



## Original Research

### **Dermatoglyphic analysis of asthma sufferers in a population of students at the faculty of mathematics and science, Universitas Negeri Padang**

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## Abstract

Asthma is a disease defined as chronic inflammation of the airways characterised by recurrent coughing and shortness of breath. Dermatoglyphs are the appearance of fingerprint patterns of dermal ridges found on the fingers, palms, toes, and soles of the feet. Dermatoglyphs are used as tools for detecting many diseases with strong genetic underpinnings and are also used to detect abnormalities. The purpose of this study was to analyse and compare fingertip dermatoglyph patterns in asthmatics and non-asthmatics. This type of study is a descriptive study using cross-sectional sampling. A sample of up to 100 fingerprint pattern samples was taken from a population of students from the Faculty of Mathematics and Science, Universitas Negeri Padang. The results obtained showed that there was a remarkable difference in the total number of arch fingerprint patterns in asthmatic students compared to healthy subjects. This difference in numbers suggests a possible link between fingerprint patterns and asthma phenotypes.

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## Introduction

Asthma is defined as a chronic inflammatory airway disease characterised by increased sensitivity of the tracheobronchial tree to a variety of stimuli, leading to airway obstruction that can occur periodically (Sahana et al., 2013). Global Asthma Network (2022) states that asthma is a chronic disease and the Global Burden of Disease Collaboration estimates it will affect up to 262 million people worldwide in 2019. The disease is one of the causes of premature death and poor quality of life for people of all ages worldwide. About 1,000 people die every day from asthma. This mortality rate is a serious concern as most of these cases are preventable. Most fatal asthma cases occur in poor and developing countries (Zulhamidah et al., 2022).

Asthma is thought to be caused by a combination of genetic and environmental factors. Diagnosis is usually based on pattern of symptoms, response to treatment over time, and spirometry. The prevalence of asthma has increased dramatically and is now recognized as a leading cause of disability, healthcare costs and preventable death. Asthma can develop at any age, but especially at a young age. Approximately half of the cases occur before he is 10 years of age, and another third before 40 years of age (Singh et al., 2016). Based on pedigree analysis, asthma exhibits a significant autosomal recessive inheritance pattern (Bijanazadeh et al., 2011). However, it is still not possible to detect all genes in all asthma patients because the detection process is expensive and time-consuming. Therefore, specific, simple and convenient markers are needed to identify different phenotypes in the clinical management of asthma (Xue et al., 2013).

The study of the pattern of epidermal ridges on the skin of the fingers, palms, and toes is known as "Dermatoglyphics". The early study of dermatoglyphics was discussed by Sir Francis Galton in 1892 in his work on fingerprints. The study was later referred to as Dermatoglyphics by Dr. Harold Cummins in 1926, although the process of fingerprint identification has been in use for several hundred years, the most famous ancient fingerprint design is the carving on the wall of the aisle of the Neothalic cemetery, located on the island of Brittany L'île de Gavr'inis, the inner walls of which are covered with designs incised circular patterns, spirals, curves, meanders and straight lines made in various combinations (Bhat et al., 2014).

The science of dermatoglyphics is based on two main facts; firstly, fingerprints differ slightly, and no two individuals, not even identical twins, have exactly the same fingerprint pattern, and secondly, these fingerprints are permanent for life and are resistant to superficial injuries and environmental changes after the 21st week of intrauterine life (Pakhale et al., 2012). With age, growth, and environmental changes, the pattern of dermatoglyphics does not change throughout life. Dermatoglyphic changes only in the size of the ridges, which occur in accordance with the development of the hands and feet. The variation in dermatoglyphics in humans is different from the others and shows the characteristics of each individual. Fingerprint patterns are generally divided into three forms, namely arch, loop, whorl. The arch pattern is a pattern that does not have a triradii, the loop pattern is curved and has a triradii, and the whorl is a circular pattern which has two triradii (Chastanti, 2020).

Dermatoglyphs are patterns that form on the outer skin, originating from the hypodermal neural system and formed during the 10th to 17th week of embryonic period. Like other physical traits in humans, dermatoglyphics is also influenced by genes and the environment (Xue et al., 2013). This fingerprint pattern is a genetic manifestation that is controlled by multiple genes (polygene), in which this fingerprint pattern will not change throughout a person's lifetime. Apart from genes and environment, modulation of dermatoglyphic patterns are possibly influenced by blood supply and nerve supply (Zulhamidah et al., 2022). Dermatoglyphic patterns are now widely used as a clinical diagnostic for several diseases related to chromosomes and growth defects such as mongolism, Turner syndrome, cardiovascular disease, and schizophrenia (Mahajan & Gour, 2011).

There are not many studies linking dermatoglyphic patterns to asthma, and few studies showing relation between dermatoglyphic patterns that help predict the occurrence of asthma (Pakhale et al., 2012; Sahana et al., 2013; T.K et al., 2020; Zulhamidah et al., 2022). The association of dermatoglyph patterns with asthma is prognostic rather than diagnostic, and to identify people with a specific disease rather than to define pre-existing disease. Therefore, this study was conducted to determine the possible association between asthma and dermatoglyphic patterns.

## Method

### Materials

The tools used to collect fingerprint samples in this research are ink pads, wet wipes, and form papers.

### Methods

Research and sampling were conducted from November to December 2022 at the Faculty of Mathematical Sciences, Universitas Negeri Padang. This is descriptive research with a cross-sectional sampling method. Samples were obtained from 100 active students and divided into two groups: 50 asthmatics (referred to as the case group) and 50 healthy individuals (randomly selected control group). Control group selected from among the students that had no respiratory problems or any asthma-related symptoms.

Data is taken from each subject by first filling out a consent form using Google form. The dermatoglyphic pattern data collection technique uses the ink and finger rolling method. The requested data is that the volunteer represents all of their fingers. Data collection in this study was initially carried out by recording student data for which the dermatoglyphic pattern was to be taken,

namely the name, study program and year of admission of the student. Then the fingers are cleaned with wet wipes to remove grease, sweat and other debris. Then fingertips were placed on the inked pad and made sure the entire surface of the fingers is covered in ink. Lastly, the fingers were placed on the form paper to collect the fingerprints.

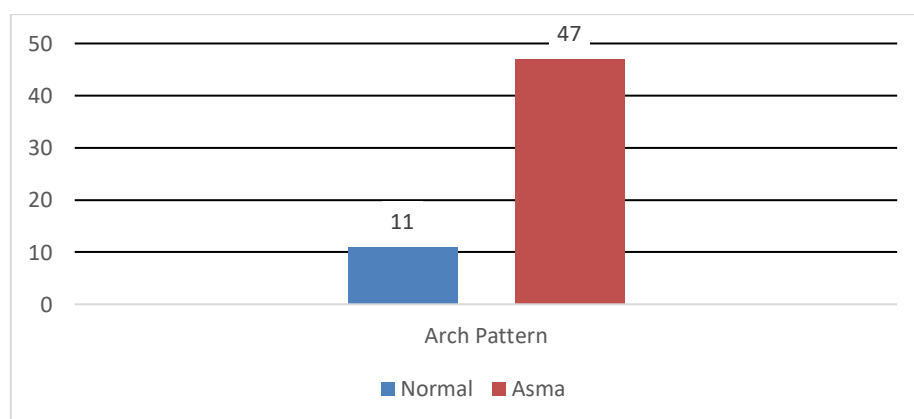
## Results and Discussion

Fingerprint patterns can be broadly classified into three shapes: arch, loop, and whorl. A triradii is a point where three groups of ridges coming from three directions meet at an angle of approximately 120°. The core is basically a ridge surrounded by 180° inverted ridge panels. Loop patterns include triradii and core.

The loop is either radial or ulnar. A finger has radial loops if the triradii of the finger are on the pinky side of the hand in question and the loops open toward the thumb. A finger has an ulnar loop if the triradii of the finger is on the thumb side of that hand and the loop opens into the little finger. A whorl is a pattern of characteristic ridges built around a core. The shape of the pattern area can be either circular or oval. This pattern has two triradii with ridges forming different patterns inside. The arch is the simplest and least common pattern, bending slightly distally across the finger. It can be classified as "simple" if the ridges are slightly above the middle of the finger, or "tented" if the ridges are pointed (Singh et al., 2016). The average fingerprint pattern on the human hand is 5% arch pattern, 25-30% whorl pattern, and the most common pattern with 65-70% is loop pattern (Suryo, 2011). In a study conducted by Cummis and Midlo regarding fingerprints, it was stated that arch patterns in the dermatoglyphic analysis of the Mongoloid group were only found in about 2-3% (Jacob & Indriati, 2000).

Factors that cause asthma can be divided into two groups: genetic and environmental. Genetic factors caused by a family history of asthma, a history of allergic diseases, and even the development of the disease due to premature birth. On the other hand, environmental factors that cause it come from outside the body, such as: Vehicle exhaust fumes, cigarette smoke, cold air, dust, humidity, and allergens. Studies on asthma are among the most commonly conducted studies, but the relationship between asthma and dermatoglyphics has not been widely discussed. Therefore, this study examines dermatoglyphics patterns in students with asthma and its association with the student's fingerprint pattern.

Based on a study conducted, we obtained a comparison of arch fingerprint pattern counts on asthmatics and healthy individuals in the student population of the Faculty of Mathematics and Science, Universitas Negeri Padang. Based on the graphic image of the number of arch fingerprint patterns (Figure 1), the number of arch fingerprint patterns of asthmatics students is up to 47, while arch patterns found in healthy students were only 11. Arch fingerprint patterns tend to be trusted as one of the disease detection factors, this shows that dermatoglyphics, especially the arch fingerprint pattern, are important aids in diagnosing and understanding the genetics of many diseases, including asthma. However, there are few studies on the association between dermatoglyphs, especially arch fingerprint patterns, and asthma.



**Figure 1.** Total of Arch fingerprint patterns

Some studies show a predominance of Arch fingerprint patterns in people with certain medical conditions. A study conducted in Andhra Pradesh, India, showed that women with diabetes mellitus had more arch fingerprint patterns (5.7%). A study conducted in Zaria, Nigeria, showed that male diabetics had more arch patterns than the general population (Marpaung & Jaya, 2015). The arch fingerprint pattern, which in this study primarily belongs to asthmatic patients, may provide researchers with a benchmark that this pattern could indeed be used as a biomarker to detect asthma risk.

## Conclusion

Asthma can arise from two factors: hereditary or hereditary factors and trigger factors. Based on the studies conducted, arch fingerprint patterns are known to be more prevalent in asthmatics than in healthy subjects, and there may be an association between arch fingerprint patterns and asthma phenotypes. Based on the results of this study, the arch fingerprint pattern should be further investigated to become a biomarker for asthma and several other diseases.

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