Study on the Relationship between Fingerprint Pattern and Intellectual Performance

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A B S T R A C T

Background: The concepts of 'Intelligence' and 'Intellectual Performance' though seem alike, but are different. Intelligence assessment of an individual is technical, is done by the application of multiple, reliable and validated, IQ (Intelligence Quotient) tests on the same individual in different settings (date, place and time). However, 'Intellectual performance' (IP) has a reference only to the present study, wherein, multiple choice questions (MCQs) test was conducted to analyse intelligence of the participants in a single setting. Loop, Whorl, Arch and Composite form the 4 main patterns of a fingerprint system. From the data reported by authors of the previous studies, it was evident that relationship existed between fingerprint pattern and an individual's intelligence. Thus, the present study was taken up with the goal to assess the relationship.

Methods: The present study was descriptive-correlational, and was approved by the Institutional Ethics Committee (IEC) of Velammal Medical College Hospital and Research Institute, and included consenting medical (MBBS) students (aged between 19 to 21 years) of the same institute. The population was 138 students, of which, 137 students (sample size) participated in the study with the implementation of the inclusion criteria. Sample size being 137, of a total population of 138 students, meant Confidence Level as 95% with Confidence Interval as 1.

Results: It was observed that participants with **'**Arch**'** fingerprint pattern performed better. To assess the statistical significance, Chi Square Test was applied. The test was significant with p value = 0.034553 (< 0.05), which meant, participants with arch pattern performed significantly better than others. Further statistical analysis revealed that it was female participants with **'**Arch**'** fingerprint pattern, who significantly (p value=0.007872) contributed to the overall better performance of the participants with **'**Arch**'** fingerprint pattern.

Conclusion: loops were more frequent (44.5%) amongst the participants. However, in the present study, loops and whorls were less frequent, whereas, arch and composite were more frequent in comparison to standard distribution of occurrence. It was observed that participants with **'**Arch**'** fingerprint pattern performed better.

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►*Implication for health policy/practice/research/medical education:* Fingerprint Pattern and Intellectual Performance

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1. Introduction:

The concepts of 'Intelligence' and 'intellectual performance' though seem alike, but are different. Intelligence assessment of an individual is technical, is done by the application of multiple, reliable and validated, IQ (Intelligence Quotient) tests on the same individual in different settings (date, place & time). However, 'Intellectual performance' (IP) has a reference only to the present study, wherein, multiple choice questions (MCQs) test was conducted to analyse intelligence of the participants in a single setting.

Fingerprint system (dactylography) was, and still is, one of the most useful tools in identifying a person. DNA fingerprinting, though regarded as more superior to dactylography in uniqueness; in monozygotic (identical) twins, it's the fingerprint which is unique, not the DNA pattern. Dactylography is still an essential tool for identification in Forensic analysis. Fingerprints are constant, unique and form the most reliable criteria for identification (1). They are impressions of friction ridges of all parts of the finger (2). A friction ridge is a raised portion of the epidermis on the palmar and plantar skin (3). Fingerprints are genotypically determined and thus remain unchanged from birth till death (4).

Adermatoglyphia is one rare medical condition characterized by the absence of fingerprints. Affected people have smooth fingertips, palms, toes and soles, but no other medical signs or symptoms. Many researchers describe it as immigration delay disease, because, lack of fingerprints causes delays when affected people attempt to prove their identity while travelling (5). Mutation in a gene (SMARCAD1), which is responsible for the formation of dermatoglyphs, is supposedly the cause for Adermatoglyphia (6). The anti-cancer medication, capecitabine, may also cause loss of fingerprints (7). These conditions have a role in the present study by being a part of the exclusion criteria.

Loop, whorl, arch and composite form the 4 main patterns of a fingerprint system, with loops being more frequent (60%), followed by whorl, arch, and composite (8). Finger print classification systems include the Roscher system, the Juan Vucetich system, and the Henry Classification System. Amongst these, the Henry system was developed in India and implemented in most English-speaking countries (9). There are also more complex classification systems that sub-classify patterns even further as plain arches or tented arches, loops into radial and ulnar. Whorls may also have sub-group classifications including plain whorls, accidental whorls, double loop whorls, peacock's eye, and central pocket loop whorls (9). However, the present study focussed on the 4 main patterns, which are, Loop, whorl, arch and composite. We all have one or more of these patterns in our palmer and plantar skin.

Okajima, by his study in 1975, reported that finger print pattern is inherited from genes (10). Authors, Babler and Rossa et al, believed in prenatal environment playing a vital role in determining an individual's fingerprint pattern (11, 12). Mostaf, in his study in 2009, reported that each finger is connected with one brain lobe and a specific type of intelligence, and each type of fingerprint pattern is connected with a particular type of learning, like Whorl with Cognitive learning, Ulnar Loop with Affective Learning, Radial Loop with Critical Thinking, Tented Arch with Enthusiastic Learning, and plain Arch with Reflective Learning (13). Kumari et al, in

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her study in 2014, reported about variation in finger print patterns in intellectually disabled people from that of normal people (14). Charles parker, by his study in 1971, reported that fingerprint pattern does correlate with the intelligence of an individual (15). From the data reported by the authors of previous studies, it was clear that relationship did exist between fingerprint pattern and an individual's intelligence, which made author of the present study believe that more research is required, from various regions of the world, in order to provide reasonable explanations for fingerprint pattern and intelligence relationship. Thus, the present study was taken up with the objective to analyse the relationship between fingerprint pattern and intellectual performance of an individual.

2. Materials and Methods:

The present study was descriptive-correlational, and was approved by the Institutional Ethics Committee (IEC) of Velammal Medical College Hospital and Research Institute, and included consenting medical (MBBS) students (aged between 19 to 21 years) of the same institute (Inclusion Criteria). Age group 19-21years was taken up considering their accessibility to the department of Forensic Medicine. Also, age group interval was maintained at minimal (2 years) in order to avoid the age factor to affect the analysis of the study. Written informed consent was taken from the participants of the present study. Students, who failed to deliver legible fingerprint patterns, were excluded, and, students in whom finger ridges were obscured by scars, deformities, birth defect or disease, were also excluded (Exclusion Criteria). The population was 138 students, of which, 137 students (sample size) participated in the study with the implementation of the inclusion criteria. Sample size being 137, of a population of total 138 students (population), meant Confidence Level as 95% with Confidence Interval as 1. Sample size was calculated using Sample Size Calculator presented as a public service of Creative Research Systems: Survey software, '**The Survey System'.**

To standardize the procedure, left Thumb impression (data1) was taken using inkpad. Multiple choice questions (MCQs) test was conducted to analyze intellectual performance (IP) of the participants. All the questions were aimed at assessing basic reasoning and intelligence of the participants. The questions were prepared in a way that the participants needed to think out of the box to answer them. The questions can be considered reliable and valid by the fact that they were selected from various online IQ assessment tests with explained answers. The test was of 100 marks. Negative marking was implemented. Performance in that objective test reflected on intelligence of the participants, and was considered data2. The present study has 'Intellectual performance' in the title rather than just 'intelligence' because the study participants had to perform in the intelligence assessment MCQ test in order to prove their intelligence. Also, Intellectual performance, in the present study, is a derivative of inherent 'intelligence' of the respective participants, and therefore the terms, 'intellectual performance' and' intelligence' will be used in the same sense. Both data, along with basic data like age & sex, was entered in a tabulated proforma and analyzed to meet the objective of the study. Statistical analysis was done using online Graphpad software based on scores of the participants in the conducted test. Significance of correlation was assessed by the application of Chi-square test and unpaired T-test. Significance was assessed with P value<0.05.

3. Results:

Table1 mentions descriptive statistics, wherein, loops were more frequent (44.5%) amongst the participants. However, in the present study, loops and whorls were less frequent, whereas, arch and composite were more frequent in comparison to standard distribution of occurrence (8). It was observed that participants with **'**Arch**'** fingerprint pattern performed better. To assess the statistical significance of this better performance, Chi Square Test was applied (Table 2).

Table 1: Performance (*MCQ test scores)* distribution of the participants

	Participants (n=137)	%	Mean score (out of 100)	Standard Deviation (SD)
Loop (L)	61	44.5	62.87	16.24
Whorl (W)	42	30.7	62.98	16.08
Arch (A)	26	19	70.77	12.62
Composite (C)	8	5.8	59.38	15.45
Males (m)	55	40.1	66.09	15.60
Females (f)	82	59.9	62.93	15.75
19-20years	95	69.3	62.95	16.24
20-21years	42	30.7	67.02	16.08

Table 2: Chi square test on *MCQ test scores* of the participants

Chi Square Test	MCQ test scores out of 100				P value	Statistical result
	< 48.49	48.49-64.2	64.2-79.91	>79.91		
Arch	1	6	9	10	*0.0346*	*Significant at p<0.05*
other patterns	13	28	54	16		
Arch (f)	1	3	4	8	*0.0079*	*Significant at p<0.05*
other patterns(f)	10	19	29	8		
Arch (m)	0	3	5	2	*0.7746*	*Not Significant at p<0.05*
other patterns(m)	3	9	25	8		

Table 3: Unpaired t test on *MCQ test scores* of the participants

Unpaired t test	n=137 n(f)=82 n(m)=55	Mean Score (100)	Standard Deviation (SD)	Two-tailed P value	Statistical result
Arch	26	70.77	12.62	0.0172	Significant at p<0.05
other patterns	111	62.66	16.01		
Arch (f)	16	71.25	13.23	0.0175	Significant at p<0.05
other patterns (f)	66	60.91	15.74		
Arch (m)	10	70	12.25	0.3859	Not Significant at p<0.05
other patterns (m)	45	65.22	16.24		

Table 4: Unpaired t test on *IQ (Intelligence Quotient) scores* of the participants

Unpaired t test	n=137	Mean IQ	Standard Deviation (SD)	two-tailed P value	Statistical result
Arch	26	105.58	11.94	0.0180	Significant at p<0.05
other patterns	111	97.94	15.19		

In order to evaluate statistical significance using chi square test, performance of the participants was grouped into 4 categories, which were; "less than 48.49", "48.49 to 64.2", "64.2 to 79.91", and "greater than 79.91". These 4 categories in Table 2 were derivatives of Mean (64.2) and Standard Deviation (15.71) of overall performance of all the 137 participants. The test was significant with P value = 0.034553 (< 0.05),

which meant, participants with arch pattern performed significantly better than others. Further statistical analysis revealed that it was female participants with **'**Arch**'** fingerprint pattern, who significantly (P value=0.007872) contributed to the better performance of the participants with **'**Arch**'** fingerprint pattern.

Statistical analysis (unpaired t test) was done on IQ (intelligence quotient) scoring of the participants also (Table 4**)**. IQ scores of the participants were calculated as per the present method used in IQ tests (16). Median raw score was determined, which was 65. The median raw score of the sample was defined as IQ 100; and each standard deviation (15.71), on either side of the median, was defined as 15 IQ points.

4. Discussion:

In the present study, males outperformed females (not significantly though), and in comparison to the standard frequency of occurrence, Arch pattern was more frequent, loops were proportionately lower, and whorls, marginally lower. Significant correlation was seen between female participants with Arch fingerprint pattern and their intellectual performance. None of the other patterns showed significant correlation. This means, with presence of Arch fingerprint pattern in a female's left thumb, more are the chances of her being intelligent. In the study by Kumari et al in 2014, statistically insignificant results were reported, whereas, that by Parker in 1971, whorl pattern significantly correlated with high intelligence (14, 15). In the study reported by Parker, the lower intelligence quotient (IQ) ranges (70-89) had arches more in conjunction with loops; and in the upper IQ ranges (110-129), loops were found more often in conjunction with whorls. Both normal (90-109) and above normal (110-129) IQ ranges were found to have statistically significant amounts of whorl patterns as compared to below normal (70-89) IQ ranges. In the present study, arch pattern was more frequent in above average IQ (100-115) and high IQ (>115) ranges. Loops and whorls were found in conjunction with arch in below (85-100) and above average (100-115) IQs. Interestingly, composite pattern was more distributed towards below average (85-100) and low IQ (<85) ranges.

Parker had an assumption that arch pattern underlies all finger prints, and Arches, particularly tented arches, begin to merge with loops, and loops in turn merge with whorls. He considered Arch as the simplest pattern; loops as complex form of arch patterns and whorls, the most complex form of arch pattern. Parker thus hypothesised that, "more the complexity of an individual's fingerprint pattern, more are the chances of him/her being intelligent". However, the present study has contradicted his hypothesis.

The Henry Classification System classifies the fingerprint patterns (in order of decreasing frequency) into Loop, Whorl and Arch (8). This classification considers composite pattern as a form of whorl. Considering the Henry Classification System, 'Arch' being the least frequent of the fingerprint patterns, hypothesis; that can be made out of the results of the present study, is that, more the rarity of an individual's fingerprint pattern, more are the chances of him/her being intelligent. Thus, it can be summarised that, Parker's study found correlation in complexity of a fingerprint pattern with an individual's intelligence, whereas, the present study found correlation in rarity of a fingerprint pattern with an individual's intelligence.

All the participants, in the present study, hailed from various cultural backgrounds. The author believes this to be the only limitation of the present study, because, some participants could have had disadvantage in the test simply because they didn't have the cultural education required for the test to give accurate results. The author believes that this limitation can be overcome by conducting the study on single ethnic group, wherein, all participants hail from similar cultural backgrounds.

5. Conclusion

From the present study findings, it was observed that participants with presence of 'Arch' fingerprint pattern in their left thumbs

had a significant correlation to their intelligence. Chi Square Test was significant with P value = 0.034553 (< 0.05). Further statistical analysis revealed that it was female participants, with 'Arch' fingerprint pattern in their left thumbs, who significantly contributed to the overall better performance of the 'Arch' fingerprint pattern participants (Chi square test was significant with p value=0.007872). The findings were significant with the application of unpaired t test too. Thus, it is concluded that there is significant correlation between presence of 'Arch' fingerprint pattern in female left thumbs, and their intellectual performance. However, Author of the present study believes that more research is required, from various regions of the world, in order to come to a unanimous reasonable conclusion regarding fingerprint pattern and intelligence correlation.

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7. Conflicts of interest

The author declares that there were no conflicts of interest.

8. References:

1. Pillay VV. Textbook of Forensic Medicine and Toxicology. 15th Ed. Hyderabad: Paras Medical Publishers. 2009:53-94.
2. Kanchan, T, Chattopadhyay S. Distribution of Fingerprint Patterns among Medical Students. Journal of Indian Academy of Forensic Medicine. 2006;28(2):65-8.
3. Vij K. Textbook of Forensic Medicine and Toxicology. 3rd ED. New Delhi: Elsevier. 2005;89-91.
4. Subrahmanyam BV. Modi's Medical Jurisprudence and Toxicology. 22nd Ed. New Delhi: Butterworths India. 1999;71-7.
5. Burger B, Fuchs D, Sprecher E, Itin P. The immigration delay disease: adermatoglyphia-inherited absence of epidermal ridges. J Am Acad Dermatol. 2011;64(5):974–80.
6. Nousbeck J, Burger b, Fuchs-Telem D, Pavlovsky M, Fenig S, Sarig O, Itin P, Sprecher E. A Mutation in a Skin-Specific Isoform of SMARCAD1 Causes Autosomal-Dominant Adermatoglyphia. American Journal of Human Genetics. 2011;89(2):302–7.
7. Wong M, Choo SP, Tan EH. Travel warning with capecitabine. Annals of Oncology. 2009;20(7).
8. Reddy KSN and Murthy OP. The essentials of forensic medicine and toxicology. New delhi: Jaypee. 2014;85.
9. Engert, Gerald J. International Corner. Identification News. 1964;14(1).
10. Okajima M. Development of dermal ridge in the fetus. Journal of Medical genetics. 1975;12:243-50.
11. Babler WJ. Embryonic development of epidermal ridges and their configurations. Birth Defects Original Article Series. 1991;27:95-112.
12. Rossa A, Gutierrez B, Arias B and Fananas L. Dermatoglyphics and abnormal palmar flexion creases as markers of early prenatal stress in children with idiopathic intellectual disability. Journal of Intellectual Disability Research. 2001;45:416-23.
13. Najafi M. Association between finger patterns of Digit II and intelligence quotient level in adolescents. Iran J Pediatr. 2009;19(3):77-284.
14. Kumari KL, Babu SV, Kumar SV. Dermatoglyphics and its Relation to Intelligence Levels of Young Students. IOSR Journal of Dental and Medical Sciences. 2014;13(5):1-3.
15. Parker C. Highlights by C Parker. Finger Print and Identification Magazine. 1971;52(12):16.
16. Gottfredson, Linda S. Chapter 1: Logical fallacies used to dismiss the evidence on intelligence testing. In: Phelps, Richard F. Correcting fallacies about educational and psychological testing. Washington (DC); American psychological association. 2009;31-3.