NISEB Journal Vol. 18, No. 3. September, 2018 1595-6938/2018
Printed in Nigeria (2018) Society for Experimental Biology of Nigeria
http://www.ojs.klobexjournals.com/index.php/nisebj

Usefulness of Digital Dermatoglyphics as Indicator of Academic Performance among a Group of Nigerian Students

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Abstract
This study was carried out to determine the dermatoglyphics correlates of academic performance among final year students of the Department of Cell Biology and Genetics, University of Lagos. A total number of 81 students (31 Male: 50 Female) participated in the study. Digital dermatoglyphics parameters including print pattern and ridge count were obtained electronically with Secugen fingerprints sensor coupled with automated inkless fingerprint imaging software. The results revealed that loop was the most frequent fingerprint pattern with 65.9% occurrence while arch was the least frequent occurring with a frequency of 7.3%. Finger ridge count correlated negatively with Cummulative Grade Point Average (CGPA) implying that students with higher ridge count tended to have lower CGPA; however, the association was not significant (P>0.05). Fingerprint pattern on the left hand was a better indicator of academic performance when compared to the right hand. It was observed that left hand whorl was a positive indicator of academic performance in contrast to left hand loop, where higher frequency of whorl indicated lower academic performance. The implication of these results for proper guidance of student in our academic institutions is discussed.

Keywords: Dermatoglyphics, Fingerprints, Academic brilliance, Intelligence

Introduction
Dermatoglyphics is the scientific study of dermal prints which include prints of the fingers (fingerprints), palms, soles and toes of humans and other animals (1). Out of the various dermal prints, fingerprints have attracted the greatest attention being the most usually taken biometric parameter in view of its accessibility and convenience. Digital dermatoglyphics traits of an individual has strong genetic component. According to a study, fingerprint phenotype is a monogenic trait modified by another gene (2). Other studies, however, argued that fingerprint phenotypes are complex traits with multifactorial basis implying existence of many genes interacting with several environmental factors.

Formation of fingerprints starts during the embryonic life: from the 10^{th} week of pregnancy and by 24^{th} week, the prints are well established. Once formed, they remain permanent throughout life except in cases of severe burn or other accident that may cause damage to the print patterns. Dermal prints in general could therefore be considered as fossils of specific period of postnatal development and mirror of a person's individuality. Fingerprints traits are unique because no two individuals (even monozygotic twins) have identical prints (3). Thus, fingerprints have been of great importance in personal identification and forensics.

Interest in dermatoglyphics has continued to rise not only because of its importance in personal identification and forensics, but also because of its association with several genetic diseases that are chromosomal, monogenic or multifactorial in origin. It is not new that individuals affected with Down syndrome (trisomy-21) have particular print pattern (4). Other chromosomal conditions with significant association with fingerprint patterns include trisomy of Group G chromosome, deletion of short arm of chromosome 5, trisomy x (47, xxx) and others (5). Similar reports of diseases associated with dermatoglyphics trait have been documented for sickle cell anaemia (6), schizophrenia (7), cancer (8), type-1 and type-2 diabetes (9).

There are reports that dermatoglyphics traits are associated with intelligence especially academic performance (10). Academic brilliance, an important component of intelligence, is a complex trait, and it is of great importance in view of its role in determining academic achievement, career choice, and quality of postnatal life. In this regard, recent development of a test called Dermatoglyphics Multiple Intelligence Test (DMIT) lends credence to the importance of dermatoglyphics in determining an individual's intelligence. The test may be used to identify an individual's learning, thinking, and personality attributes including his/her hidden talents (10). Association between fingerprint patterns and intelligence quotient (IQ) has been reported (11), while preliminary studies on the relationship between dermatoglyphics and intelligence have been documented by Nanakorn (12). Studies in other populations have also attested to the association between fingerprints and academic performance (10); however, few such studies exist for Nigerian populations; one of the few studies carried out in this area in Nigeria include Adekoya *et al.* (13) on multiple intelligence.

The main objective of this investigation is to assess association between digital dermatoglyphics and academic performance with a view to possibly predicting academic performance from digital dermatoglyphics traits. We

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hope that the result of this study would enhance early identification of students with special needs for targeted teaching and surveillance at all levels of education in Nigeria and other African countries.

Materials and Methods

Subjects and Informed Consent:

A total of 81 final year undergraduates (30Male: 51Female) of 18 to 28 years old participated in the study. After a thorough explanation of the study, each participant was requested to fill a consent form before administering the questionnaire.

Data Collection

Demographic data such as age, sex, ethnicity, family background etc. were obtained through questionnaires while dermatoglyphics data (print pattern and ridge count) were obtained electronically with Secugen fingerprint sensor coupled with automated inkless fingerprint imaging software. Cumulative Grade Point Average (CGPA), the measure of academic performance used for this study, was obtained from the Course Adviser of the graduating set after approval of the results by the Faculty of Science Board of Studies. The CGPA was classified into different classes of degree according to the university's degree classification scheme viz First Class (4.50 – 5.00), Second Class Upper (3.50 – 4.49), Second Class Lower (2.40 – 3.49), Third Class (1.50 – 2.39) and Pass (1.00 – 1.49).

Data Analysis

The data were analysed using SPSS version 23 software package. Data that satisfied normality test were subjected to t-test if two groups were being compared or ANOVA if three (3) or more groups were involved. Correlation matrix was generated through simple correlation analysis in order to assess association between variables. In all cases, $P<0.05$ was considered significant.

Results

Summary Statistics of Fingerprint Patterns and Ridge Counts

The three main types of fingerprint pattern were encountered in this study; they were loop, whorl, and arch including the two major sub-types of loop (ulnar and radial loop) as shown in Fig. 1.

Fig. 1: The Three Main Types of Fingerprint Patterns namely: Loop (Radial and Ulnar), Whorl and Arch

In Table 1, the most frequently encountered print pattern was loop occurring with a frequency of 65.9% as opposed to arch (7.3%) with the least frequency. Out of the two types of loops, radial loop was the most frequent (51.5%) compared with ulnar loop (48.5%). Table 2 shows the total ridge counts obtained for each finger, each hand, and both hands.

Association between Ridge Counts

There are highly significant ($P<0.01$) intercorrelations among ridge counts obtained in all the fingers of both hands (Table 3). The fingers with the highest correlation in ridge counts are the left middle and the right middle fingers ($r=0.798$; $p<0.01$).

Relationship between Dermatoglyphics Traits and Cumulative Grade Point Averege (CGPA).

On the left hand, as the mean occurrence of whorl reduces, academic performance also reduces (Figure 2). In contrast, as the mean occurrence of loop increases, academic performance decreases. The right hand did not reveal clear association between mean occurrence of print pattern and academic performance. When both hands were combined, whorl and loop patterns showed contrasting association with academic performance but it was not as well-defined as when only the left hand was examined. Ridge counts in all the fingers showed negative association with CGPA (Table 3) but the association was not significant ($P>0.05$).

Table 1: Frequency of Different Fingerprints Patters on the Left, Right and Both Hands of the Subjects

	Left Hand			Right Hand			Both Hands		
	Loop	Whorl	Arch	Loop	Whorl	Arch	Loop	Whorl	Arch
Thumb	45(55.6%)	20(24.7%)	11(13.6%)	41(50.6%)	26(32.1%)	7(8.6%)	86(57.3%)	46(30.7%)	18(12%)
Index	39(38.1%)	28(34.6%)	11(13.6%)	47(58%)	27(33.3%)	7(8.6%)	86(54.1%)	55(34.6%)	18(11.3%)
Middle	51(63%)	19(23.5%)	8(9.9%)	59(72.9%)	15(18.5%)	5(6.2%)	110(70.1%)	34(21.7%)	13(8.3%)
Ring	44(54.3%)	30(37%)	3(3.7%)	46(56.8%)	29(35.8%)	3(3.7%)	90(58.1%)	59(38.1%)	6(3.9%)
Little	69(85.2%)	9(11.1%)	1(1.2%)	70(86.4%)	5(6.2%)	1(1.2%)	139(89.7%)	14(9%)	2(1.3%)

Table 2: Summary Statistics of Ridge Count on the Left, Right, and Both Hands of the Subjects

	Left Hand					Right Hand					Both Hands				
	Thu	Ind	Mid	Rin	Lit	Thu	Ind	Mid	Rin	Lit	Thu	Ind	Mid	Rin	Lit
Min-Max	0-18	0-19	0-15	0-18	0-19	0-18	0-17	0-17	0-17	0-19	0-18	0-19	0-17	0-18	0-19
Range	18	19	15	18	19	18	17	17	17	19	36	36	32	35	38
Mean	8.4	8.2	8.9	9.3	9.6	8.9	8.8	9.5	10.1	9.7	16.8	17.0	18.4	19.4	19.4
SD	4.6	4.8	4.6	4.4	3.9	4.7	4.1	4.1	3.9	3.8	9.3	8.9	8.8	8.4	7.7

Table 3: Correlation Matrix Showing Association between Finger Ridge Count and Cumulative Grade Point Average (CGPA)

	LT	LI	LM	LR	LL	RT	RI	RM	RR	RL
LT	1									
LI	.565**	1								
LM	.556**	.745**	1							
LR	.337**	.641**	.731**	1						
LL	.500**	.651**	.604**	.566**	1					
RT	.580**	.617**	.665**	.553**	.429**	1				
RI	.614**	.695**	.635**	.536**	.566**	.693**	1			
RM	.524**	.763**	.798**	.790**	.610**	.719**	.747**	1		
RR	.430**	.542**	.702**	.792**	.489**	.622**	.570**	.776**	1	
RL	.585**	.667**	.652**	.679**	.625**	.697**	.725**	.725**	.708**	1
CGPA	-.015	-.135	-.109	-.189	-.086	-.073	-.166	-.179	-.041	-.211

Note: LT-Left thumb; LI-Left index finger; LM-Left middle finger; LR-Left ring finger; Left little finger; RT-Right thumb; RI-Right index finger; RM-Right middle finger; RR-Right ring finger; RL-Right little finger

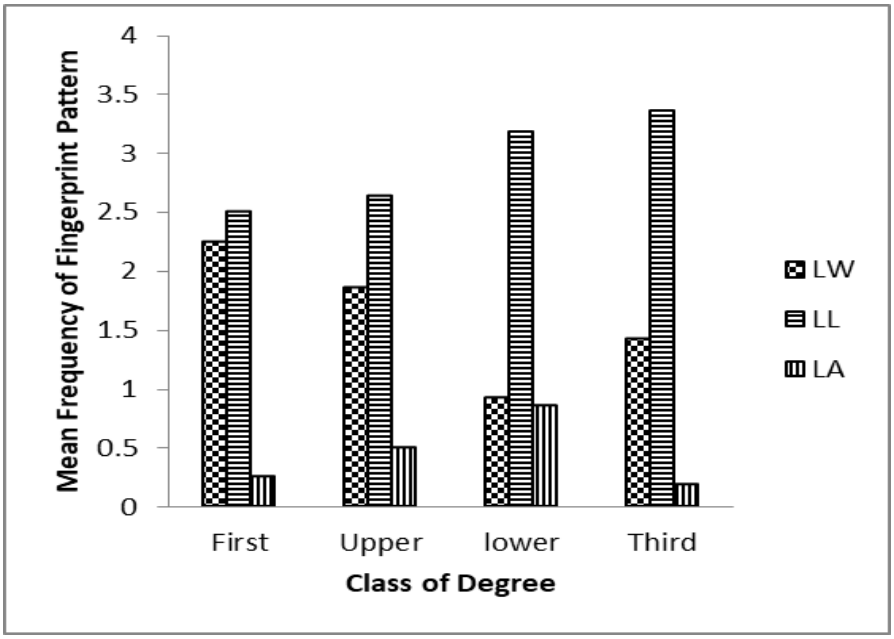

Fig. 2: Distribution of Fingerprint Pattern among Different Classes of Degree
Note: LW-Left Whorl, LL- Left Loop, LA-Left Arch

Discussion

Final year students were chosen for this study because they would have spent enough time on their study to have cumulative grade points (CGP) sufficient to determine their academic performance using their CGPA. The high frequency of loop observed in the study compared to other types of fingerprints agrees with Nafaji (11) working on the association between student's fingerprint pattern and their academic achievement in Indian population.

Significantly high intercorrelations were observed in ridge counts among all the fingers. This implies that an individual with a high ridge count on one finger tends to have high ridge counts on other fingers as well. The reason for this is not clear. There was negative association between ridge count and CGPA but the association was not significant. Nonetheless, the consistency of the negative relationship between finger ride counts and CGPA in all the fingers gave a strong impression that people with higher ridge count tend to have lower academic performance.

Lack of significance of the association between ridge count and academic performance may be due to the small sample size and consideration of only one faculty/discipline in this study. Thus the power of statistical analysis might be too low to detect subtle, but important relationship between ridge count and academic performance. We are of the opinion that future researchers should consider these limitations in planning their investigation.

The frequency of loop and whorl had contrasting influence on academic performance: Whorl was a positive predictor of academic performance while loop was a negative predictor. This was more clearly seen on the left hand than on the right hand or on both hands combined. This implies that when print pattern instead of ridge count is used, left hand serves as better indicator than the right hand or both hands combined. However, in our opinion both the ridge count and print pattern should be considered in predicting a student's academic performance.

Several mechanisms have been proposed for the link between dermatoglyphics trait and intelligence/academic brilliance. One of the most attractive explanations is by Nagaraj (2016) who opined that each finger is connected with one brain lobe specifying a specific type of intelligence. Furthermore, studies have shown that each type of fingerprint pattern is connected with a particular type of learning such as cognitive learning, affective learning, critical thinking, enthusiastic learning and reflective learning (10).

The results of this study are very important in a country like Nigeria where education is becoming increasingly important with many schools and universities springing up. We therefore strongly uphold the suggestion that academic institutions should take cognizance of the relationship between dermatoglyphics and academic performance to enhance early identifications of students who may need special attention and surveillance.

Acknowledgement

We thank Dr. Oyebola Adekola, Dr. Amida Adele and Mrs. Olufunmilayo Abati for their encouragement and support.

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