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COMPARATIVE STUDY OF THE FINGERPRINT PATTERNS IN MARINDUQE AND MANILA, PHILIPPINES

Lea C. Garcia
University of the Philippines Rural High School,
UP Los Baños, College, Laguna
PHILIPPINES
leureal@yahoo.com

ABSTRACT

This study determined the fingerprint patterns of 61 families living in Marinduque, Philippines. This data was compared with the data previously collected from Metro Manila in terms of the most common fingerprint pattern (among the males and females) as well as total ridge counts (TRCs). Also, the study aimed to determine the relationship among the different familial relationships. Direct counting was used consisting of 116 individuals (63 males and 53 females). In the two (2) populations, loops are the most commonly found fingerprint pattern and arches are the least common in both males and females. The frequency of loops is highest followed by whorls and arches in the two (2) populations. In the Marinduque population, TRCs ranged from 38-328 (male) and 56-219 (female). Using Mann-Whitney U test, there is a significant difference between the values of parental TRC of the two populations indicating sexual dimorphism. The Pearson correlation coefficients were significant for mother-child and midparent-child ($\alpha = 0.01$). Only the Marinduque population showed no significant relationship for parent-parent relationship. It is recommended that further studies on fingerprints of individuals with congenital diseases be conducted. Moreover, a greater sampling size should be obtained as well as more accurate methods of sampling.

Keywords: fingerprint, fingerprint pattern, frequency pattern, midparent-child, mother-child, sexual dimorphism.

INTRODUCTION

A fingerprint offers an infallible means of personal identification despite personal denial, fake names, or changes in personal appearance due to age, disease, plastic surgery, or accident. It is a unique image produced when the folds, twists, and turns of the ridges on the pads of the fingers are scanned. Other visible human characteristics tend to change but fingerprints are much more persistent. Every person in the world has distinct variations in their ridge folds, twists and turns, however, fingerprints for an individual remain stable through time. Barring injuries or surgery causing deep scarring, or diseases such as leprosy damaging the formative layers of friction ridge skin (injuries, scarring and diseases tend to exhibit telltale indicators of unnatural change), finger and palm print features have never been shown to move about or change their unit relationship throughout the life of a person. These characteristics have made fingerprints very useful for law enforcement officials in many criminal cases. Police officers, crime scene investigators and others in the justice system rely on forensic science techniques to ensure that the right people are punished for law violations and to keep people safe. The practice of using fingerprints as a means of identification is called "dactyloscopy". Today, this practice is a very important tool in modern law enforcement. Finger ridges and ridge patterns are highly heritable, durable, and age-independent human traits and have been studied as a model quantitative trait in humans for over 80 years. Fingerprints also vary considerably among different groups of people and can be useful as tools for tracing individuals to particular populations. Because fingerprints are highly variable and genetically influenced, they have important significance for forensic science, anthropology, ethnology, genetics, and medicine (Zhang et al., 2010). Dermatoglyphics, the study of pattern traceries of fine ridges on fingers, palm and sole has been a useful tool for personal identification and determination of paternity for quite some time. It proves important due to the fact that (1) unlike most human traits; dermal ridges and the configurations formed by them are not affected by age. (2) Detailed structure of individual ridges is extremely variable and (3) throughout postnatal life they are not affected by the environment (Ekanem, et al.,2009). In the late 19th century, Sir Francis Galton started the study of ridged skin and fingerprints. Gutierez et al. (2012) reported that since that time, extensive work has been carried out on the biology and genetics of skin patterns. The highlights in the history and development of fingerprinting are presented in Table 1.

Table 1. Summary of important events in the history and development of dermatoglyphics

Date	Scientist Involved	Historical Event
1685	Gouard Bidloo	Fits book with detailed drawings of fingerprints
1685	Marcelo Malphighi	First to chronicle observations of fingerprints under microscope
1788	J.C.A. Mayer	First to write out basic tenets of fingerprint analysis
1823	John E. Purkinje	First classification system, nine print categories
1833	Sir Charles Bell	An anatomist who studied structure and function of hands
1858	Sir Wm. Herschel	British Chief Administration Officer Hooghly District, Bengal India
1880	Dr. Henry Faulds	Suggested picking up of fingerprints at crime scene
1892	Sir Francis Galton	An Anthropologist who is cousin of Charles Darwin who made his landmark publication, Fingerprints; Inventor of dermatoglyphics; made the first practical method of fingerprint identification; responsible for basic nomenclature (arch, loop, whorl); scientifically demonstrated permanence of fingerprints; conducted first twins research
1897	Harris Hawthorne Wilder	First American to study dermatoglyphics; named the A, B, C D triradii points; invented the Main Line Index; studied thenar hypothenar eminences, zones II, III IV
1904	Inez Whipple	Made the first serious study on non-human prints
1923	Kristine Bonnevie	Conducted extensive genetic studies

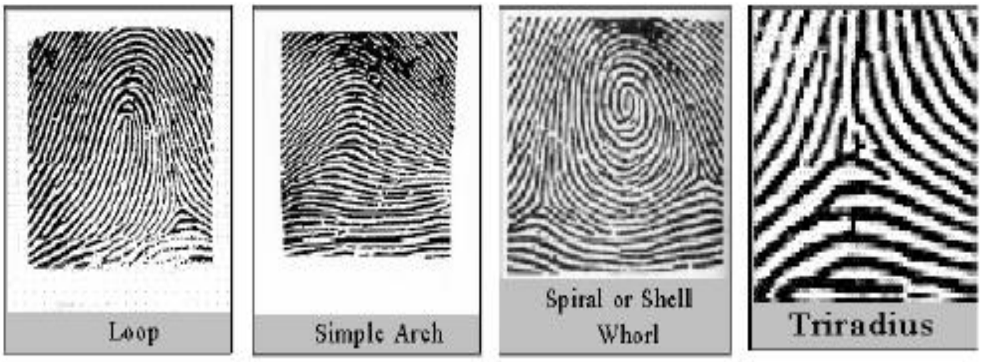
Early studies were conducted on fingerprints and fingerprint patterns. Bonnevie (1924) used quantitative value based on the ridge count by calculating the correlation coefficients between small samples of monozygotic (0.92 ± 0.04) and dizygotic twins (0.54 ± 0.08), and an estimate of the value between sibs (0.60 ± 0.12). A modification on Bonnevie's quantitative value was made by Newman (1930) when calculations on a larger sample were repeated yielding similar estimates: 0.95 ± 0.01 for monozygotic and 0.46 ± 0.08 for dizygotic twins. In all studies involving fingerprints, there is a need to consider all types of relationships in order to determine the mode of inheritance of fingerprint patterns. Correlation and relationships were established among families using fingerprints through the use of statistical analyses on the total ridge count (TRC) and the use of the mathematical theories of Fisher (1918) and Penrose (1949) involving the correlation coefficient (Holt, 1961). The findings indicate that the parent-child and sib-sib correlation coefficients are very nearly 0.5. According to Fisher, this value is the expected value for both when inheritance is due to perfectly additive genes, and there is absence of dominance. Results also showed that there is no significant parent-parent correlation (0.05 ± 0.07), which shows that random mating occurred (Holt, 1961). The use of mid-parental value which is the average measurement for the two parents is another method for determining the mode of inheritance in fingerprints. According to Penrose (1949), the correlation coefficient between the TRCs of mid-parent and child should be around 0.71 when additive genes with independent effect are involved. Slatis et al. (1976) analyzed the fingerprints of 571 members of the Habbanite isolate in Israel suggesting inherited patterns and pattern sequences. There was a genetic theory developed assuming that the basic fingerprint pattern sequence is all ulnar loops and that a variety of genes (Table 2) causes deviations from this pattern sequence. Genes that have been proposed include: (1) a semidominant gene for whorls on the thumbs; (2) a semidominant gene for whorls on the ring fingers which acts like the gene for whorls on the thumbs; (3) a dominant gene for arches on the thumbs and often on other fingers; (4) one or more dominant genes for arches on the fingers; (5) a dominant gene for whorls on all fingers except for an ulnar loop on the middle finger; (6) a dominant gene for radial loops on the index fingers, frequently associated with an arch on the middle fingers; and (7) a recessive gene for radial loops on the ring and little fingers. Individually, these genes may affect the whole hand or only one or more of the fingers. They may act independently or may show epistatic behavior in which the phenotypic effect of one gene may be masked by another. It is possible, however, that other populations lack these genes and have factors for other fingerprint characteristics.

Table 2. Summary of genes affecting fingerprint patterns (Fogle, 1990)

Effect	Inheritance	Genotypes	Phenotypes
Thumb	Semi-dominant	AA	Whorls, both thumbs
		Aa	2 ulnar loops or 1 ulnar loop and 1 whorl
		Aa	Ulnar loops, both thumbs
Thumb	Dominant	B-	Arches on thumbs and often other fingers
Index finger	Dominant	C-	Radial loops on index finger, often associated with an arch on the middle finger
Ring finger	Semi-dominant	CC	Whorls, both fingers
		Cc	2 ulnar loops or 1 ulnar loop and 1 whorl
		Cc	Ulnar loops on both fingers
Ring or little finger	Recessive	Dd	Radial loops
All fingers	Dominant	E-	Whorls on all fingers except for an ulnar loop on middle finger
All fingers	Dominant	F-*	Arches on fingers

*maybe more than one gene involved

The fingerprints are so unique but there are only three (3) major types observed- loop, arch and whorl (Fig. 1 a-c). Traditionally, the ridge count is defined as the number of ridges that intersect or touch the line drawn from the easily recognized triradius (where three ridges meet) to the center of the pattern (Rower, 2013). In short, the triradius (Fig.1d) is a point of convergence of the three ridge groups at an angle of nearly 120 degrees with respect to each other. It is used to differentiate one to another ridge group. The most common pattern, a simple loop (60%–70%) of all patterns, characterized by a single triradius, is most advantageous for tactile perception and precision grip. The loop is more complicated, having one triradius and a core or center, a ridge surrounded by ridges folding over themselves. Loops can be classified radial if the loops have their triradius on the side of the little finger and open towards the thumb, while ulnar loops have their triradius on the side of the thumb and open towards the little finger (Bath et al.,2014). The ulnar loop is the most frequently occurring pattern at 63.5% of the general British population, while the radial loop has a frequency of 5.4%. Simple arches have no true triradii, resulting in a zero count and can be either plain, with ridges flowing smoothly, or tented, with ridges going over a slight "hump" in the center of the pattern. Kucken & Newell (2005) reported that arches are seen the least, with a frequency of 5% observed in the general British population. He added that whorls have two triradii yielding two counts, a core and with a frequency of 26.1%.



(a) **(b)** **(c)** **(d)**

Figure 1. The three main types of fingerprint patterns (a-c) and (d) triradius. (a) Loop has one triradius; (b) Arch has none; (c) Whorls have two triradii.

The skin has pores where the ridges can be found (Figure 2). The dermal ridges originate from the fetal volar pads and begin to develop at about the sixth to seventh week. The visibility of the ridges is at about 3 months and the complete development is about sixth months. The development of ridges is likely to be influenced by nerve and nerve development, oxygen and nutrient supply, distribution of sweat glands and epithelial growth (Offei et al., 2014). Many factors and many genes are likely to influence ridge pattern formation.

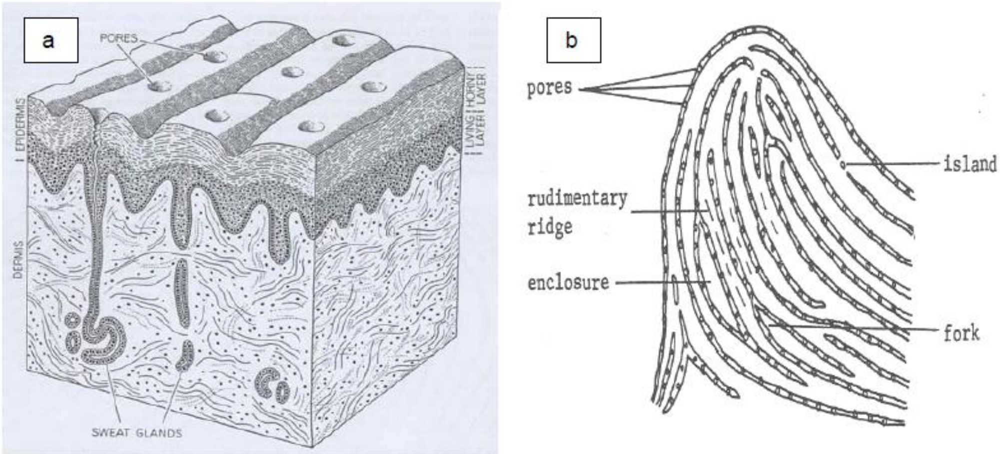


Figure 2 (a) Structure of skin showing pores within ridges (Penrose, 1969) and (b) ridge pattern showing pores within ridges and a few of the descriptive terms commonly used to describe ridge patterns (Fogle, 1990).

According to Hassan et al. (2011), the inheritance of fingerprints is due to perfectly additive genes without dominance, more commonly known as polygenic inheritance. The polygenic or quantitative trait is the TRC which is the sum of the ridge counts for all 10 fingers. It has been found out that the average TRC for males is 145 and that for females is 126 (Han et al., 2003). For an arch, the ridge count is O. The ridge count on a finger with a loop is determined by counting the number of ridges between the triradius and the centre or core of the pattern. For a whorl, a ridge count is made from each triradius to the centre of the fingerprint, but only the higher of the two possible counts is used. Rishi and Sharma (2014) added that the triradius is not included in the count, nor is the final ridge when it forms the centre of the pattern. Ridges which run close to the line without meeting it are excluded, but two ridges resulting from a bifurcation are both counted. It is usual to exclude from the count the fine secondary intervening ridges which occur occasionally, chiefly on thumbs. These secondary intervening ridges do not carry sweat gland pores. Furthermore, they are not as high as other ridges and whether or not they appear on a print depends on the degree of pressure exerted when the print is made. It is possible, therefore, to have two prints of the same finger, one showing secondary ridges and the other not. Islands, on the other hand are always counted. Thus, the quantification of fingerprints is through determining the TRC. It has been found to be the most consistent and reliable measurement for familial investigations and has been used as the parameter in statistical analysis to identify the mode of inheritance of fingerprints (Zhou et al., 2006).

The ridge count is an objective feature of fingerprint patterns and provides an estimate of the pattern size that is more effective than directly measuring the distance from triradius to core, because it is independent of age. It also gives some indication of the pattern type. Furthermore, the ridge count is a good basis for statistical analysis, particularly because it can be used to obtain the total ridge count. It is interesting to note that while the TRC is a discontinuous character, because it is expressed in whole numbers, statistical tests making use of it show that it behaves like a continuously varying one (Roewer, 2013). Anthropometric studies of the digit, palm and feet provides data that reveal the relative distribution of dermal ridges among people in different geographical zones. Ekanem et al. (2009) made a cross-sectional study using 200 males and 200 females of Annang ethnic group in Akwa Ibom in Nigeria to establish their digital dermatoglyphic traits. The procedure involved the counting and classifying of their ridge pattern configurations of arches, loops and whorls. Results showed that ulnar loops were the most predominant digital pattern in females (50.1%) than in males (39.6%), followed by whorls (42.9%) in males, then arches (31.1”%) in females and radial loop (2.1%) in males. It was also found out that the sex differences between these patterns were statistically significant with the index of pattern intensity (P1) showing a higher value in males (15.13) than the females (11.88). A very important finding was sexual dimorphism which was evident with the males showing higher TRC than the females ($p < 0.001$).

As mentioned earlier, dermal ridges originate from fetal volar pads composed of mesenchymal tissue starting at the sixth to seventh week of development. It is important to note the size and position of the volar pads because these are largely responsible for ridge patterns observed. Generally, small pads produce arches and larger pads produce loops or whorls. Lateral displacement of the volar pad creates asymmetry of the pattern. Ridges become visible at about 3 months and are completed by the sixth month of prenatal development. Vashist et al. (2014) postulated that ridges are influenced by blood vessel-nerve pairs at the border between the dermis and epidermis during prenatal development. Since growth is a dynamic process, one in which many components contribute and can mutually interact, there must be many genes involved. Fang et al. (2006) has demonstrated a very close correspondence between the observed and predicted correlation for TRC and the degree of genetic relatedness. That is, TRC acts as an additive genetic trait with little dominance deviation. TRC is a near perfect fit to the classic polygenic model in which one assumes that each gene adds in some small way to the total observed variability. A phenotypic expression which requires a multitude of tissue types, all simultaneously growing and changing as development proceeds, is at odds with a simplistic image of genes being somehow additive (Hassan et al., 2011 & Han et al. 2003).

To date, only few studies on fingerprints in the Philippines have been conducted. The homogeneous group in Marinduque was an interesting group for a fingerprint pattern study. Moreover, there were not much studies on comparing different fingerprint patterns particularly between Marinduque Province and Metro Manila. Thus, this study aimed to describe the fingerprint patterns of males and females in Marinduque as well as compare this data with the Metro Manila population focusing on the common fingerprint pattern and total ridge count. Likewise, the study aimed to determine the relationship among the different familial relationships.

MATERIALS AND METHODS

Location and Duration of Study

The fingerprint, obtained from 61 families, composed of mother, father, and daughter and/or son consisted of 63 males and 53 females in the study population. The sampling population was from the families living in Isla Gaspar, Brgy Pinggan, Gasan and in Brgy. Dawis both from Marinduque Province, Philippines. The general method employed in obtaining the fingerprints was the direct counting of the prints on the participants. The collection of sample was done in the second semester of SY 2017-2018.

Analysis

The respective TRCs for the fingerprints of all 116 individuals were scored. Moreover, the patterns were identified and the fingerprint TRC distributions were obtained separately for males and females. For fingerprint TRCs, the statistical tool, Pearson correlation coefficient was obtained for midparent (the average between the two parents) -child, father-child, mother-child, and parent-parent relationships. The frequency distributions of the pattern types, namely, arches, loops, and whorls, were also obtained, and these were compared between male-female, father-child, mother-child, and parent-parent relationships. Mann-Whitney U test was used to confirm sexual dimorphism. Analyses were done using SPSS v11.5. After discussing the fingerprinting pattern results of the Marinduque population, the said results were compared with the data obtained from Metro Manila in terms of the parameters mentioned previously.

RESULTS

Fingerprint patterns were observed among 61 families in Marinduque, Philippines. Generally, loops were the common pattern followed by whorls and lastly by arches. Specifically, for loops and arches patterns, the female population got higher frequencies than the male population. For loops, the frequency of the female population was higher at 70.0% than the male population at 61.4%. Similarly, for arches, the female population got a higher frequency (2.6%) than the male population (1.9%). For whorls, this time, the male population had a higher frequency at 36.7% than the female population at 27.4%. Table 3 summarizes the distribution of fingerprint patterns among males and females in Marinduque, Philippines.

Table 3. Distribution of fingerprint patterns among males and females (Marinduque)

	Male (n=63)				Female (n=53)			
Fingerprint	**A**	**L**	**W**	**Total**	**A**	**L**	**W**	**Total**
L1-L5[1]	7	204	104	315	9	183	73	265
Frequency	**0.022**	**0.648**	**0.330**		**0.034**	**0.691**	**0.275**	
R1-R5[2]	5	183	127	315	5	188	72	265
Frequency	**0.016**	**0.581**	**0.403**		**0.019**	**0.709**	**0.272**	
Total	12	387	231	630	14	371	145	530
Frequency	**0.019**	**0.614**	**0.367**		**0.026**	**0.700**	**0.274**	

[1]L1-L5: Patterns observed from the digits of the left hand
[2]R1-R5: Patterns observed from the digits of the right hand
A- Arch; L – Loop; W - Whorl

Meanwhile, Table 4 shows the frequencies of each fingerprint pattern comparing males and females in Marinduque and Metro Manila. In both areas, results show that loops are the most commonly found pattern, followed by whorls and lastly by arches. Specifically, in terms of the loop pattern, females in both areas got a higher frequency (Marinduque-70.0%; Manila-57.0%) than the males (Marinduque-61.4%; Metro Manila-55.0%). For the whorl pattern, the males got a higher frequency (Marinduque-36.7%; Metro Manila-43.3%) than the females (Marinduque-27.4%; Metro Manila-41.8%). For the arches, the females in Marinduque got a higher frequency at 2.6% than the males at 1.9%. In Metro Manila, the males got a higher frequency at 1.7% than the females at 1.3%.

Table 4. Frequencies of each pattern type for fingerprints among males and females (Marinduque vs. Metro Manila)

Pattern Types	Fingerprints (%)			
	Marinduque		Metro Manila	
	Male (n=63)	Female (n=53)	Male (n=264)	Female (n=276)
Arches	1.9	2.6	1.7	1.3
Loops	61.4	70.0	55.0	57.0
Whorls	36.7	27.4	43.3	41.8
Total	100	100	100	100

Table 5 shows the frequency distributions of the fingerprint pattern types in the general populations of Marinduque and Metro Manila. It can be noted that consistently, in both areas, loops were also found to be the most common pattern. Loops in Marinduque got a higher frequency of 65.30% than Metro Manila at 56.0%. The next pattern was whorl, with Metro Manila obtaining a higher frequency of 42.5% than Marinduque at 32.4%. For arches, Marinduque was higher at 2.20% than Metro Manila at 1.50%.

Table 5. Distribution of fingerprint patterns in the general populations (Marinduque vs Metro Manila

	Fingerprint Pattern							
	Marinduque (n=116)				Metro Manila (n=540)			
	A	L	W	Total	A	L	W	Total
L1-L5[1]	16	387	177	580	42	1487	1171	2700
Frequency	**0.028**	**0.667**	**0.305**		**0.016**	**0.551**	**0.434**	
R1-R5[2]	10	371	199	580	39	1536	1125	2700
Frequency	**0.017**	**0.640**	**0.343**		**0.014**	**0.569**	**0.417**	
Total	26	758	376	1160	81	3023	2296	5400
Frequency	**0.022**	**0.653**	**0.324**		**0.015**	**0.560**	**0.425**	

These results indicate that the families in the Marinduque and Manila populations display a predominance of one fingerprint pattern which is loop. According to several recent research studies, certain fingerprint patterns appear with great frequency among people of certain ethnic heritages (Gutierez et al., 2012). Specifically, Marinduque population has a homogeneous heritage. This means that the communities have a common expression of the ways of living that is passed on from generation to generation, including customs, practices, places, objects, artistic expressions and values. Likewise, loop is also the most common pattern observed in Metro Manila though the data provided did not include a procedure for determining whether Metro Manila is of homogenous or heterogenous grouping. Having also a loop pattern as the most common pattern, it could be assumed that some respondents in Metro Manila has homogeneous grouping. Likewise, in both the sexes of the two populations, Table 4 indicates that loops rule the chart followed by whorls and arches, which is in accordance with all previous works (Umraniya et al., 2013). Table 6 and Figure 3 indicate that the average mean of fingerprints in Marinduque was higher in males than in females (Figure 3). Moreover, the TRC values ranged from 38 to 328 while for the females, the range was from 56 to 219 (Table 6). The mean TRC of fingerprints in males was 157.19 with a standard deviation of 51.54. The mean and standard deviation of fingerprints was lower in females, at 137.92 and 37.74, respectively. Using Mann-Whitney U Test, it was found out that the means and standard deviations of the TRC of males and females are significantly different at 0.05 level of significance indicating that there is sexual dimorphism (distinct difference between males and females) in this population. These differences in the average total ridge counts of the male and female indicate different distinct forms which means that they are sexually dimorphic**.** However, no data on male and female TRCs was given from Metro Manila for comparison with the data in Marinduque.

Table 6. Average Fingerprint Total Ridge Count among Males and Females (Marinduque)

Gender	**Total Ridge Count**		
	Marinduque		
	Range	Average	Standard Deviation
Male	38-328	157.19	51.54
Female	56-219	137.92	37.74

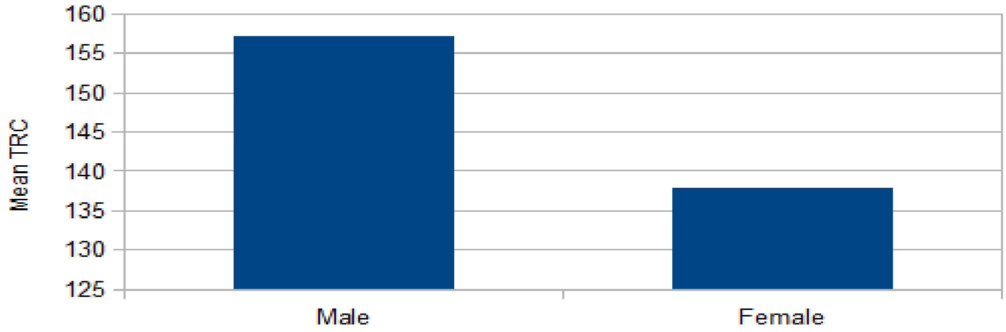


Figure 3. Comparison of average male and female TRC in Marinduque (n=116)

Table 7 shows the average TRC of each member of the family. The rank, from the highest to the lowest averages and standard deviations, consisted of the father, followed by the mother and lastly, the child. Results show that the average TRCs, means and standard deviations for the father, mother and the child in Marinduque were found to be higher than the TRCs for the same individuals in Metro Manila. Mann-Whitney U test revealed that there is a significant difference between the values of parental TRC of Marinduque and Metro Manila populations. However, there is no significant difference between the child's TRC in the two areas. Generally, the larger TRCs can be observed in the more positively skewed (skewed to the right) distributions of fingerprints in males than in females in Marinduque than in Metro Manila having the lower skewness (more skewed to the left) distribution of TRCs. This can be explained by the differences in pattern type frequencies between gender and the two populations. Figure 4 shows the average TRCs of the father, mother and child of Marinduque and Metro Manila.

Table 7. Average Fingerprint Total Ridge Count and their corresponding Mid-parental Value (Marinduque vs. Metro Manila)

Position in the Family	Total Ridge Count			
	Marinduque		Metro Manila	
	Range	Average (SD)	Range	Average (SD)
Father	79-328	164.16 (54.12)	0-274	134.69*** (49.07)
Mother	63-219	140.46 (42.73)	19-253	126.12* (47.83)
Child	38-232	137.66 (45.67)	19-231	130.19 (47.19)
Midparental value		152.31 (41.86)		130.19*** (41.09)

*** Means are different at 0.01 level of significance (Mann-Whitney U Test)

* Means are different at 0.10 level of significance (Mann-Whitney U Test)

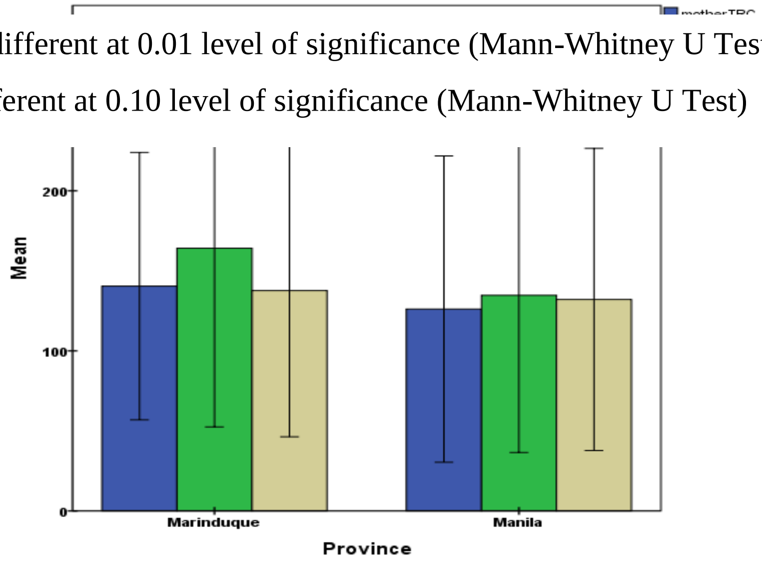


Figure 4. Average TRCs of the Father, Mother and Child of Marinduque and Metro Manila

Meanwhile, the Pearson correlation coefficients for different familial relationships obtained using the TRCs of the fingerprints are summarized in Table 8. In both Marinduque and Metro Manila populations, all the correlations for the fingerprints were found to be significant, with the midparent-child relationship being the highest, which signified the direct relationship. There was also positive correlation between parent-parent, father-child, and mother-child. Since both midparent-child correlation coefficients got the highest values in both areas at 0.01 level, this probably indicated that similar modes of inheritance are in effect in the mid-parent and child relationships. For the midparent-child, the value of 0.725 in Metro Manila was much closer to the expected value of 0.71 than the value of 0.645 in Marinduque. Meanwhile, the parent-parent relationship in both areas showed the lowest coefficients indicating indirect relationship.

Table 8. Correlation Coefficient of Fingerprint TRC (Marinduque vs. Metro Manila)

Relationships	**Correlation Coefficient**	
	Marinduque	**Metro Manila**
Parent-Parent	0.513**	0.457**
Father-Child	0.553**	0.683**
Mother-Child	0.573**	0.559**
Midparent-Child	0.645**	0.725**

** Correlation is significant at 0.01 level of significance (1-tailed)

The data for the individual parent-child correlations was important to obtain since it was expected to be 0.5 for both in polygenic inheritance (Wu et al., 2004). Based on the results, the father-child (0.553) and mother-child (0.573) correlations for fingerprints in Marinduque were very close to this expected value. In the case of Metro Manila, the mother-child correlation (0.559) was also very close to the expected value, however, for the father-child relationship, its correlation was a little higher (0.683) than the expected value. Though only one correlation coefficient was not consistent with the expected value, it must be conclusive that parent-child relationships should always show a positive correlation. After all, Wu et al., (2004) said that the TRC of the offspring depends on both the father and mother, and since both parents are taken into account using the midparental value, the midparent-child correlation takes precedence over father-child and mother-child correlations in the analyses.

SUMMARY, CONCLUSION AND RECOMMENDATION

The purpose of this study is to determine the fingerprint patterns of 61 families living in Marinduque, Philippines and compare it with the data previously collected from Metro Manila in terms of the most common fingerprint pattern (among the males and females) as well as total ridge counts (TRCs). Likewise, the study aimed to determine the relationship among the different familial relationships.

From the present study the following conclusions are drawn:

i. Loops are the most commonly found fingerprint pattern and arches are the least common in both males and females in the two (2) populations.

ii. The frequency of loops is highest followed by whorls and arches in the two (2) populations.

iii. Results reveal higher incidence of loops in females than in males in the two (2) populations; higher incidence of whorls in males than in females in the two (2) populations; higher incidence of arches in females than in males in the Marinduque population and higher incidence of arches in males than in females in the Metro Manila population. The display of different patterns of fingerprint among males and females indicates that distribution of specific pattern of fingerprint is not related to gender.

iv. The significant difference between the values of parental TRC of the two populations indicates sexual dimorphism.

v. In both Marinduque and Metro Manila populations, all the correlations for the fingerprints were found to be significant, with the midparent-child relationship being the highest, which signified direct relationship. While the parent-parent relationship in both areas showed the lowest coefficients indicating indirect relationship.

Kucken and Newell (2005) reported that a significant link has been established by pioneer workers between ridge pattern in congenital heart diseases, diabetes, lung tuberculosis, breast cancer and bronchial asthma. Thus, it is recommended that further studies be done in order to establish the particular pattern of inheritance involved in such diseases using fingerprint patterns. Moreover, having a small number of families sampled in Marinduque, Philippines, further sampling and better methods are recommended to ensure better values for correlations.

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