Zajc Petranović for spending her valuable time to review the manuscript.

Competing Interests: No competing interests were disclosed.

Referee Responses for Version 1



Esperanza Gutierrez Redomero

Department of Zoology and Physical Anthropology, Faculty of Biology, University of Alcalá, Alcalá de Henares, Madrid, Spain

Approved with reservations: 07 May 2013

Referee Report: 07 May 2013

The study was based on data from 100 individuals (50 left-handed [31 females, 19 males] and 50 right-handed [27 males, 23 females]). The greatest limitation of this study is the small sample size, as authors indicate; this size would be even smaller if the sample was analyzed by sex, as should have been done. The distribution of digital patterns presents sex differences in most of the samples analyzed, and so, the results cannot be accepted because they are affected by the effect of sex differences.

I have read this submission. I believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Competing Interests: No competing interests were disclosed.

1 Comment

Author Response

Buddhika Wijerathne, Faculty of Medicine and Allied Sciences, Rajarata University of Sri Lanka, Sri Lanka, Sri Lanka

Posted: 08 Jul 2013

We would like to thank Professor Esperanza Gutierrez Redomero for the valuable time spent reviewing our manuscript and the important comments she has made. We have attempted to address and incorporate most of the concerns that were raised in version 2 of our article.

Competing Interests: No competing interests were disclosed.