Original Article

Biological Variability of Sweat Gland Pores in the Fingerprints of a Fars Iranian Family from Khorasan Razavi Province, Iran

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Abstract

Introduction: Poroscopy is a method of identification in which the characteristics of sweat pores are compared from different aspects. These pore openings are present along the friction ridges found on the distal end of digits, palms and soles in the hands and feet.

Materials amd Methods: This study enrolled 100 Iranian males from the Fars family who resided in Khorasan Razavi Province. The average age of participants was 20 years. Pictures of their finger tips and tri-linear A positions of both hands were taken using a Dino-Lite-313 puls and Dino-capture software. Then circle areas of 80l16-5l12 mm2 were considered in all pictures and the numbers of pore ducts of the sweat glands that occurred in these given areas were counted. The results were analyzed by Minitab Statistical Software. The finger and palm printing method was used in order to complete the sampling process. The size, number, position and relative distance of the pores on the fingers and toes were examined in detail.

Results: Evaluation of the qualitative results and comparison with the findings of other studies showed morphological variety within the sweat pores of the Fars family of the Iranian population.

Conclusion: The variance in morphology and density of these pore canals can probably represent a foundation for classifying humans or applying the same in biological anthropology.

Keywords: Sweat gland pores, Der matogliphic, Forensic medicine

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Introduction

Fingerprint friction ridge details are generally described in a hierarchical order at three different levels: level 1 (pattern), level 2 (minutia points), and level 3 (pores and ridge contours). Level 1 is the macro detail such as ridge flow and pattern type whereas level 2 (points) are the Galton characteristics or minutiae points such as bifurcations and endings [1,2]. Level 3 features are often defined as the dimensional attributes of the ridges and shape that include sweat pores, ridge contours, and ridge edge features, all of which provide quantitative data to support more accurate robust fingerprint recognition. Among these features, pores have most extensively been studied [2-4].

Pores are the small openings on the surface of fingerprint ridges formed by the ducts of sweat glands. In humans, around week 14 of pregnancy sweat glands appear along the apices of the epidermal ridges and once formed on the ridges they become fixed and never degenerate or move. Extensive research has shown that pore patterns are unique to each individual In addition, pore-to-pore distance differs from one person to another and varies depending upon the location in the finger [5-7].

Poroscopy is a method of identification in which the characteristics of sweat pores are compared in different aspects. These pore openings are present along the friction ridges found on the distal end of digits, palms and soles of the hands and feet. This method, initially examined by Edmond Locard in 1912, was later developed. Locard realized that the characteristics of sweat pores were useful for the science of identification as with the characteristics of ridges of dermatoglyphic patterns. He has discovered that pore characteristics are permanent, unchangeable and unique. Whenever the number of ridge characteristics is inadequate, poroscopy can be used as an independent method of identification [2,5].

The objective of this study was to assess the biological variability of sweat gland pores in the fingerprints of a sample of the Fars family from the Iranian population.

Materials and Methods

This study was performed by making palm and finger prints from 100 male adults of the Iranian Fars family who were residents of Khorasan Razavi Province, Iran.

All study procedures were approved by the Medical Ethics Committee Mashhad University of Medical Sciences, Mashhad, Iran

For the purpose of making a clear set of finger prints, first each finger was covered with ink and then the inked-fingers were rolled from side-to-side on imprint paper. To create a print of palm lines, first the ink was uniformly spread on the palm of the hand and then the inked-palm was imprinted on a paper placed over a rolling cylinder. Thus, a distinctive print of each person's characteristics was generated(Figure 1). In order to complete archive information, we used a Dino-Lite-313 puls (it is the name of microscope)AM digital microscope and Dino-capture software. Circle areas of 80/16-5/12 mm^2 were considered in all pictures. The numbers of pore ducts of sweat glands observed on these selected areas were counted (Figure 2) and the results analyzed by Minitab Statistical Software. The finger and palm printing method was used in order to complete the sampling process.

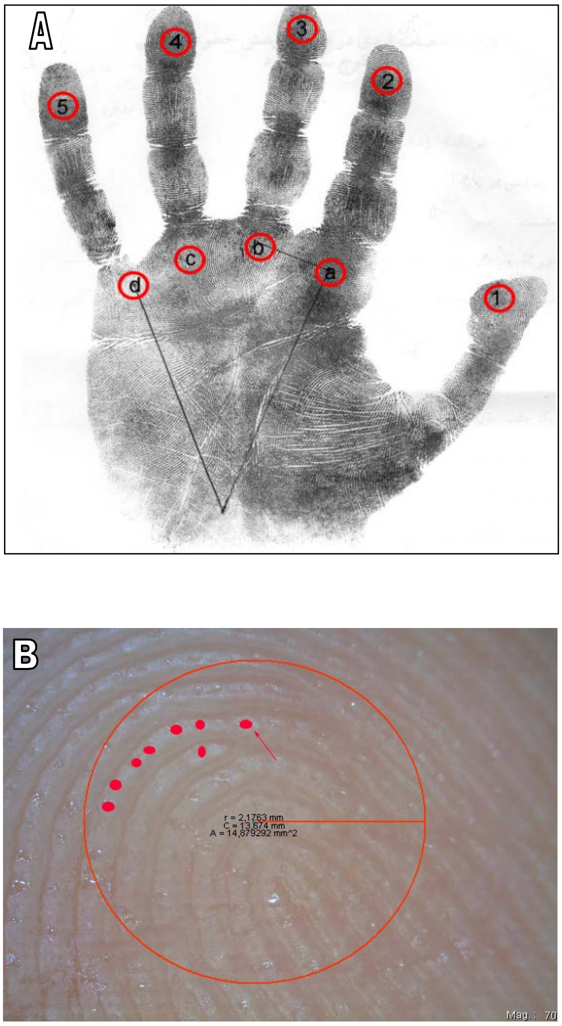

Figure 1. The anatomical position under consideration in this study (a) and samples of photos taken from the finger tips (b). The point of the arrow shows one of the pores.

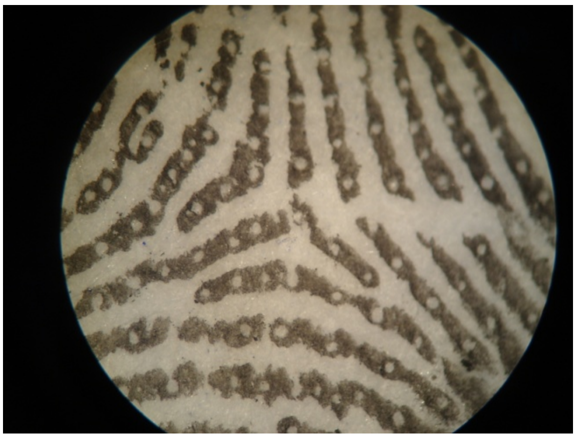

Figure 2. Picture of trilinear position A under 50x magnitude.

The following sweat pore characteristics were examined under a stereomicroscope with standard 50x magnification:

1) Number of pores: Friction ridges in a circle area of 50 mm diameter were selected under 50x magnification and the number of pore openings along the friction ridges and in tri-linear A position were counted in each unit, at random and on average.

2) Distance between pores: Distances between pores were calculated by counting the number of pores in each unit and the findings classified as follows: a) pores with close distances were those pores located in close proximity and the number of pores found in one cm of length were more than 12;b) clusters of pores with close distances were cluster pores found in groups of two or more in one cm of length; c) distant sweat pores where the number of pores varied from 8 to 11 in one cm of length and the pores were further apart in distance compared to the other classes; and d) chain-like sweat pores were pores joined together that appeared chain-like with no distance between them.

3) Size of pores: Pore size was determined in comparison with the size of the biggest pore on the finger print impression and divided into three types: small, medium and large.

4) Shapes of pores: Pores that occurred on a ridge might be: i) circular, ii) rhomboid, iii) oval, iv) rounded and v) square shaped. In each area, the frequency of occurrence of these pores was determined by counting the numbers of pores of a common shape.

5) Position on the ridge: The positions of pores were determined according to location, along the middle or the side of the ridge. Pores might open on the side of the ridge (appear to be positioned in the furrow). In this case, pores were open and bow-shaped. Otherwise, pores were closed and located on the side of the ridge within a distinctive area [5].

Results

The average number of pores varied from 10 to 11 in each cm of ridge length. We observed that the pores usually were located at equal distances from each other in a single row along the middle of the ridge. In the present study, medium-sized pores were the most frequently observed in all areas of the print (76.16%), followed by large-sized pores (16.15%) Small-sized pores were the least frequently observed 7.99%; (Figure 3,4).

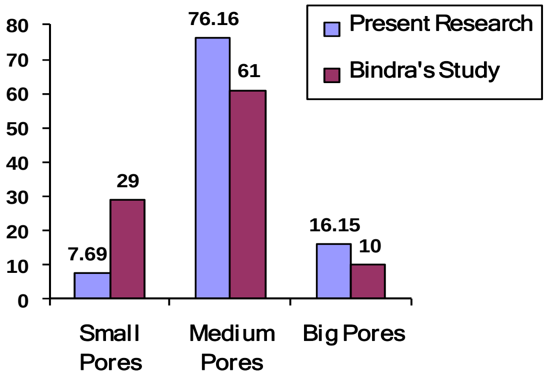

Figure 3. Comparison of pore size in Bindra's study to the current research.

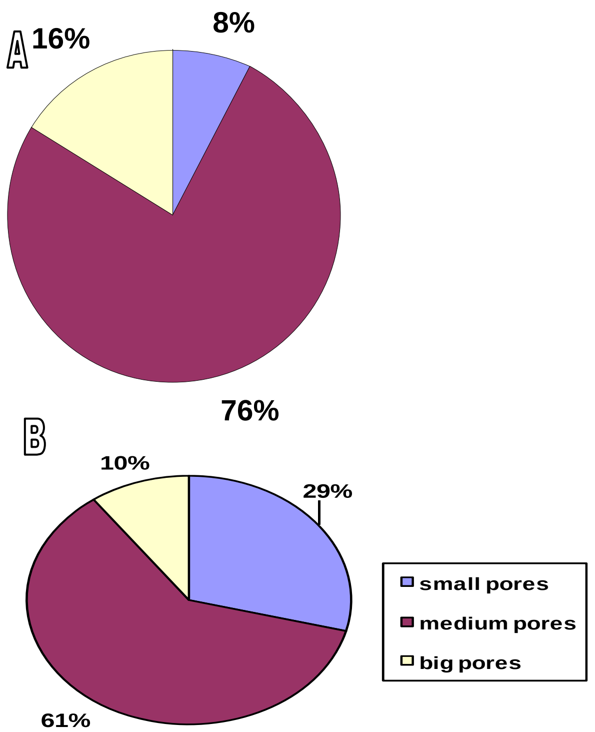

Figure 4. Frequency of pore size. Present research (A), Bindra's study (B).

Approximately 46.5% of the shapes studied were circular, which was much higher than the amount found in a study by Bindra (23%–31%). Approximately 3.85% were oval-shaped, and 1.54% were square and rhomboid in nature. Pores with similar shapes seemed to be grouped together or spread apart, but the second type was usually predominant (Figures 5,6). It could be said that most appeared in the middle or were located on the side of the ridge (57%). Pores located in the middle of the ridge were of the closed type and clear (43%), which supported findings by Bindra.

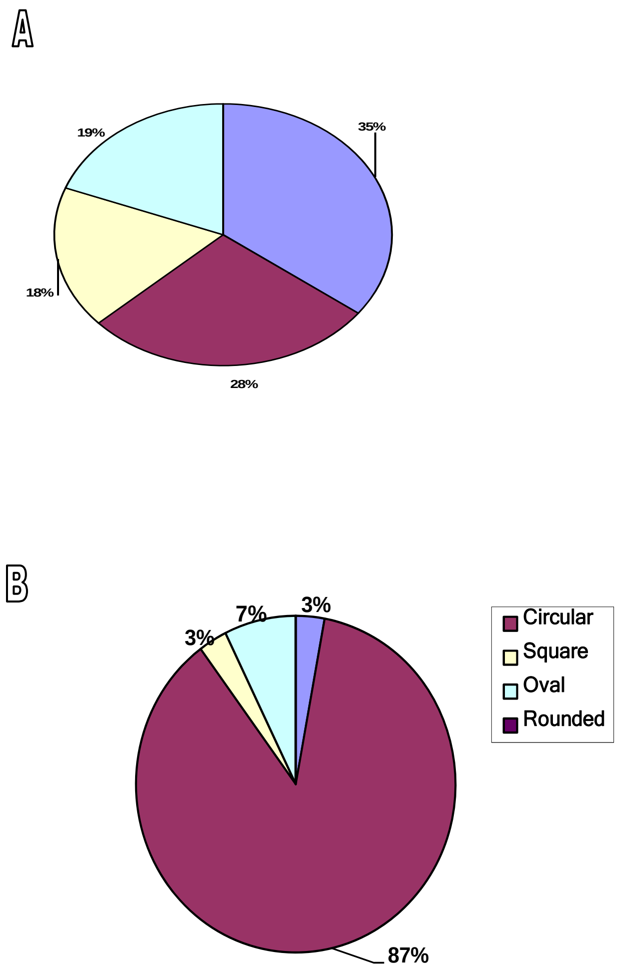

Figure 5. Frequency of pore shapes. Bindra's study (A), present research (B)

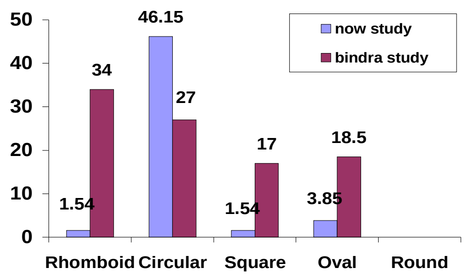

Figure 6. Comparison of pore shapes in Bindra's study and present research.

Discussion

Fingerprint formation has received significant attention in forensic science because of the uniqueness of an individual's fingerprint which remains unchanged throughout life. Other applications for fingerprints include the diagnosis of certain genetic defects and ethnic studies which seem to have become obsolete due to the introduction of DNA methods [9].

Pores have been used as useful supplementary features for an extended period of time in forensic applications. The use of pores in automatic fingerprint recognition systems has two advantages. First, pores are more difficult to be damaged or mimicked than minutiae. Second, pores are abundant on fingerprints. Even a small fingerprint fragment can have a number of pores [10,11].

Comprehensive studies have been performed on sweat pores and inked-print impressions. In this kind of research, the number and size of sweat pores, their relative position and distances on the finger print, palm and sole imprints were compared and evaluated. Use of pores and ridge shape features in fingerprint matching has been studied and focused on pores that used fingerprint fragments [5,8,12,13].

Fake finger submission attack is a major problem in fingerprint recognition systems. (Choi et, al). have introduced a sutible detective method based on multiple static features comprised of individual pore spacings that are useful for determining physiological and statistical characteristics of live and fake fingerprints [14]. Consequently, a fake fingerprint image can be detected because the characteristics of pore information do not resemble a live pore. Derakhshani et al. have shown that perspiration patterns were observed only in live fingers and suggested using pore frequency of a fingerprint as a static feature [15].

Kryszczuk et al. proposed to utilize pore locations to match fingerprint fragments. They studied how pores might be used in matching partial fingerprints and showed that the smaller the fingerprint fragments, the greater the benefits of using pores [13].

In a single fingerprint image more than 1400 pores can be found. Only 20 to 40 pores are necessary for fingerprint identification. Therefore the pore's centroid-based matching approach will effectively improve the accuracy of a Fingerprint Identification System [16]. Evaluation of the qualitative results and comparison with the findings of Bindra, B, Jusuja's has shown morphological variety in the sweat pores of a Fars family of the Iranian population. Bindra has reported several morphological varieties in an Indian population, thus the variance in morphology and density of these pore canals can probably represent a foundation for classifying humans or applying the same in biological anthropology.

Creation of such an archive in this research will be of great importance for the development of fundamental anthropological studies and in its application for other similar research findings. Poroscopy and its supplementations can be of tremendous assistance in the progress of research that involves human biology, local and regional planning, identification of special gene-related illnesses and affected populations, resistant or sensitive genes and subjects related to medical anthropology. It may also be of assistance in social science, police science, identification and law.

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