ISSN No:-2456-2165

Differences in Fingerprint Patterns and Axial Triradius Digital Angles between Normal and Autistic Children's Parents of Javanese Ethnic

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Abstract:- Autism is a serious neurological development disorder that affects the way of communicating and relating to others. Genetic factors influence fingerprint patterns and axial triradius digital (ATD) angles. The aim of this study was to determine the difference in fingerprint patterns and ATD angles between autistic children's parents and normal children's parents of Javanese ethnic in Surabaya. This cross-sectional study used 24 autistic children's parents and 24 normal children's parents. The differences in fingerprint patterns will be analyzed using Chi-Square Test. The differences in right ATD angle will be analyzed using Independent Sample T-Test and the left using Mann-Whitney Test. The results of this study obtained the frequency of fingerprint pattern types of autistic subjects consisted of whorl (20.66%), ulnar loop (17.36%), double loop (2.26%), radial loop (0.35%), tented arch (0.69%), arch (0.35%). Normal subjects consisted of whorl (10.42%), ulnar loop (23.26%), double loop (2.60%), radial loop (0.69%), tented arch (0.87%), arch (3.82%). The mean of right ATD angle for autistic subjects was ± 43.17, normal subjects was ± 40.62. The mean of left ATD angle for autistic subjects was ± 42.83, normal subjects was ± 40.58. Statistical analysis showed there were significant differences of fingerprint patterns in digitidexter IV (p = 0.018) and digiti sinister II (p = 0.010). Most of autistic subjects had whorl patterns and most of normal subject had ulnar loop patterns. The right ATD angle (p = 0.277) and the left ATD angle (p = 0.125) were not significant differences between autistic and normal children's parents.

Keywords:- *Autism, Axial Triradius Digital Angle, Fingerprint Patterns, Javanese.*

I. INTRODUCTION

Autism is a serious neurological development disorder that affects the way of communicating and relating to others [2]. Autism has several developmental disorders before the age of 3 years, there were communication, social interaction disorders and language disorders, and behavioral disorders [22]. Symptoms that occur in autism can affect self-development, learning, and health. At the age of 1 year, it is very vulnerable to changes in the development and learning of autistic children. Autistic children or children with autism can talk directly to friends their age, when they called they do not respond, no eye contact or body movements, and do not smile at people who are facing them or saying goodbye to them, but autistic children can read words [8].There were 1 in 50 people with autism in the United States in 2013, while in 2014 there were 1 in 68 people with autism, and more precisely 1 in 42 were male and 1 in 189 were female. There were 1 in 160 children with autism in the world [6].

In the United States the prevalence of autism spectrum disorder (ASD) increased significantly in 2016, there were 25 per 1000 children at 3-17 years old. The incidence of autism was 1 in 110 Americans or 1 in 70 males in 2007. In 2008, 1.9% of incidences of autism were found in Iran. The prevalence of autism spectrum disorder (ASD) was estimated at 6.6 per 10,000 children in Iran in 2012 [23]. The prevalence of autism in March 2018 was found 1 in 54 (1.9%) children aged 8 years. At the end of 2018, there were 1 in 44 (2.3%) suffered from autism, which shows an increase in the total of autistic children [4].

Based on extraordinary education statistical data in 2020/2021, it was found that there were 889 children with autism in Indonesia. The total of public special schools has 277 students and private special schools has 612 students [5]. Based on data from the Ministry of Education and Culture 2021, there were 125 students with autism in East Java Special Schools in 2020/2021. Based on the main data of education 2021 there were several special schools in Surabaya City. The total of special schools is 44 private schools, including 22 schools that accept children with autism. Surabaya city is divided into 5 regions, there is West Surabaya with 232 students of special schools, East Surabaya with 284 students, South Surabaya with 213 students, North Surabaya with 85 students, and Central Surabaya with 74 students. The total of students in special schools who accept children with autism in Surabaya is 888 students [17].

The characteristics of children with autism are sensory disorders, motor coordination disorders, communication disorders, and social interaction disorders [15]. There are 2 parts of the chromosomes that cause autism chromosomes 2 and 7, and chromosomes 16 and 17. In the pathogenesis of autism, there are developmental disorders in chromosome, and brain development disorders so that several organs, including the finger tendrils change [32]. There is a patten intensity as a sign to differentiate several types of fingerprints, it was found by Dr. Horold Cummins. The delta/triradius point is a combination of three tendrils pointing in 3 directions like a triangle with an angle of 120º. It is classified into 3 types: Arche type (without any delta/triradius); Loop type (marked by the presence of a single delta/triradius point); whorl type (marked by two delta/triradius points) [18].

ISSN No:-2456-2165

The palmar surface can be divided into dermatoglyphic areas consists of, hypothenar, famous, and four inter-digital areas numbered I to IV. The hypothenar pattern consists of 3 main patterns: circles, loops, and tented arches. Typically, there are 4 "digital triradius" on the proximal base of the digits II, III, IV, V. On the radioulnar line are named a, b, c, and d. The configuration area between the digital triradius "a" and "b" is interdigital II, between triradii "b" and "c" is inter-digital III, and between triradii "c" and "d" are inter-digital IV [29]. The Axial Triradius Digital (ATD) angle is formed between the line drawn from the triradius at the base of the index and the little finger to the axial triradius, the more distal the axial triradius, the greater the angle. The position of the axial triradius forming an angle greater than 56º is called "distal" [29].

Dermatoglyphic is a science that studies fingerprints and skin patterns on human hands and feet [7]. Strokes on the palms and soles of the feet cannot be imitated and classified, it can also be said to be a descendant of the family [27]. Fingerprint patterns have 8 types of mental retardation or autism spectrum disorder including, Whorl, Arch, Ulnar Loop, Tented Arch, Radial Loop, Double Loop, Central Pocket Whorl, and Accidental Whorl [20]. Reference [12] The Axial Triradius Digital (ATD) angle is correlated with faulty chromosomes and disease. The ATD angle is a triradius-t relationship to triradius-d and triradius-a to triradius-t. The ATD angle is also affected by the prenatal and postnatal environment and will change with the subsequent palm and foot development [12].

Genetic factors can also influence fingerprint patterns. There is research that explains genetic relationships control the effects of pleiotropism genes. Genetic factors determine variations in fingerprint patterns [32]. ATD angle is also associated with certain disorders and diseases, for example, people with mental retardation have an ATD angle of about < 30º to > 65º {20]. This case indicates that fingerprints can be related to people with autism. The World Health Organization (WHO) said the international prevalence of autism is around 0.76%, but it is only about 16% of the global child population. The prevalence in the United States (US) estimates that 1.68% or 1 in 59 children at the age of 8 years has autism spectrum disorder (ASD). In 2016 autistic parents were 2.5% more than children [11].

The total of children with autism in Indonesia in 2012 was 1.68 per 1000, which means more than 112,000 autistic people in Indonesia are > 5 years old [8]. According to Zeidan in 2022, it is estimated that 1 in 100 people worldwide will have autism, which is an average and prevalence in various studies. The prevalence of autism is very low and unknown in many countries [34]. Fingerprint patterns, angles, and flexion palmar fold patterns are in autistic and normal people. Men with autism has a higher degree of discrepancy in fingerprint patterns than male adolescents. In research it was said that autism has many numbers of loops and a decrease in the number of ridges on the right and left thumbs of the index finger. It states that fingerprints can be useful in screening children with autism [28].

The risk factor that can increase the risk of Autism Spectrum Disorder (ASD) according to [31] is prenatal where physical, mental, and psychological well-being as well as family finances during pregnancy can affect the development and health of the fetus. If a mother is mentally and physically unhealthy and malnourished, then the baby will also be unhealthy. Other factors are age, old age in the elderly can affect the risk factors for autism, in men aged > 34 years will have a 2-fold higher risk of autism in children. Due to the formation of germ line cell mutations and modifications in DNA that result in epigenetic changes in neurodevelopment, there are disturbances in sperm genomic printing. Premature (<35 weeks) and post-term (>42 weeks) gestational age can increase the risk of autism [31]. Environmental risk factors for pregnant women exposed to rubella and cytomegalovirus can also cause a risk of autism [9].

Environmental factors such as heavy metal poisoning can cause autism because the secretion of heavy metals can be genetically disruptive, for example, arsetic (As), antimony (Sb),Cadmium (Cd), mercury (Hg), and lead (Pb) are strong toxins. Chemical substances in food can be harmful, such as pesticides in vegetables that can interfere with the function of genes in the central nerve to cause children with autism [9]. Autism spectrum disorder (ASD) is considered by some researchers to be a disorder of distorted connectivity between normally functioning neurons and intrinsic defects of neuron function in the cerebral cortex. Cellular or molecular abnormalities of neurons as well as tissue abnormalities will occur in cognitive and socio-communicative disorders that deviate from autism with the impaired normal physiological balance between excitation and brain inhibition. Alterations in the subcortical system such as basal connectivity of the ganglia-substantia nigra, contribute to cognitive impairment and motor stereotypes in autism. Another influence of the connectivity of cortical and subcortical systems in the developing brain occurs in testosterone [33].

According to this study, autism is a side effect of tissue dysfunction and as a contributor to other tissue disorders. Malformations of cortical development, by which focal structural lesions expressly express disturbances in the organization and normal cortical circuits. Genetic defects also affect brain development processes such as, the chaos of ion channel molecules, and aberrant cortical neurogenesis resulting in poor cortical development [33]. Cerebral cortical malformations in autism occur as a result of the migration of damaged nerves to the cerebral cortex during the first 6 months of pregnancy. There is some cortical dysgenesis in autistic patients with neuronal migration disorders, namely, thickened cortex, high neuron density, poor grey-white matter, and ectopic grey matter. It is also seen in the post-mortem cerebral tissue that has been observed in autistic patients that there is a decrease in levels of reelin (an extracellular matrix protein that contributes to neuron migration). The arrangement of synapses and dendritic spines can also cause autism, especially in the brain, showing an increase in long and thin dendritic spines [13].

ISSN No:-2456-2165

There are several complications in autism: sensory problems in autism can cause emotional discomfort, autism also does not respond to the sensation of pain, heat, and cold. Seizures are also one of the complications of autism, while mental health problems in autism are prone to depression, anxiety, impulsive behavior, and mood swings [14]. The prognosis of autism is not always bad, the prognosis will improve if treatment is appropriate and depends on age. Several factors influence the prognosis of autism, such as the severity of symptoms or brain disorders at an age that requires early diagnosis at a young age and intensive and integrated care so that the greater the success, and the smarter the child with autism, the better the prognosis. 20% of people with autism cannot speak for the rest of their lives, while the rest can speak fluently and varied [10].

In the previous study, no one has conducted research on the differences in fingerprint patterns and ATD angles between normal children's parents and autistic children's parents in the Javanese ethnic of Surabaya city or similar research. Then, this study will explore more about the differences in fingerprint patterns and Axial Triradius Digital (ATD) angles between normal children's parents and autistic children's parents in Javanese ethnic in Surabaya City, Indonesia.

II. METHODS

This study is an observational analytical study with a cross-sectional design. The population was parents of normal children and parents of children with autism who live as Javanese ethnic in Surabaya city. Sampling used a purposive sampling technique with a total sample of 24 parents of normal children and 24 parents of children with autism with Javanese ethnicity in Surabaya city. The distribution of research subjects covers 5 areas of Surabaya City, there were West Surabaya 6 subjects, East Surabaya 8 subjects, South Surabaya 6 subjects, North Surabaya 2 subjects, and Central Surabaya 2 subjects. The research was conducted from August – November 2022 at Made Surabaya Elementary School, Public Special School BaktiAsih Surabaya, Santi Mulia, Tuna Mulia, AGCA Center, and Putra Mandiri. The dependent variables in this study are fingerprint patterns and Axial Triradius Digital (ATD) angles.

The fingerprint pattern is a stroke on the fingers of the hand. The ATD angle is 3 corners located in the palm of the hand of the normal children's parents and autistic children's parents. The statistical methods used in this study are descriptive and comparative analysis. Differences in fingerprint patterns between normal children's parents and autistic children's parents will be analyzed using chi-square test. The differences in ATD angles will be analyzed using parametric statistics (Independent sample t-test) for data with normal distribution and homogeneous variance. If the data is not normal or homogeneous will be analyzed with non-parametric statistics (Mann Whitney-test). The normality test used in this study is Shapiro wilk, while the homogeneity test used levene test. This study has obtained ethical clearance according to letter No. 029/EC/KEPK – FKUC/IX/2022.

III. RESULT

A. Fingerprint Patterns

Fingerprint patterns are divided into six categories: whorl, ulnar loop, double loop, radial loop, tented arch, and arch. The distribution of autistic children's parents' fingerprints is described in Table I. The frequency of fingerprint pattern types often appearing in autistic children's parents is the whorl type (20.66%). While others have an ulnar loop (17.36%), double loop (2.26%), tented arch (0.69%), radial loop (0.35%), and arch (0.35%). Table II shows the frequency of the right-hand and left-hand fingerprint pattern types often appearing in normal children's parents is an ulnar loop (23.26%). While others have whorl (10.42%), arch (3.82%), double loop (2.60%), tented arch (0.82%) and radial loop (0.69%).

Table 1: 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**		
Whorl	14	11	7	18	12	10	11	10	14	12	119	20.66
Ulnar Loop	8	9	15	6	12	11	8	11	9	11	100	17.36
Double Loop	2	1	2	0	0	3	4	1	0	0	13	2.26
Radial Loop	0	2	0	0	0	0	0	0	0	0	2	0.35
Tented Arch	0	1	0	0	0	0	1	1	0	1	4	0.69
Arch	0	0	0	0	0	0	0	1	1	0	2	0.35
Total	**24**	**24**	**24**	**24**	**24**	**24**	**24**	**24**	**24**	**24**	**576**	**100**

Table 2: 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**		
Whorl	8	5	4	10	5	6	3	5	9	5	60	10.42
Ulnar Loop	11	10	17	14	15	13	11	14	13	16	134	23.26
Double Loop	3	2	0	0	1	2	4	1	1	1	15	2.60
Radial Loop	0	1	0	0	0	1	1	0	1	0	4	0.69
Tented Arch	0	2	1	0	1	0	0	1	0	0	5	0.87
Arch	2	4	2	0	2	2	5	3	0	2	22	3.82
Total	**24**	**24**	**24**	**24**	**24**	**24**	**24**	**24**	**24**	**24**	**576**	**100**

ISSN No:-2456-2165

Table 3: Differences in Digiti Dexter Fingerprint Patterns of Autistic and Normal Children's Parents

No	Child	Fingerprint Patterns n (%)						P-value
		Whorl	Ulnar loop	Double loop	Radial loop	Tented arch	Arch	
I	A	14 (29.2)	8 (16.7)	2 (4.2)	0 (0)	0 (0)	0 (0)	0.164
	N	8 (16.7)	11 (22.9)	3 (6.3)	0 (0)	0 (0)	2 (4.2)	
II	A	11 (22.9)	9 (18.8)	1 (2.1)	2 (4.2)	1 (2.1)	0 (0)	0.112
	N	5 (10.4)	10 (20.8)	2 (4.2)	1 (2.1)	2 (4.2)	4 (8.3)	
III	A	7 (14.6)	15 (31.3)	2 (4.2)	0 (0)	0 (0)	0 (0)	0.096
	N	4 (8.3)	17 (35.4)	0 (0)	0 (0)	1 (2.1)	2 (4.2)	
IV	A	18 (37.5)	6 (12.5)	0 (0)	0 (0)	0 (0)	0 (0)	**0.018***
	N	10 (20.8)	14 (29.2)	0 (0)	0 (0)	0 (0)	0 (0)	
V	A	12 (25)	12 (25)	0 (0)	0 (0)	0 (0)	0 (0)	0.065
	N	5 (10.4)	15 (31.3)	1 (2.1)	0 (0)	1 (2.1)	2 (4.2)	

* = p-value < 0.05 (Significant differences)

A = Autistic Children
N = Normal Children

The differences in fingerprint patterns between normal children's parents and autistic children's parents of Javanese ethnic in Surabaya city will be analyzed using chi-square test with the requirement that cells <5 is not more than 20% of the total cells. The hypothesis will be tested with a 5% significant level. If chi-square test has p-value < 0.05, there is a significant difference between fingerprint patterns of normal children's parents and autistic children's parents. The chi-square test results in Table III show the difference in fingerprint patterns between normal children's parents and autistic children's parents digitidexter IV has a p-value (0.018) < 0.05, so there is a significant difference between normal children's parents and autistic children's parents digitidexter IV. Based on the percentage value, most autistic children's parents have a fingerprint pattern on the digitidexter IV is a whorl pattern of 37.5% (18 people) while the ulnar loop is only 12.5% (6 people).

Meanwhile, the percentage value of normal children's parents has a fingerprint pattern on the digitidexter IV is ulnar loop pattern 29.2% (14 people) and whorl 20.8% (10 people). None of the normal children's parents and autistic children have a double loop, radial loop, tented arch, and arch. The result of statistical analysis shows that autistic children's parents have more whorl fingerprint patterns, while parents with normal children have more ulnar loop fingerprint patterns. The chi-square test results of differences in fingerprint patterns in parents with normal children and parents with autistic children on digitidexterI, II, III and V have a p-value > 0.05. There is no significant difference in the fingerprints of normal children's parents with autistic children's parents on digitidexterI, II, III, and V.

ISSN No:-2456-2165

Table 4: Differences in Digiti Sinister Fingerprint Patterns of Autistic and Normal Children's Parents

No	Child	Fingerprint Patterns n (%)						P-value
		Whorl	Ulnar loop	Double loop	Radial loop	Tented arch	Arch	
I	A	10 (20.8)	11 (22.9)	3 (6.3)	0 (0)	0 (0)	0 (0)	0.236
	N	6 (12.5)	13 (27.1)	2 (4.2)	1 (2.1)	0 (0)	2 (4.2)	
II	A	11 (22.9)	8 (16.7)	4 (8.3)	0 (0)	1 (2.1)	0 (0)	0.010*
	N	3 (6.3)	11 (22.9)	4 (8.3)	1 (2.1)	0 (0)	5 (10.4)	
III	A	10 (20.8)	12 (22.9)	1 (2.1)	0 (0)	1 (2.1)	1 (2.1)	0.540
	N	5 (10.4)	14 (29.2)	1 (2.1)	0 (0)	1 (2.1)	3 (6.3)	
IV	A	14 (29.2)	9 (18.8)	0 (0)	0 (0)	0 (0)	1 (2.1)	0.200
	N	9 (18.8)	13 (27.1)	1 (2.1)	1 (2.1)	0 (0)	0 (0)	
V	A	12 (25)	11 (22.9)	0 (0)	0 (0)	1 (2.1)	0 (0)	0.051
	N	5 (10.4)	16 (33.3)	1 (2.1)	0 (0)	1 (2.1)	2 (4.2)	

* = p-value < 0.05 (Significant differences)

A = Autistic Children
N = Normal Children

Table IV shows that the chi-square test results differences in fingerprint patterns of normal children's parents and autistic children's parents on digiti sinister II have a p-value (0.010) < 0.05, then there is a significant difference between the fingerprint pattern of normal children's parents and autistic children's parents on digiti sinister II.Based on the percentage value, the most of autistic children's parents have a digiti sinister II fingerprint pattern whorl 22.9% (11 people). While others have ulnar loop of 16.7% (8 people), double loop 8.3% (4 people), tented arch 2.1% (1 person). The most of normal children's parents have a digiti sinister II fingerprint pattern ulnar loop 22.9% (11 people). While others have arch 10.4% (5 people), double loop 8.3% (4 people), whorl 6.3% (3 people) and radial loop 2.1% (1 person). The results of statistical analysis show that most autistic children's parents have whorl patterns. While normal children's parents have ulnar loop patterns.

As for the results of the chi-square test, the difference in fingerprint patterns of normal and autistic children's parents on digiti sinister I, III, IV, and V have a p-value > 0.05. Then, there is no significant difference in the fingerprint pattern of normal children's parents and autistic children's parents on digiti sinister I, III, IV, and V.

B. Digital Triradius Axial Angle (ATD)

The results of the ATD angle will be described using minimum, maximum, mean, median, and standard deviation. The mean and standard deviation of the right palm ATD angle of autistic children's parents in Table V was 43.17 ± 6.92 with the lowest score of 34 and the highest score of 66. Meanwhile, normal children's parents have a lower score of 40.63 ± 4.31 with the lowest of 32 and the highest of 51. The mean left palm ATD angle of autistic children's parent of 42.83 ± 5.43 with the lowest score of 33 and the highest score of 55 (Table 5). Normal children's parents have a lower score than autistic children's parents, which is 40.58 ± 4.50 with the lowest ATD angle of 31 and the highest of 50.

Based on descriptive results, it shows that both of right and left palms of normal children's parents have a lower mean than autistic children's parents. However, it is necessary to test statistically whether there are significant differences between normal and autistic children's parents or not. Based on the normality test, the right palm ATD angle of autistic children's parents have a p-value (0.004) <α (0.05). Then it is not normally distributed. The right palm ATD angle of normal children's parents have a p-value (0.194) > α (0.05). Then it is normally distributed. Both right palm ATD angle of normal and autistic children's parents have a homogeneous variance with a p-value (0.122) > α (0.05).

Because the right palm ATD angle is not normally distributed, then the difference in ATD angle between normal and austistic children's parents will be analyzed using non-parametric statistics (Mann Whitney test). Table 6 shows that median of the right palm ATD angle of autistic children's parents is 42.50 while the median of normal children's parents is 40. The difference between both is only 2.5. The Mann Whitney test results have p-value (0.277) > 0.050. This result shows that the right palm ATD angle of normal and autistic children's parents is not significantly different or both have the same ATD angle.

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Table 5: Charachteristi of The ATD Angle of The Right and Left Palm of Autistic and Normal Children

ATD Angle	Child	Min-Max	Median	Mean ± SD
Right Palm	Autistic	34-66	42.50	43.17 ± 6.92
	Normal	32-51	40.00	40.63 ± 4.31
Left Palm	Autistic	33-55	42.50	42.83 ± 5.43
	Normal	31-50	40.00	40.58 ± 4.50

* = p-value < 0.05 (Significant differences)

Table 6: Differencens in The Right and Left Palm ATD Angle of Autistic and Normal Children

ATD Angle	Child	Median	Differences	p-value
Right Palm	Autistic	42.50	2.50	0.277
	Normal	40.00		
ATD Angle	Child	Mean	Differences	p-value
Left Palm	Autistic	42.83 ± 5.43	2.25	0.125
	Normal	40.58 ± 4.50		

* = p-value < 0.05 (Significant differences)

The results of the normality test of the left palm ATD angle of the autistic children's parents have a p-value (0.602) > α (0.05) and normal children's parents have a p-value (0.166) > α (0.05). Both is normally distributed. Both of normal and autistic children's parents have a homogeneous variance with a p-value (0.304) > α (0.05). The left palm ATD angle is normally distributed and homogeneous variance, the difference of the left palm ATD angle between austistic children's parents and normal children's parents will be analyzed using parametric statistics (Independent Sample T-Test). Table VI shows that the mean left palm ATD angle of autistic children's parents is 42.83 ± 5.43, while normal children's parents is 40.58 + 4.50. The difference is only 2.25. The independent sample t-test results have p-value (0.125) > 0.050. Then, left palm ATD angle between normal children's parents and autistic children's parents is not significantly different or both have the same ATD angle of the left palm.

IV. DISCUSSION

The group of this study consists of parents of children with autism and parents of normal children. The results of this study show that there is a difference between digitidexter IV and digiti sinister II with a p-value < 0.05. In previous studies, genetic factors can influence fingerprint patterns to change because the growth of fingerprint patterns occurs when they are still in the womb. If there are chromosomal change in the fetus, it will affect in fingerprint patterns change of the child [26]. References [21] was reported that there was an inheritance of patterns in families, where there were 22 families consisting of fathers, mothers, and biological children. The results of the previous study showed that 6 children (14.6%) had the same type of pattern as their father, 10 children (24.4%) had the same type of pattern as their mother, and 19 children (46.4%) had the same type of pattern as both their parents and 6 children (14.6%) matched one of their parents. Most parents had whorl pattern and their children had whorl patterns, it can be concluded that parents' fingerprints are inherited to their children [21].

In previous studies, it was found that most of the fingerprint pattern in children with autism in Palembang were radial loops (51.4%), whorl (36.9%), ulnar loops (11.7%) [25]. Another study said that arch pattern was the least fingerprint pattern in children with autism in Palembang with a total case of 17 (3.7%) out of 443 (96.3%) cases [21]. Another previous study said most of children with autism (male) had the whorl patterns (62.41%) and the least fingerprint pattern was arch (9.17%) [30]. Previous studies have shown that the fingerprint pattern of normal children was ulnar loop (42.28%) and whorl (32.15%) [19]. Another study reported that most of the fingerprint patterns in normal children in Yogyakarta were ulnar loop (53%), whorl (38%), arch (5%) and radial loop (4%) [1].

Previous studies have shown that ethnic and racial differences can also determine differences in fingerprint patterns in various ethnic groups. From 11 ethnic studies, it was found that most of minang ethnic had whorl pattern (70%). The most pattern in Javanese was loop (60.4%), and the Madurese has 100% loop [24]. The ATD (Axial triradius digital) angle of dexter was found that a p-value (0.277) > α (0.05) which is greater than significant level. This means that there is no significant difference between parents of children with autism and parents of normal children. The difference is 2.50. The ATD dexter angle of parents of children with autism is greater than parents of normal children.

The ATD (Axial triradius digital) angle of sinister was found that a p-value (0.125) > α (0.05) was greater than significant level. This means that there is no significant difference between parents of children with autism and parents of normal children. The difference is 2.25. The ATD sinister angle of parents of children with autism was greater than parents of normal children. The results of this study are in accordance with the results of previous studies which showed that the ATD angle of boys with autism is wider than the ATD angle of normal children [30]. This result is different from previous studies, which showed that the ATD angle in children with autism was smaller than normal children. The ATD angle of children with autism (girl) is also to be greater than of children with autism (boy) [3]. Previous studies compared the ATD angles of parents who have cleft children and parents who have normal children

conducted by Maria Iriane, Sanjoto and Leokito [16], found that the ATD angle has significant differences in fathers which means that the relationship between father and child is stronger than the relationship between mother and child [16].

V. CONCLUSIONS

Based on the results of research conducted, it was shown that there were significant differences in fingerprint patterns in digiti IV dexter and digiti II sinister between autistic and normal children's parents. There was an increase in whorl patterns in digiti IV dexterand digiti II sinister in parents who have children with autism than normal children. There was no significant difference in the ATD angle between autistic and normal children's parents, as the p-value of the right palm was 0.277 > 0.050 and the p-value of the left palm was 0.125 > 0.050. Research more intensive is needed to improve the sample homogeneity (genetic background, age restriction, and comparative analysis between male and female) with larger sample sizes to make them more valid and to add dermatoglyphic parameters to obtain more complete results.

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