



# DERMATOGLYPHIC PATTERNS AND ACADEMIC PERFORMANCE OF COLLEGE STUDENTS: A RELATIONSHIP?



KRITI SACHAN<sup>1</sup>, \*SHEETAL MALHAN<sup>1</sup> , AKSHITA RASTOGI<sup>2</sup>, ANSHIKA JAIN<sup>2</sup>

<sup>1</sup>Department of Physiotherapy, School of Allied Health Sciences, Sharda University, Greater Noida, India

<sup>2</sup>Department of Physiotherapy, Teerthanker Mahaveer University, Moradabad, Uttar Pradesh India

Article Type: Research Article

Article Citation: Sachan K, Malhan S, Rastogi A, Jain A. Dermatoglyphic patterns and academic performance of college students: a relationship? SALT J Sci Res Healthc. 2022 March 03; 2(1): 34-39.

Received Date: February 19, 2022

Accepted Date: March 02, 2022

Published Date: March 03, 2022

\*Corresponding Author: Sheetal Malhan, Assistant Professor, Department of Physiotherapy, School of Allied Health Science, Sharda University, Greater Noida 201306, India.

ORCID ID: 0000-0002-8363-306X

Email: sheetalmalhanphysio@gmail.com

## ABSTRACT

Dermatoglyphics is the study of patterns of epidermal ridges and these patterns do not change through entire life and thus are unique features of identification. This study aimed at finding a relation between the dermatoglyphic patterns and the academic performance among the physiotherapy students of Teerthanker Mahaveer University with the sole intent of using these patterns for categorising students into above average, below average and average performance. A total of 100 physiotherapy students of 3<sup>rd</sup> and 4<sup>th</sup> year were included in the study (31 male and 69 female). The students were categorised as average, above average and below average performers on the basis of cumulative percentage of end term exams of last 2 years. The dermatoglyphic patterns were recorded using the flat-bed scanner method. Students with above average academic performance had prevalence of loop pattern (Whorls 37 %, loops 58 %, arches 4 %) while students with below average academic performance had prevalence of whorl pattern (Whorls 58 %, loops 39 %, arches 2 %) and a negative correlation of 'atd' angle to the academic performance was observed. Thus, these patterns may be used as adjunct tool for identifying and differentiate individuals on the basis of academic performance so that different methods and educational strategies may be made a part of the curriculum for enhancing the performance of low scoring individuals.

**Keywords:** Dermatoglyphics, fingerprint, atd angle, academic performance

## INTRODUCTION

Dermatoglyphics is the study of patterns of epidermal ridges that exist in palms and soles of an individual.<sup>[1]</sup> The term dermatoglyphics was given by Cummins which is derivative of two words 'derma' which refers to 'skin' and 'glyphe' which refers to 'curves'.<sup>[2]</sup> These ridges get differentiated in their permanent pattern during 3<sup>rd</sup>-4<sup>th</sup> month of fetal development and do not change through the entire life except for change in dimensions in proportion to individual's growth also, the characteristic ridge patterns of an individual are not distorted unless the epidermis is damaged to a depth of 1mm.<sup>[2]</sup>

The dermatoglyphic patterns are analysed in different

ways such as - Finger print analysis (e.g. arches, loops and whorls), Finger ridge counts, Position of the axial triradii 'atd' angle, No. of palmar triradii, a-b ridge count<sup>[3,4]</sup>

Studies have shown that the palm and fingerprint patterns are closely linked with brain functions as these patterns develop at the same period when brain development takes place from the ectoderm.<sup>[5]</sup> If there is any abnormality present in the genetic trait, the children inherit it and it is reproduced in the dermatoglyphic pattern of the individual<sup>[6]</sup>. Thus, it serves as a tool in identifying diseases having hereditary origin and is used to screen genetic anomalies.<sup>[2]</sup> Identification is based on characteristics which are unique for an individual which may be

physical, mental or psychological and dermatoglyphics play a major role in identification.<sup>[7]</sup>

Fingerprints are basically the impressions of patterns that are formed by epidermal or papillary ridges of fingertips.<sup>[8]</sup> Fingerprint patterns are determined genotypically and do not change from birth till death.<sup>[9]</sup> Each finger relates to a lobe of brain and each fingerprint relates to a specific learning type for e.g. Ulnar Loop pattern- Affective Learning, Radial loop pattern- Critical Thinking, Whorls are related with cognitive learning and Arch pattern is related with reflective learning.<sup>[10]</sup>

The term achievement is used in contrast with the term ability, which implies that achievement is a result of ability or effort.<sup>[11,12]</sup> However genetic researches suggest that the differences in academic achievement of an individual are significantly heritable.<sup>[13,14,15]</sup> The heritable nature of academic achievement is as significant as the heritability of intelligence.<sup>[16]</sup> The academia is premediated to enhance the learning ability and critical thinking by offering students with challenges.<sup>[17]</sup> In the educational settings, intelligence has a critical role in academic performance of an individual<sup>[18]</sup> and numerous studies have established that less IQ= Intelligence Quotient and attention deficits result in lower achievement levels.<sup>[19,20,21]</sup> Dermatoglyphic studies also help in making an individual aware of his potential, strengths and personality traits<sup>[10]</sup> and also assists in analysing multiple intelligences and thus can be used as a way to recognize and develop talents and for providing proper educational training.<sup>[22]</sup> Thus understanding about the factors that affect academic achievement is necessary to carry out efficient educational interventions for an individual's optimal perfor-

mance.<sup>[23]</sup>

Thus, this study attempts to find the relation of dermatoglyphic patterns with academic performance of students in order to use dermatoglyphics as a tool for identifying and differentiate individuals on the basis of academic performance so that different methods and educational strategies can be made the part of curriculum for enhancing the performance of low scoring individuals.

## MATERIALS AND METHODS

In this study 100 subjects (males 31 and females 69) were included. The subjects were taken through purposive sampling from Department of Physiotherapy, Teerthanker Mahaveer University, Moradabad; who fulfilled the inclusion and exclusion criteria. To fulfil the inclusion criteria both male and female subjects between the age of 18-25 were included. Subjects involved in any sports activity, or with any physical disability or injury on hand were excluded from this study. A consent form was signed prior to the start of the procedure to ensure safety. The subjects received detailed explanation of the aims and procedure of the study.

The fingerprints of each participant were scanned bilaterally using Canon Lide 300 flatbed scanner. The hands of the subjects were clean, and fingerprints were scanned by placing the subject's hand against the scanning surface with fingers apart. Thumb images were scanned separately due to orientation of thumb in different plane. The dermatoglyphic patterns of the subjects were evaluated according to the classification given by Cummins and Midlow.<sup>[2]</sup>



Figure1. Canon Lide 300 flatbed scanner

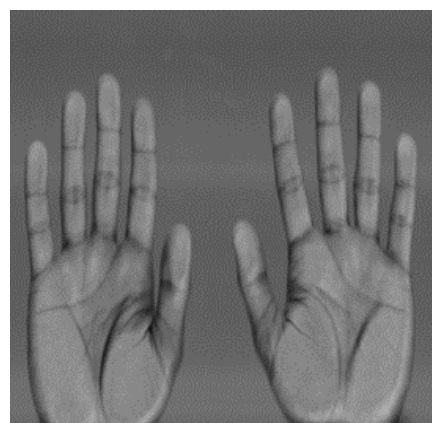


Figure 2. Hand scans

For the atd angle, 'a', 't', 'd' delta points were marked and joined using a marker & magnifying glass and the angle was measured using a protractor.

The students were divided in 3 categories on the basis of their academic performance: above average, average and below average. The parameter for measuring academic performance was taken as cumulative percentage of two consecutive end term exams. Students with above average performance scored 70 % and above (n= 26), students who scored between 60 % to 70 % were average performers (n=58) and students with below 60 % were categorised as below average (n=16). The data was recorded in MS excel (2016 version) and was analysed using SPSS software (version 20).

## RESULTS AND DISCUSSION

The data was analysed using SPSS software. Correlation between both the variables was achieved using Pearsons test. **'atd' angle**- Readings of 'atd' angles in above average students is Mean= 41.31, S.D= 3.42 of

left hand and Mean= 39.77, S.D= 4.30 of right hand. In average students the readings are Mean= 41.34, S.D= 4.89 of left hand and Mean= 40.69, S.D= 5.55 of right hand. In below average students Mean= 41.13, S.D= 3.94 of left hand and Mean= 39.69, S.D= 3.36 of the right hand.

### Fingerprint Patterns and Academic Performance

Correlation between readings of academic performance [Mean= 65.41, S.D= 5.90] and frequency of fingerprint patterns i.e. whorls [Mean= 4.26, S.D= 3.07] shows a weak negative correlation,  $r = -.199$  that of loops [Mean= 5.24, S.D= 2.73] shows a weak positive correlation,  $r = .206$  and arches [Mean= .51, S.D= 1.01] shows a very weak positive correlation,  $r = .047$  i.e. the  $r$  lies from 0 to 1.

### 'atd' Angle and Academic Performance

Correlation of readings of the average percentage of marks in end term exams [Mean=65.41, S.D= 5.90] and readings of 'atd' angle of the dominant hand [Mean= 40.28, S.D= 4.93] is very weakly negative,  $r = -.015$  i.e. the  $r$  value lies between 0 and 1.

Table1. Descriptive Statistics of 'atd' angle measurements

	ABOVE AVERAGE		AVERAGE		BELOW AVERAGE	
	ATD LEFT	ATD RIGHT	ATD LEFT	ATD RIGHT	ATD LEFT	ATD RIGHT
MEAN	41.31	39.77	41.34	40.69	41.13	39.69
SD	3.42	4.30	4.89	5.55	3.94	3.36

Graph 1. Descriptive Statistics of 'atd' angle measurements

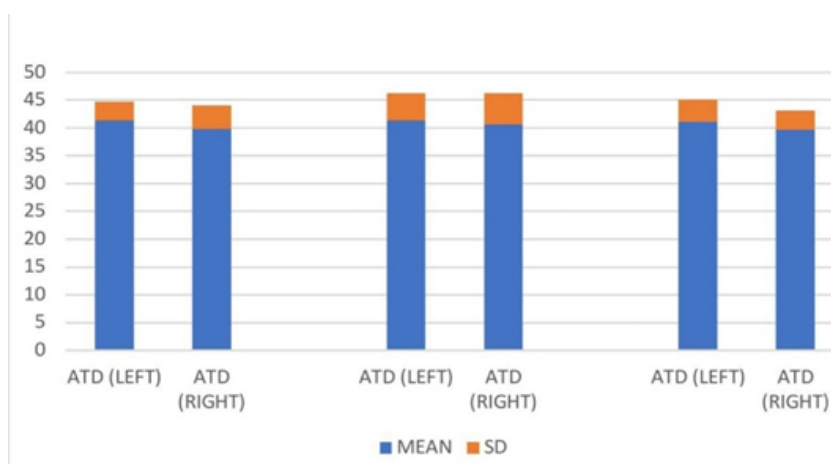


Table2. Correlation of finger patterns with academic performance

	Whorls	Loops	Arches
Mean	4.25	5.24	.51
SD	3.05	2.73	1.01
Correlation with academic performance	-.193	.206	.047

Graph 2. Correlation of finger patterns with academic performance

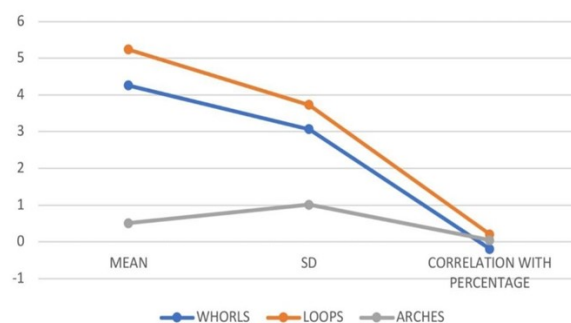
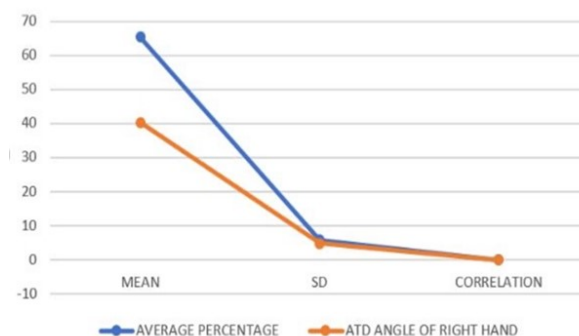


Table 3. Correlation of 'atd' angle with academic performance

	MEAN	SD	CORRELATION
AVERAGE PERCENTAGE OF MARKS	65.41	5.90	-.015
ATD ANGLE OF RIGHT HAND	40.28	4.93	-.015

Graph 3. Correlation of 'atd' angle with academic performance



## DISCUSSION

### ATD angle and academic achievement

Previous researches have also shown that angles  $<30^\circ$  and  $>65^\circ$  are associated with mental retardation. [24] It was observed that majority of the sample group had 'atd' angle in the range  $34^\circ$  to  $47^\circ$  irrespective of their academic performance.

Cesarik concluded through their study that the 'atd' angle decreases in males and females with super intelligence but this trend was not observed in present work as both the students with higher academic performance and lower academic performance were found in similar range of the 'atd' angle. [25] This finding is analogous to a study done by Rishi and Sharma in which they found that there is no direct relationship between the academic performance and the atd angles. [26]

The results of the study show a very weak negative correlation between academic performance and 'atd' angle. The results confirm the alternative hypothesis and the correlation established is weak but the nature being negative indicates that with the increase in atd angle there may be a decrease in academic performance of

the individual though it cannot be postulated as the correlation between them is very weak.

### Finger print patterns and academic achievement

Analysis of finger print patterns from this study suggest that loop pattern is the most commonly occurring pattern followed by whorls and arches in both males and females which is in consonance with the previous studies.

Kanchan T et.al in their study among medical students found that loops were the most frequently occurring patterns followed by whorls and arches in both hands among males and females. While loops were predominant on index, middle and little fingers and whorls were predominant on the thumb and ring fingers. [9] Nayak et.al in their study among Malaysian medical students found that loops were the most dominant pattern followed by whorls. [27]

However, some studies suggest that whorls are the most commonly occurring pattern followed by loop and arch. Nayak et.al in their study studied about the correlation between dermatoglyphic pattern of right thumb,

academic performance and learning methodologies of medical students and found that whorl pattern was the most commonly occurring pattern in their study. But they also found that the loop pattern was associated with better academic performance of students [27] which is similar to the results of our study that reveal the students with higher academic performance have prevalence of loop pattern while ones with lower academic performance have a prevalence of whorl pattern.

Adenowo and Dareb in their study of fingerprint patterns of medical students have found that distribution of loop pattern was the highest among the category of good students. [28] Mostaf in his study of association of finger print patterns with intelligence quotient reported that the loop pattern is associated with better academic performance and higher IQ.[29]

Our results also show a weak negative correlation between whorls and academic performance and a very weak positive correlation between loop pattern and academic performance. The results of our study con-

firm the alternative hypothesis that there may be a significant correlation between fingerprint patterns and academic performance.

## CONCLUSION

This study shows that there is a negative co-relation of whorl pattern to the average percentage of marks of last 2 consecutive end term exams and a significant positive co-relation of loop patterns to the average percentage which suggests that students with prevalence of loop patterns show a better academic performance than individuals with prevalence of whorl patterns.

A negative correlation of 'atd' angle (dominant hand) was found to the average percentage of last 2 consecutive years end term exams which was very weakly significant which suggests that individuals with greater 'atd' angle may have a lower academic performance but this cannot be used as a method to segregate students who tend to score higher as the relation is very weakly significant.

## REFERENCES

1. Kobylansky E, Bejerano M, Kartznelson MB, Malkin I. Relationship between genetic anomalies of different levels and deviations in dermatoglyphic traits- dermatoglyphic sexual dimorphism in control healthy group of Israel Jews. *Hist Anthropol*. 2006; 4: 61-121.
2. Cummins H, Midlow C. *Finger Prints, palm and sole. An introduction to dermatoglyphics*. 1961; Dover Publication. Inc New York.
3. Schaumann B, Alter M. *Dermatoglyphics in medical disorders*. New York: Springer Verlag; 1976: 187-189.
4. Chimne HD, Ksheersagar DD. Dermatoglyphics in Angiographically proven coronary artery disease. *J Anat Soc India*. 2012; 61(2): 262-8.
5. van Oel CJ, Baaré WF, Hulshoff Pol HE, Haag J, Balazs J, Dingemans A, Kahn RS, Sitskoorn MM. Differentiating between low and high susceptibility to schizophrenia in twins: the significance of dermatoglyphic indices in relation to other determinants of brain development. *Schizophr Res*. 2001 Dec 1;52(3):181-93. [https://doi.org/10.1016/s0920-9964\(01\)00153-0](https://doi.org/10.1016/s0920-9964(01)00153-0). PMID: 11705712.
6. Walker JFA. Sex linked recessive finger print pattern. *J Hered*. 1964; 32: 279-80.
7. Rastogi P, Pillai KR. A study of finger prints in relation of gender and blood groups. *J Indian Acad Forensic Medicine*. 2010; 32: 11-3.
8. Purkinje JE, physiological examination of visual organ and of the cutaneous system Brilaree/Vratisavial Typis Universities, 1823 (translated to English by Cummins H and Kennedy RW; *Am.J. Crim Law. Criminal*) 1940; 31; 343-356.
9. Kanchan T, Chattopadhyay S. Distribution of finger print patterns among medical students. *J Indian Acad Forensic Med*. 2006; 28(2): 65-68.
10. Kumari L, Babu V, Kumar V. Dermatoglyphics and Its relation to intelligence levels of young students. *IOSR J Dent Med Sci*. 2014; 13: 1-3.
11. Asbury K, Plomin R. *G is for Genes: The Impact of Genetics on Education and Achievement* (Wiley-Blackwell, Chichester, UK). 2013.
12. Nye B, Konstantopoulos S, Hedges LV. How large are teacher effects? *Educ Eval Policy Anal*. 2004; 26(3): 237-257.
13. Gill CE, Jardine R, Martin NG. Further evidence for genetic influences on educational achievement. *Br J Educ Psychol*. 1985 Nov;55 ( Pt 3):240-50. <https://doi.org/10.1111/j.2044-8279.1985.tb02629.x>. PMID: 4084442.
14. Martin NG, Martin PG. The inheritance of scholastic abilities in a sample of twins. I. Ascertainments of the sample and diagnosis of zygosity. *Ann Hum Genet*. 1975 Oct;39(2):213-8. <https://doi.org/10.1111/j.1469-1809.1975.tb00124.x>. PMID: 1053248.
15. Plomin R, DeFries JC, Knopik VS, Neiderhiser JM. *Behavioral Genetics* (Worth Publishers, New York), 6<sup>th</sup> Ed.; 2013.
16. Kovas Y, Voronin I, Kaydalov A, Malykh SB, Dale PS, Plomin R. Literacy and numeracy are more heritable than intelligence in primary school. *Psychol Sci*. 2013 Oct;24(10):2048-56. <https://doi.org/10.1177/0956797613486982>. Epub 2013 Sep 3. PMID: 24002885; PMCID: PMC3834736.

17. Kennett DJ, Keefer K. Impact of learned resourcefulness and theories of intelligence on academic achievement of university students: An integrated approach. *J Educ Psychol.* 2006 Jun 1; 26(3): 441-57.
18. Soares DL, Lemos GC, Primi R, Almeida LS. The relationship between intelligence and academic achievement throughout middle school: The role of students' prior academic performance. *Learning and Individual Differences.* 2015 Jul 1; 41:73-8. <http://dx.doi.org/10.1016/j.lindif.2015.02.005>.
19. Hinshaw SP. Externalizing behavior problems and academic underachievement in childhood and adolescence: causal relationships and underlying mechanisms. *Psychol Bull.* 1992 Jan;111(1):127-55. <https://doi.org/10.1037/0033-2909.111.1.127>. PMID: 1539086.
20. Hedges, L. V., & Nowell, A. (1999). Changes in the black- white gap in achievement test scores. *Sociology of Education.* 1999; 72(2), 111-135.
21. Johnson W, McGue M, Iacono WG. Disruptive behaviour and school grades: Genetic and Environmental relations in 11-year-olds. *J Educ Psychol.* 2005; 97: 391-405.
22. Fournier NA, Ross AH. Sex, Ancestral, and pattern type variation of fingerprint minutiae: A forensic perspective on anthropological dermatoglyphics. *Am J Phys Anthropol.* 2016 Aug;160(4):625-32. <https://doi.org/10.1002/ajpa.22869>. Epub 2015 Sep 23. PMID: 26397817.
23. Rimfeld K, Kovas Y, Dale PS, Plomin R. True grit and genetics: Predicting academic achievement from personality. *J Pers Soc Psychol.* 2016 Nov;111(5):780-789. <https://doi.org/10.1037/pspp0000089>. Epub 2016 Feb 11. PMID: 26867111; PMCID: PMC4981570.
24. Vashist M, Neelkamal M, Yadav R, Lal M. Trisomy-T (21; 21) with Mosaicism in a Down Syndrome Girl Child Case Report. *Int J Hum Genet.* 2009 Jun 1; 9(2): 105-7.
25. Cesarik M, Bozicevic D, Milicic J, Ivekovic V, Pavicevic R. Quantitative dermatoglyphic analysis in persons with superior intelligence. *Coll Anthropol.* 1996 Jan 1; 20(2).
26. Rishi R, Sharma A. Relationship of Angle atd with academic performance level of science students in Annual Senior Secondary Examination. *Int J Innov Res Practices.* 2014; 2(9): 1-9.
27. Nayak SB, Kaur PJ, Teow XM, Tan JM, Aithal AP. A study on the dermatoglyphic pattern of the right thumb among the Malaysian medical students. *J Punjab Acad Forensic Med Toxicol.* 2016; 16(1): 26-30.
28. Adenowo TK, Dare BJ. Digital and Palmer Dermatoglyphic; A bio-indicator for intelligence quotient. *J Basic Appl Res.* 2016; 2(3): 313-9.
29. Najafi M. Association between finger Patterns of Digit II and Intelligence Quotient level in adolescents. *Iran J Pediatr.* 2009; 19(3): 277-284.



**ARTICLE TYPE:** Research Article; **ORCID ID:** Open Researcher and Contributor Identifier (ORCID) ID of corresponding author: <https://orcid.org/0000-0002-8363-306X>; **ETHICAL:** Institutional Ethics Committee; **ACKNOWLEDGEMENT:** None; **FINANCIAL DISCLOSURE:** The authors declare that there was no financial aid received.; **CONFLICT OF INTEREST:** No conflict of interest associated with this research work.; **AUTHORS CONTRIBUTION:** Idea and Conceptualization: K.S., S.M., Collection of Data, Compilation: A.R., A.J., K.S., S.M., Final Editing: K.S., S.M.; **CORRESPONDING AUTHOR AFFILIATIONS:** Sheetal Malhan, Assistant Professor, Department of Physiotherapy, School of Allied Health Science, Sharda University, Greater Noida 201306, India.; **CORRESPONDING AUTHOR EMAIL:** sheetalmalhanphysio@gmail.com; **ARTICLE CITATION:** Sachan K, Malhan S, Rastogi A, Jain A. Dermatoglyphic patterns and academic performance of college students: a relationship? *SALT J Sci Res Healthc.* 2022 March 03; 2(1): 34-39.

**PUBLISHER'S NOTE:** All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

© Kriti Sachan, [Sheetal Malhan](#), Akshita Rastogi, Anshika Jain.

Originally published in the *SALT Journal of Scientific Research in Healthcare* (<https://saltjsrh.in/>), 03.03.2022.

This is an open-access article distributed under the terms of the Creative Commons License (<https://creativecommons.org/licenses/by-nc-nd/4.0/>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work, first published in the *SALT Journal of Scientific Research in Healthcare* (<https://saltjsrh.in/>), is properly cited. The complete bibliographic information, a link to the original publication on <https://saltjsrh.in/>, as well as this copyright and license information must be included.