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Differences Dermatoglyphics Patterns in Normal and Asthmatic Children's Parents: A Javanese Study

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Abstract:- Asthma is a chronic respiratory disease caused by genetic and environmental factors. The ATD fingerprint design and orientation will be shaped by intrauterine environmental variables over the same time period. According to the 2018 Basic Health Research asthma prevalence data, the incidence of asthma identified by physicians in East Java Province hit 2.6%. The aim of this research is to see if there are any variations in dermatoglyphic patterns (fingerprint patterns and ATD angles) between Javanese parents with bronchial asthma and Javanese parents with normal children in Surabaya. This type of research is observational analytic cross sectional design. The sample is parents who have normal children and parents who have children with bronchial asthma in the Javanese in the city of Surabaya. Data analysis used Chi-Square test and T-test. Results: This study found that the frequency of fingerprint patterns on the dexter I digit (P=0.009), dexter II digit (P=0.003), V dexter digit (P=0.044), and sinister I digit (P=0.045) between parents and normal children was found significantly different from statistical analysis. There were no significant differences in other dermatoglyphic parameters.

Keywords:- *Fingerprint Pattern, Axial Triradius Digital Angle, Broncial Asthma.*

I. INTRODUCTION

Asthma is a chronic inflammatory disease of the airways with manifestations of wheezing, shortness of breath, chest tightness, and coughing. It is also known that asthma occurs due to genetic and environmental factors. In developing countries, asthma is a disease that is underdiagnosed and undertreated, which can have a negative impact on a person's quality of life, both in childhood and adulthood. Asthma affects as many as 300 million people worldwide, according to the Global Initiative on Asthma in 2018 [2]. Adults account for 7.5% of cases in the United States. The prevalence of asthma in the world ranges from 1% to 18%. Asthma has a mortality rate of 180,000 for various age, economic, and geographic groups. In addition, the Centers for Disease Control and Prevention predict that the national prevalence of asthma will be 8.4% among adults and 5.8% among children under the age of 18 by 2020 [4]. Asthma prevalence in Indonesia was found to be 2.4% in the Research and Development of the Ministry of Health of the Republic of Indonesia in 2018 on the Prevalence of Asthma in Basic Health Research. 2.6% of people in East Java Province were found to have asthma, with more women than males. According to the 2018 RI Ministry of Health report, the prevalence of bronchial asthma patients diagnosed by doctors of all ages in the city of Surabaya is 3.17% [8]. According to the findings of a collaboration that took place in 2013, between the Central Bureau of Statistics (BPS) and the Institute of Southeast Asian Studies (ISEAS), the Javanese are the largest ethnic group in Indonesia, amounting to 40.05 percent of the population in Indonesia. By using Javanese as a sample for research, it can indirectly represent fingerprint patterns and ATD angles in the Indonesian population [5]

The human genetic inheritance system is biologically very varied, for example, in terms of disease risk and physical characteristics. It is this variation that makes each individual distinguishable from generation to generation. One of the genetic patterns that can be used as a benchmark is fingerprints. The science that studies fingerprints or stroke marks on the ridges of the skin of the hands (fingers and soles), toes and soles of the feet is known as dermatoglyphics [9]. The word dermatoglyph comes from the ancient Greek words derma, meaning skin, and glyph, which means engraving [16]. The development of dermatoglyphics occurs from the 10th week to the 12th week. After that, it will be perfectly formed in the 21st week of fetal development [9]. As well as being useful for personal identification, dermatoglyphics serve as a tool that can be used to sort out the population for several medical disorders, systemic conditions with genetic disorders, and congenital anomalies [9]. In other words, dermatoglyphics can function for the investigation of various genetically based diseases. In the human respiratory tract, especially in adults, there is an ADAM33 protein isoform that is present during the human. Embryology period from the 8^{th} to the 12^{th} week. ADAM 33 is known to be associated with lung function [1]. Lung and skin embryogenesis have almost the same period of time, this is the reason why researchers associate bronchial asthma with dermatoglyphics. From the explanation described above, it can be seen that dermatoglyphics can be used as a tool for early detection of individuals who have medical or systemic disorders with genetic disorders such as bronchial asthma. Research on differences in fingerprint patterns and ATD angles in normal parents compared to parents of children with bronchial asthma has not been carried out, especially in the Javanese, so it is hoped that this can be useful as a non-invasive anatomical marker for cases of bronchial asthma during child development.

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II. METHOD

This type of research was analytic-observational with a cross-sectional design. The participants in this study were Javanese parents who had normal children and Javanese parents who had children with bronchial asthma in the city of Surabaya. Purposive sampling is the sampling method used. Research tools and materials consist of fingerprints (ten fingers) on the right and left palms of parents of normal children and parents of children with bronchial asthma. SDN Made Surabaya, Tambak Rejo Health Center, Made Health Center, Sememi Health Center, Lidah Kulon Health Center, Lidah Kulon Health Center, Lontar Health Center, and Benowo Health Center are research locations from August to October 2022. The Statistical Program for Social Science (SPSS) is used to process and analyze research data.

III. RESULT

A. *Fingerprint Patterns*

The distribution of several fingerprint patterns types, such as ulnar loop, radial loop, double loop, central pocket loop, plain whorl, plain arch, and tented arch, is shown in Table 1. The most prevalent pattern in the group of parents whose children had bronchial asthma was the ulnar loop (49.79%), which was followed by the plain whorl (43.19%), radial loop (3.19%), double loop (1.91%), plain arch (1.28%), and central pocket loop (0.43%).

TABLE I. DISTRIBUTION OF AUSTISTIC CHILDREN'S PARENTS FINGERPRINT PATTERNS

Fingerprint Pattern	Digiti Dexter					Digiti Sinister					Total	%
	I	II	III	IV	V	I	II	III	IV	V		
Ulnar loop	19	22	32	15	22	24	22	30	18	30	234	49,79%
Radial loop	1	4	0	1	0	2	1	3	2	1	15	3,19%
Double loop	1	0	2	0	0	3	2	1	0	0	9	1,91%
Central P. loop	0	0	0	0	0	0	1	0	1	0	2	0,43 %
Plain whorl	26	20	13	31	24	17	19	12	25	16	203	43,19%
Plain arch	0	0	0	0	1	1	2	1	1	0	6	1,28%
Tented arch	0	1	0	0	0	0	0	0	0	0	1	0,21%
Total	**47**	**47**	**47**	**47**	**47**	**47**	**47**	**47**	**47**	**47**	**47**	**100%**

Table 2 shows the distribution of fingerprint patterns from groups of parents who have normal children. The most prevalent fingerprint pattern in the group of parents with normal fingerprints was the ulnar loop (55.96%), which was followed by plain whorl (26.71%), double loop (8.09%), plain arch (4.96%), radial loop (1.49), tented arch (1.49%), and central pocket loop (0.21%).

Table 3 is the result of a statistical test on differences in right-hand fingerprint patterns between the two groups. It is stated that there is a significant difference if the p-value is 0.05. It was found that there were significant differences in several fingers, namely the dexter 1 digit with a p-value of 0.009, the second digit with a p-value of 0.003, and the dexter 5 digit with a p-value of 0.044. Meanwhile, table 4 shows the results of the SPSS test between the two groups of Javanese parents who have normal children and children with bronchial asthma, in which there is only a significant difference in the 1st digit with a p-value of 0.045.

A statistical analysis of the variations in right-hand fingerprint patterns between the two groups is shown in Table 3. If the p-value less than 0,5, there is a significant different. It can be said that there is a significant difference if the p-value is < 0.05. The p-value for the 1st *digiti dexter* is 0.009, the p-value for the 2nd *digiti dexter* is 0.003, and the p-value for the 5th *digiti dexter* is 0.044, were determined to have significant differences. Table 4 displays the SPSS findings from the test for the two groups of Javanese parents with normal children and children who have bronchial asthma, with the p-value of 1st *digiti sinister* is 0.045 that showing significant difference.

Table 3 displays the chi-square test result. The difference between the fingerprint patterns of normal and asthmatic children's on the 5th *digiti dexter* has a p-value (0.044) <0.05 indicating that the fingerprint patterns of the ethnic parents varied significantly. The percentage value shows that the majority of parents who have children with asthma have a Plain whorl fingerprint pattern of 25.5% (24 people), while those with an Ulnar Loop fingerprint pattern are 23 .4% (20 people), and a plain arch fingerprint pattern is 1.1% (1 person). The majority of Javanese parents who have normal children have an Ulnar loop fingerprint pattern of 31.9% (30 people), while those with Plain Whorl fingerprints only amount to 12.8% (12 people), Double loop 2.1% (2 people), Plain Arch 2.1% (2 people), and Tented Arch 1.1% (1 person). The results of statistical tests show that Javanese parents who have children with asthma tend to have a Plain whorl fingerprint pattern, while Javanese parents who have normal children tend to have an Ulnar loop fingerprint pattern on the 5th *digiti dexter*. The chi-square test outcomes shows that there is difference in the fingerprint patterns of Javanes parents with normal children and Javanese parents of children with asthma on the 3rd and 4th *digiti dexter* has a p-value less than 0.05 as a result, there is no obvious distinction between the fingerprint patterns of Javanese parents with normal children and Javanese parents with asthmatic children on 3rd and 4th *digiti dexter*.

TABLE II. DISTRIBUTION OF NORMAL CHILDREN'S PARENTS FINGERPRINT PATTERNS

Fingerprint Pattern	Digiti Dexter					Digiti Sinister					Total	%
	I	II	III	IV	V	I	II	III	IV	V		
Ulnar loop	19	22	32	15	22	24	22	30	18	30	234	49,79%
Radial loop	1	4	0	1	0	2	1	3	2	1	15	3,19%
Double loop	1	0	2	0	0	3	2	1	0	0	9	1,91%
Central P. loop	0	0	0	0	0	0	1	0	1	0	2	0,43 %
Plain whorl	26	20	13	31	24	17	19	12	25	16	203	43,19%
Plain arch	0	0	0	0	1	1	2	1	1	0	6	1,28%
Tented arch	0	1	0	0	0	0	0	0	0	0	1	0,21%
Total	**47**	**47**	**47**	**47**	**47**	**47**	**47**	**47**	**47**	**47**	**47**	**100%**

The chi-square test findings in Table 4 demonstrate a variation in the fingerprint pattern of the 1st *digiti sinister* of normal and asthmatic children's parents had a p-value (0.045) less than 0.05 as a result, there is a considerable variation between the fingerprint patterns of parents of normal and asthmatic children. Based on the percentage value, it can be seen that the majority of Javanesse parents of children with asthma have an Ulnar loop fingerprint pattern of 25.5% (24 people) and Plain Whorl 18.1% (17 people), while those with Double loop fingerprints are 3.2% (3 people), Radial loop 2.1% (2 people) and Plain Arch 1.1% (1 person). The majority of normal parents had the fingerprint patterns Ulnar loop 27.7% (26 people) and Double loop 10.6% (10 people), while those who had the fingerprint patterns Plain Whorl 7.4% (7 people), Radial loop 1.1% (1 person), and Plain Arch 3.2% (3 people) were less common. The results of statistical tests showed that Javanse parents of children with asthma had more Ulnar loop and Plain Whorl fingerprint patterns predominated, but Ulnar loop fingerprint patterns predominated in Javanese parents of normal children and Double loop fingerprint patterns on the 1st *digiti sinister*.

The chi-square test findings, which show a difference in fingerprint between Javanese parents with normal children and Javanese parents with asthmatic children on the *digitti sinister* 2, 3, 4, and 5 that have a p-value greater than 0.05. As a result, there is no discernible difference between the fingerprint patterns of Javanese parents with normal children and Javanese parents with asthmatic children on the *digiti sinister* 2, 3, 4, and 5.

TABLE III. VARIATIONS IN FINGERPRINT PATTERNS OF JAVANESE PARENTS WITH NORMAL AND ASTHMATIC (DIGITI DEXTER)

Digiti Dexter	Children's Parent	Fingerprint Patterns n (%)						T. Arch	P-value
		Ulnar loop	Radial loop	Double loop	Central Pocket	Plain Whorl	Plain Arch		
1	Asthma	19 (20,2)	1 (1,1)	1 (1,1)	0 (0,0)	26 (27,7)	0 (0,0)	0 (0,0)	**0,009***
	Normal	24 (25,5)	0 (0,0)	7 (7,4)	0 (0,0)	14 (14,9)	2 (2,1)	0 (0,0)	
2	Asthma	22 (23,4)	4 (4,3)	0 (0,0)	0 (0,0)	20 (21,3)	0 (0,0)	1 (1,1)	**0,003***
	Normal	21 (22,3)	1 (1,1)	3 (3,2)	0 (0,0)	12 (12,8)	6 (6,4)	4 (4,3)	
3	Asthma	32 (34,0)	0 (0,0)	2 (2,1)	0 (0,0)	13 (13,8)	0 (0,0)	0 (0,0)	0,130
	Normal	33 (35,1)	0 (0,0)	0 (0,0)	0 (0,0)	11 (11,7)	2 (2,1)	1 (1,1)	
4	Asthma	15 (16,0)	1 (1,1)	0 (0,0)	0 (0,0)	31 (33,0)	0 (0,0)	0 (0,0)	0,094
	Normal	24 (25,5)	0 (0,0)	1 (1,1)	0 (0,0)	22 (23,4)	0 (0,0)	0 (0,0)	
5	Asthma	22 (23,4)	0 (0,0)	0 (0,0)	0 (0,0)	24 (25,5)	1 (1,1)	0 (0,0)	**0,044***
	Normal	30 (31,9)	0 (0,0)	2 (2,1)	0 (0,0)	12 (12,8)	2 (2,1)	1 (1,1)	

* = p-value < 0.05 (Significant differences)

TABLE IV. VARIATIONS IN FINGERPRINT PATTERNS OF JAVANESE PARENTS WITH NORMAL AND ASTHMATIC (DIGITI DEXTER)

Digiti Dexter	Children's Parent	Fingerprint Patterns n (%)						T. Arch	P-value
		Ulnar loop	Radial loop	Double loop	Central Pocket	Plain Whorl	Plain Arch		
1	Asthma	24	2	3	0	17	1	0	**0,045***

		(25,5)	(2.1)	(3,2)	(0,0)	(18,1)	(1,1)	(0,0)	
	Normal	26 (27,7)	1 (1,1)	10 (10,6)	0 (0,0)	7 (7,4)	3 (3,2)	0 (0,0)	
2	Asthma	22 (23,4)	1 (1,1)	2 (2,1)	0 (0,0)	19 (20,2)	2 (2,1)	0 (0,0)	0,064
	Normal	25 (26,6)	3 (3,2)	5 (5,3)	0 (0,0)	7 (7,4)	6 (6,4)	0 (0,0)	
3	Asthma	30 (31,9)	3 (3,2)	1 (1,1)	0 (0,0)	10 (10,6)	1 (1,1)	0 (0,0)	0,057
	Normal	27 (28,7)	0 (0,0)	5 (5,3)	0 (0,0)	10 (10,6)	4 (4,3)	1 (1,1)	
4	Asthma	18 (19,1)	2 (2,1)	0 (0,0)	1 (1,1)	25 (26,6)	1 (1,1)	0 (0,0)	0,289
	Normal	20 (21,3)	1 (1,1)	3 (3,2)	0 (0,0)	22 (23,4)	1 (1,1)	0 (0,0)	
5	Asthma	30 (31,9)	1 (1,1)	0 (0,0)	0 (0,0)	16 (17,0)	0 (0,0)	0 (0,0)	0,104
	Normal	33 (35,1)	1 (1,1)	2 (2,1)	0 (0,0)	9 (9,6)	2 (2,1)	0 (0,0)	

* = p-value < 0.05 (Significant differences)

B. Axial Triradius Digital (ATD)

The average ATD angle of the right palm of parents of children with asthma is 41.32 + 4.23, with the minimum value of 31 and the maximum value of 48. In parents of normal children, the ATD angle of the right palm has a lower average of 40, 98 + 3.99, with the lowest ATD angle of 32 and the highest ATD angle reaching 51. The average value of the ATD angle of the left palm of a parent with asthma is 40.91 + 4.15, with the minimum value being 31 and the maximum value 49, while in parents of normal children, the average left palm ATD angle is higher, namely 41.51 + 4.29, with the minimum ATD angle of 31 and the maximum reaching 50. The results of the descriptive analysis shown in Table 5 reveal that the average ATD angle of Javanese parents with normal children is smaller than that of children with Javanese parents who have children with bronchial asthma. While the average ATD angle of the leftpalm of Javanese parents who have normal children is compared to that of Javanese parents who have children with bronchial asthma, to see if there is a statisticly significant variation in the ATD angles of the right and left palm of Javanes parents who have children with asthma and Javanese parents with healthy children, further testing is needed.

The difference between the right hand in the two groups was only 0.34. The unpaired t-test findings revealed a p-value of 0.689 > 0.050, indicating that there was no significant difference in the ATD angle of the right hand between the Javanese parents of children with asthma and the Javanese parents of normal children. Javanese parents of children with asthma have an average ATD angle of 41.51 + 4.29, while Javanese parents of normal children have an average ATD angle of 40.91 + 4.15. The difference between the two is only 0.6. The unpaired T-test gave results with a p-value of 0.496.

The results of the descriptive analysis shown in Table 5 reveal that the average ATD angle of Javanese parents with normal children is smaller than that of children with Javanese parents who have children with bronchial asthma. While the average ATD angle of the left palm of Javanese parents who have normal children is compared to Javanese parents who have children with bronchial asthma, To find out whether there is a statistically significant difference between the ATD angles of the right and left palms of parents who have children with asthma and parents with normal children, further testing is needed.

TABLE V. ATD ANGLE CHARACTERISTICS

ATD Angle	Children's Parent	Min-Max	Median	Mean ± SD
Right Palm	Asthma	31-48	42	41,32 ± 4,23
	Normal	32-51	40	40,98 ± 3,99
Left Palm	Asthma	31-49	41	40,91 ± 4,15
	Normal	31-50	40	41,51 ± 4,29

IV. DISCUSSION

In this study, the number of subject parents of normal children who were female was 45 people (95.74%), and the number of subject parents who had normal children who were male was 2 people (4.26%). In the group of parents who had children with bronchial asthma, there were 42 women (89.36%) and 5 men (10.64%). Because the number of male subjects was less than the number of female parents, the data analysis process did not differentiate between males and females. In this study, four categories were employed to classify the various fingerprint patterns such as arch, *ulnar* loop, *radial* loop, and whorl. The *ulnar* loop (54.96%), plain whorl (26.71%), double loop (8.09%), plain arch (5.96%), radial loop (1.49), tented arch (1.49%), and central pocket loop (0.21%) were the most prevalent findings in the subject group of Javanese parents with normal children. The *ulnar* loop was the most prevalent in the group of Javanese parents of children with bronchial asthma (49.79%), followed by the plain whorl (43.19%), *radial* loop (3.19%), double loop (1.91%), plain arch (1.28%), and central pocket loop (0.43%). This is consistent with a number of earlier studies that found the *ulnar* loop to be the most frequent type of pattern. As can be seen in Table 5, which lists multiple prior research whose findings showed the highest frequency of *ulnar* loop patterns, several

earlier studies claimed that the *ulnar* loop pattern was the type of pattern that was most frequently found on human fingers. The *ulnar* loop pattern (54.96%), was followed by the simple whorl fingerprint pattern type (26.71%), double loop (8.09%), and others with fewer frequencies, was found to be consistent with the results of earlier investigations in Table 5.

The whorl and *radial* loop patterns were found to increase, while the *ulnar* loop, double loop, and plain arch patterns decreased in this study. The findings of this study are comparable to Sreedharan's study, which found an increase in loop patterns in almost every finger when compared to the asthmatic group and the normal group [6]. According to Sahana *et al*, the bronchial asthma patient group had more *ulnar* loop patterns and far fewer arch patterns than the normal group [15]. In addition, a study by Singh *et al*, found that asthmatic patients had a significantly higher average *ulnar* loop pattern score and a significantly lower average arch pattern score in comparison to control group [17]. These studies found that the control group and the asthma patient group had different fingerprint patterns (normal people or those without bronchial asthma). The formation of dermatoglyphics is influenced by environmental variables and polygenic inheritance, according to a recent study by Ashirmetov *et al*, which means that variations in fingerprint patterns might be inherited from parents who also have the bronchial asthma gene [3]. According to an earlier study by Purbasari and Sumadji (2017), which examined variations in fingerprint patterns of students from different ethnicities, variances in ethnicity and race can lead to the appearance of different fingerprint patterns. According to the data, the ulnar loop pattern may be seen up to 60% of the time in Javanese, while it can be seen 100% of the time in Madurese. In contrast, 70% of the designs of the Minang tribe are whorl patterns [12]. The percentage of loop patterns increased in Javanese (52.1%) and Papuan research, respectively, according to Hidayati's 2005 study on variances in fingerprint patterns depending on ethnicity in Indonesia [7].

ATD is the angle resulting from the line connecting triradius "a" to triradius "t" and then triradius "t" to triradius "d." Three tendrils form a point at each corner, pointing in three different directions at 120º angles [10]. According to Robby *et al* in 2019, the population's average ATD angle is 35–50º [13]. On the right palm, the results of the unpaired T-test showed a p-value of 0.689 > 0.050 in both subject groups. On the left palm, the ATD angle test showed a p-value of 0.496 > 0.050, which indicated revealed there was no statistically significant variation in ATD angle between Javanese parents of children with asthma and Javanese parents of healthy children. In their 2013 study, Sahana *et al* discovered no meaningful difference in the study results between the group of Javanese parents of children with asthma and the group of Javanese parents of normal children [15]. According to Sahana et al 2016's study, the comparison of the ATD angles between the two variable groups did not reveal any statistically significant results in the right-hand control group and the asthma group, whereas it did in the left-hand asthma patient group and the control group. Pakhale *et al*, found that there was no statistically significant difference between the group of patients with asthma and the group of normal people, regardless of gender [11]. From these studies, it was concluded that there were differences in fingerprint patterns between the asthma patient group and the control group (normal people or those without bronchial asthma). A previous study conducted by Ashirmetov et al (2019) stated that dermatoglyphics are formed due to the influence of environmental factors and also polygenic heredity, so differences in fingerprint patterns can be inherited from parents who also have a bronchial asthma gene [3].

Further research by increasing the research subjects' homogeneity is expected to provide more representative and significant results. Meanwhile, another limitation is that a complete analysis was not carried out on the parameters of the dermatoglyphic pattern of the palms other than the ATD angle. Further studies with more complete parameters of palmar dermatoglyphics are expected to be carried out, considering that many previous studies found abnormal patterns of dermatoglyphics. In addition, there has been no research on the differences in fingerprint patterns of asthma patients in Indonesia, especially the parents of the patients, so this research can be a start to finding out these differences.

TABLE VI. FREQUENCY OF FONGERPRINT PATTERN TYPES IN SEVERAL STUDIES IN INDONESIA

		Frequency (%)				
Categories	**n**	***Ulnar loop***	***Radial loop***	***Arch***	***Whorl***	**Researcher**
Right Palm Student	83	61 %	-	7%	32%	(Zulhamidah et al., 2021)
Javanese Tribe	92	60,4%	-	2%	37,6%	(Purbasari and Sumadji, 2021)
Public	109	63,31%	4,16%	2,50%	31,01%	(Rosida and Panghiyangani, 2006)

V. CONCLUSION

Based on the findings of the analysis and discussion of the data that has been carried out regarding differences in fingerprint patterns and ATD angles in Javanese parents who have normal children compared to Javanese parents who have children with bronchial asthma in the city of Surabaya, It is possible to conclude that there is a considerable difference in dexter 1, with the majority of the plain whorl pattern in the group of Javanese parents with asthmatic children and the ulnar loop pattern in the group of Javanese parents with normal children. In *digiti dexter* 2, the majority of fingerprint

patterns are *ulnar loops* in both subject groups. For *digiti dexter* 5, the majority of patterns were found in plain whorl in the subject group of parents of asthmatic children, whereas in the group of parents of normal children, the majority of *ulnar loop* patterns were found. In addition, there is a significant difference in the *digiti sinister* 1 with the majority of the *ulnar loop* fingerprint pattern in the subject group of asthmatic parents and normal children's parents. There was no significant variation in the ATD angle on the right and left palms between the two subject groups (Javanese parents who had normal children and Javanese parents who had children with bronchial asthma) in this investigation.

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