

Study of Anthropometric, Dermatoglyphic Traits and Symmetry of Feet in Folk Fars Girls of Birjand Aged from Birth to 10

Azita Mehrbakhsh^{1*}, Nasser Mahdavi Shahri², Masoud Fereidoni³, Ali Moghimi⁴, Tayebe Chahkandi⁵

1. MSc. in Developmental Biology, Department of Biology, Faculty of Sciences, Ferdowsi University of Mashhad, Mashhad, Iran.

2. Professor of Cytology- Histology, Department of Biology, Faculty of Sciences, Ferdowsi University of Mashhad, Mashhad, Iran.

3. Assistant Professor in Neurophysiology, Department of Biology, Faculty of Sciences, Ferdowsi University of Mashhad, Mashhad, Iran.

4. Professor of Human- Animal Physiology, Department of Biology, Faculty of Sciences, Ferdowsi University of Mashhad, Mashhad, Iran.

5. Assistant Professor in Pediatrics, Department of Pediatrics, Birjand University of Medical Sciences, Birjand, Iran.



Azita Mehrbakhsh obtained MSc. in Developmental Biology from Ferdowsi University of Mashhad, Iran. The topic of her thesis for MSc degree was "Study of age and symmetry in anthropometric and dermatoglyphic traits of foot in girls of two decades (from birth-10 and 10-20 years old) in Fars population in Birjand. She has been working as a Biology teacher in Birjand high schools.

Article info:

Received: 30 Oct. 2013

Accepted: 22 Feb. 2014

Key Words:

Symmetry, Foot
anthropometry,
Dermatoglyphic, Fars, Birjand

ABSTRACT

Introduction: Anthropology is the science of body sizes evaluation in living people which is applied in both medical and non-medical professions. The main purpose of the study is the evaluation of foot growth from birth to the age of 10 in folk Fars girls of Birjand and to make an archive of the data and to study symmetry based on anthropometry and dermatoglyphy.

Methods: In this study, the foot length and width, heel width, arch index and toes length have been evaluated by measuring tape and toes dermal patterns detected by inky foot print. It was carried out on 92 folk Fars girls aged from birth to 10 years old.

Results: The data evaluated by measuring of feet dimensions and dermatoglyphic traces such as toe's ridge pattern and ridge line counting. Statistics results showed that foot dimensions growth occurred through ages and would be significant in special ages.

Conclusion: This study didn't show any asymmetry related to age in anthropometric and dermatoglyphic traits in right and left feet in the populations.

1. Introduction

The word "Anthropometry" was created in 1870 by a Belgian mathematician, Quetelet. The science makes methods useful in the evaluation of soft and hard tissues of the body because it enables a quantitative description of the human body. Anthropometry has the widest use in the field of anthropology, diagnosis and

ergonomic issues, and it is used in industrial and developmental studies [1].

Fetal spine owners and many invertebrates show a significant asymmetry in their organs. Almost all visceral organs, chest and tummy in anatomy, physiology and their positions are asymmetry. This asymmetry is conserved across evolution Chordate. Although details of this asymmetry between species are very diverse,

* Corresponding Author:

Azita Mehrbakhsh, MSc.

Address: Department of Biology, Faculty of Sciences, Ferdowsi University of Mashhad, Mashhad, Iran.

Tel: +98 (915) 7287088

E-mail: mehrbakhsh985@yahoo.com

yet all the normal people in a hypothetical species have similar asymmetry. Asymmetry in medicine has value as the left and right axes are affected by syndromes in humans [2].

Dermatoglyphy is the study of skin lines on the palms and soles and fingertips. Dermatoglyphic studies are conducted over 70 years. Some evidence show the formation of dermatoglyphic patterns and variations of these forms are associated with a number of unfavorable factors of intrauterine environment [3].

Communication exists between genetic anomalies of different levels and deviations in dermatoglyphic patterns. This pattern could be applied to detect specific syndrome and offer karyotype. Because in some syndromes or cancers has been shown that asymmetry in dermatoglyphic patterns have been established [4].

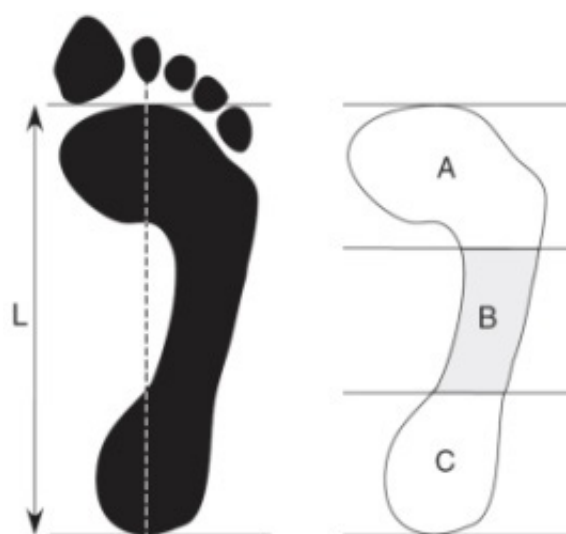
The dermal patterns once formed remain constant throughout life. Dermatoglyphics is considered as a window of congenital abnormalities and is a sensitive indicator of intrauterine anomalies [5].

Body growth during fetal and postnatal maternal depends on nutrition. Genetic, neural control, age and sex are effective on growth rate. In addition to nutrition, growth hormone, cortisol, thyroid, insulin and estrogen-like can effect on bone growth [6].

The main objective of this research is to evaluate the development of the foot from birth to age 10 years in the girls' populations of folk Fars living in the city of Birjand, South Khorasan province of Iran and to make archive of samples obtained from the survey based on anthropometric and dermatoglyphic asymmetry. For this, the study was performed on females first. Further investigations can be taken into consideration in male and also a comparison can be done between the sexes.

2. Methods and Materials

In this study, samples were chosen randomly. 92 girls were selected from hospitals and schools. One-month-old girls to 10 years old have lived in Birjand. Individuals must be selected from folk Fars in order for the research to be sufficiently accurate. A questionnaire including information about personal characteristics, language and history of disease of previous generations of parents was completed. Sampling was conducted with parental consent. The footprints were measured by using graph paper or ruler as follows: the foot length of over the foot end of the finger tips to the heel, the



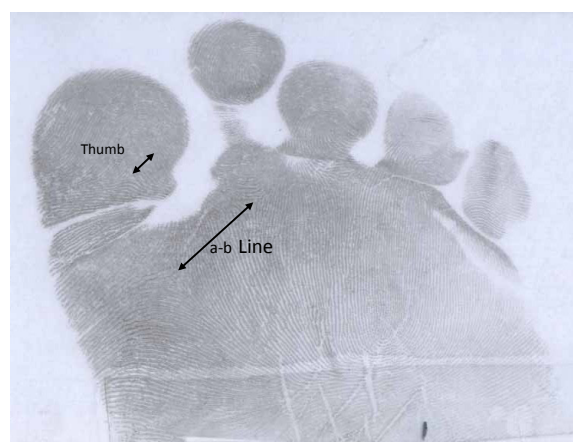
ANATOMICAL SCIENCES

Figure 1. The arc index measuring by Murrely method.

foot width of the largest area under the toes and foot in width and length of the heel in the heel area of the large size of the toes [7,8].

For measuring the arc index, the length of the foot regardless of the toes (L) was measured by tape. Then a third length of the foot without the toes in fingerprint was divided to the number (B/L) [4] (figure 1).

Dermatoglyphic patterns are divided into three main groups: arc, whorl and loop. The three lines a, b and c have been under each toes (from pointing to the little). The centre of the three lines is connected to each other and forms a-b, b-c and c-d lines. Using a magnifying glass or stereomicroscope, the lines between these three lines are counted [9] (figure 2).



ANATOMICAL SCIENCES

Figure 2. Ridge line counting in the first segment of thumb and a-b line.

3. Results

Findings -based on linear graphs of the length, width, heel width, arch index and length of toes on the right and left feet of the girls- conclude that totally there is symmetry between right and left feet of subjects. Figure 1 shows that before the age of 7 or 8, the steep of linear graph of feet long goes up, but in ages after 7-8 years the steep of graph goes straight, so that in the girls of about puberty the length of their feet fairly be assumed constant. The width of the toe and heel width is also adapted.

In figure 2, thumb toe growth is compared to the second and third together. Due to the figure, the growth of thumb is faster than the other two toes. Growth of the second toe is very close to the third. In table 1 there is no symmetry in right and left foot sizes.

Ci = Confidence interval

Statistical results of comparing dermatoglyphic patterns on the thumb on the right foot and left foot shows that in the left thumb ring pattern is 5.4% more than the right foot and in the right thumb, arc pattern is 1% and whorl is 4.3 percent more than left thumb.

According to table 2, there is no significant difference between first segment ridges counting in two thumbs, also P-value>0.05 in a-b ridge counting indicates that there is no significant difference, So, two feet do not show asymmetry in ridge counting.

4. Discussion

In a recent study, the dimensions of feet, dermatoglyphic, ridge counting and their relationship to symmetry was measured, now the obtained data can be archived as assigning dermatoglyphic and anthropometric of folk Fars from birth to age 10 and it can be

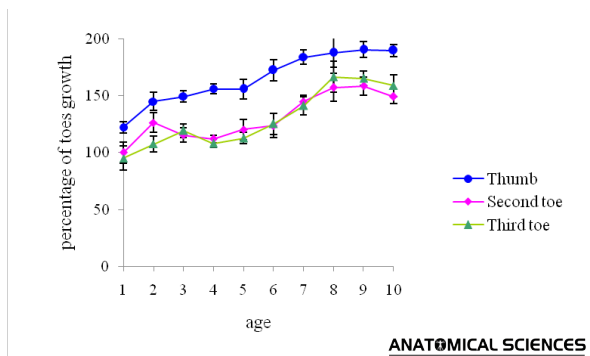


Figure 2. Comparison between growths of toes

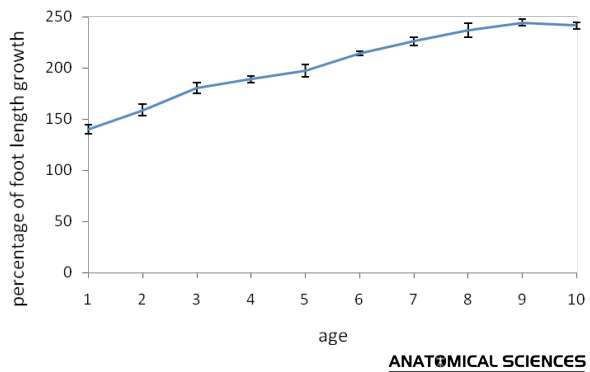


Figure 1. Percentage of foot length growth in different ages.

used in footwear industries, orthopedic, medical sections and so on.

The study shows symmetry in length and width of feet and width of heel. The results of the study indicate that the foot growth occurs very quickly in Fars folk girls aged above 7-8 years old. The growth will occur slowly around 7-10 years which are considered to be growth age and years of maturation and secretion of sex hormones. After years of stagnation, the scale of growth will begin with a lower rate.

Havill and colleagues believe that in addition to nutrition, the growth hormones, cortisol, thyroxin, insulin-like and estrogen are effective on bone growth [5].

Table 1. Average of difference between feet dimension asymmetrically. P-value is significant.

	MN±SD	P-value	Ci
Foot length	0.018±0.354	0.618	-0.055, +0.092
Foot width	-0.042±0.298	0.175	-0.104, +0.019
Heel width	-0.001±0.226	0.963	-0.048, +0.045
Arch index	-0.0009±0.017	0.584	-0.004, +0.002
Thumb length	-0.06±0.393	0.141	-0.142, +0.02

ANATOMICAL SCIENCES

Table 2. Average of difference in ridge counting in right and left foot asymmetrically

	MN±SD	P-value	Ci
Thumb ridge counting	-0.212±3.137	0.546	-0.911, +0.486
a-b ridge counting	3.309±16.244	0.065	-0.221, +6.841

ANATOMICAL SCIENCES

Cao (2000) and Pietka (2001) stated that about 7 years old, bony centers complete and the width and thickness reach to their highest [10,11].

Based on previous studies and the results of this research and the growth curves obtained in the results, probably the growth occurs rapidly about 7-8 years due to nutritional effects, growth hormones, cortisol and thyroxin which is slow when the maturity starts. So it seems that these factors together cause mutations in the growth of feet of girls from the ages of about 1 to 8. Probably at these ages bone centers are reached to their most growth and thicknesses. It seems that in ages 8 to 10, female sex hormones like estrogen actives and cause the growth of long bones, but membrane broad bones in feet are excluded and grow slower.

Murley and colleagues stated that arch index is a third of the foot print to the total foot with no toes and also said that normal arch with index of lower than 0.32 was more than flat foot in their study population [4].

Krishan and colleagues in 2010 expressed that large asymmetry in the right organs dimension was based on the preferential use of this side of the body for physical activity [12].

According to previous studies and charts of results, no significant asymmetry was observed in the anthropometric characteristics. Foot arch index in most of females in this study is obtained less than 0.32 and it seems that the normal foot arch is more than flat foot in the population. These findings conducted to previous research in other populations.

Cao (2000) and Pietka (2001) stated that around 2 years old bony center of thumb, of which is at the end, appears earlier than the other fingers and toes [10,11]. In 2006, Zanolle stated estrogen effects on osteogenesis and inactives bony centers [13].

Based on previous research and findings in the chart of comparing toes growth in the result chapter, the growth of thumb is faster than two toes and can be stopped earlier.

In previous studies by Arto and colleagues in 2004 on schizophrenia patients, decreasing over the fingers was observed [14]. The difference of this research with the present study was that no significant decreasing in the length of toes was observed in the population.

A study by Mahdavi Shahri and colleagues (2006) showed that a-b ridge counting in some patients with mood disorders differs from healthy individuals [9]. According to previous studies and the results of this study in table 2, ridge counting in thumb and a-b ridge counting showed up no significant difference between two feet.

Anthropometric and dermatoglyphic characteristics in both feet showed symmetric mode. It is likely that dimensional growth of feet which is done quickly up to 8 years, is influenced by nutrition and a combination of effective growth hormones.

Acknowledgments

The authors are appreciate Supporting Research Department of Mashhad University for providing part of budget plan and also all who co-operate in collecting the data for this study.

References

- [1] Nagvi SA. Need for anthropometric database for developing countries. *Journal of King Saud University*. 1993; 5(1): 153-54.
- [2] Levin M. The embryonic origins of left- right asymmetry. *Critical Review in Oral Biology and Medicine*. 2004; 15(4): 197-206.
- [3] Preus M, Fraser FC. Dermatoglyphics and syndromes. *American Journal of Diseases of Children*. 1972; 124(6): 933-43.
- [4] Murely GS, Menz HB, Landorf KB. A protocol for classifying normal- and flat-arched foot posture for research studies using clinical and radiographic measurements. *Journal of Foot and Ankle Research*. 2009; 2(22): 13.

- [5] Natekar PE, DeSouza FM. Fluctuating asymmetry in dermatoglyphics of carcinoma of breast. *Indian Journal of Human Genetics*. 2006; 2(12): 76-81.
- [6] Havill LM, Mahaney MC, Binkley TL, Specker BL. Effects of Genes, Sex, Age, and Activity on BMC, Bone Size, and Areal and Volumetric BMD. *Journal of Bone and Mineral Research*. 2007; 22(5): 737-46.
- [7] Oladipo G, Bob-Manuel I, Ezenatein G. Quantitative comparison of foot anthropometry under different weight bearing conditions amongst Nigerians. *The International Journal of Biological Anthropology*. 2009; 3: 1-5.
- [8] Waterson P, Sell R. Recurrent themes and developments in the history of the ergonomics society. *Ergonomics*. 2006; 49: 743-99.
- [9] Mahdavi Shahri N, Ramezani A, Shariat-zadeh SMA, Moghimi A, Soleimani M. [Quantitive and qualitative study of dermatoglyphic patterns in bipolar disorder type 1 in Khorasan Razavi province (Persian)]. *Archive of SID*. 2006; 9(3): 98-90
- [10] Cao F, Huang HK, Pietka E, Gilsanz V. Digital hand atlas and web-based bone age assessment: system design and implementation. *Computerized Medical Imaging and Graphics*. 2000; 24(5): 297-307.
- [11] Pietka E, Pospiech S, Gertych A, Cao F, Huang HK, Gilsanz V. Computer automated approach to the extraction of epiphyseal regions in hand radiographs. *Journal of Digital Imaging*. 2001; 14(4): 165-172.
- [12] Krishan K, Kanchan T, DiMaggio JA. A study of limb asymmetry and its effect on estimation of stature in forensic case work. *Forensic Science International*. 2010; 200(1-3): 181.e1- 181.e5.
- [13] Zanole A. Direct and indirect estrogen actions on osteoblasts and osteoclasts. *Development and Remodeling in Health, Disease and Aging*. 2006; 1068: 173-79.
- [14] Arto M, Freeska E, Beck C, An M, Kiss H. Digit length pattern in schizophrenia suggests disturbed prenatal hemispheric lateralization. *Neuropsychopharmacology and Biological Psychiatry*. 2004; 28(1): 191-94.

