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Fingerprints Distribution in Basrah With Patterns of Inheritance of Right and Left Indices.

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ABSTRACT: The first part of this study examines the percentage of the four major patterns of fingerprints of the thumb and their subdivisions among the population of Basrah. It was found that Loop pattern was the commonest followed by Whorl, Compound (composite) and Arch, also some subdivisions dominated over others like ulnar loop and circular whorl. Comparison between right and left thumb fingerprints of male and female show high percentage of asymmetrical patterns.

In the second part of the study, fingerprints of right and left indices were taken from 135 intact families with 439 children , all prints were examined, classified and grouped according to the four major patterns known. The results have shown that when both parents possess the same pattern, Whorl (W) pattern has the highest chance of expression in children (60%) followed by Loop (L) (40%), then Arch (A) (3 0%), the compound (C) has very low chances of expression (0.07%).

When parents are of different fingerprints:

a. whorl pattern is constant and equally affected by both parents.

b. Arch pattern has constant expression on children by both parents.

c. Families with the mothers having always L (loop) like (AL, CL, WL), maternal influence has more chance for the production of (L) children than (L) fathers.

d. Mothers possess (C) always like (LC, WC, AC) , have more chance for (C) children than the reverse.

1. INTRODUCTION

Dermatoglyphic study for personal identification becomes wide spread early in this century, started in about 1880, new modifications and applications have continued to the present[1]. It represents one aspect of the body configuration in general like weight, height, and gait...all of which are multifactorial-inherited triat [2,3] . They are important not only for forensic parternity testing but in some genetic disorders also[4,5,6].

Fingerprints are produced through the presence of a fine pattern of ridges on the skin of the palmar aspect of fingers and thumb, similar ridges are also found on the palm of the hand and sole of the foot[7], making possible the use of palm prints and foot prints for the purpose of personal identification[8].

It has been mentioned that, the pattern remains constant for the whole life of the individual and cann't be altered except by destruction of true skin by deep burns and permanent scars[9,10]. On the other hand the chance for two prints from different fingers being identical is less than one in sixty four thousands millions [11,12].

Fingerprints classified according to the arrangement of skin ridges into one of four major types, Loop , Whorle, compound and Arch pattern, they are also subdivided into loop (ulnar and radial), whorl (circular, ovale and comma-shaped), Compound (twinned loop, accidentials and lateral-pockets) and Arch (flattened and tented) [13,14]. These patterns and their subdivisions are shown in Fig 1-10.

Many studies have been carried out on the inheritance of ridge patterns, it is multifactorial inheritance, along Mendilian lines[2,3], the nature of genes responsible is not obvious till now but the effect of sex chromosome is evident in the differences between male and female, Rignelli [4] has denied the influence of the sex chromosome on fingerprints, and claimed that their control is purely autosomal. His dame is rejected since studies on Klinefilter syndrome detect some dermatoglyphic findings which indicate that sex chromosome can affect on fingerprints, also in Down syndrome, the ridge count is reduced indicating that perhaps some genes on Chromosome 21 may has its effect on ridge count[5,6].

The purpose of this study is to determine:-

1. The percentage of the four major patterns of fingerprints and their subdivisions in the thumb among people of Basrah.
2. Sex pattern differences between male and female.
3. pattern of inheritance of fingerprints of the index finger with comparison with other studies.

2. MATERIALS AND METHODS

- First part:

Fingerprints of the thumb of right and left hand of 2000 individuals were taken from different schools, colleges (covering different places in Basrah).

The study is confined to the thumb because it is most commonly used for identification purposes in many countries of the world. No names were recorded, special print forms were prepared , high quality stamp-pads were used for inking fingers, before inked each finger was cleaned well then inking and rolled from side to side including distal inter phalangeal joint.

The major print patterns and their subdivisions were obtained calculated from the total number of individual finger prints.

The percentage of each pattern is obtained. A set of magnifying hand lenses were used for clarification, representative samples selected, magnified and photographed.

Second part:

Special finger prints form were prepared ,one for each family for right and left indices of 135 intact families (fathers , mothers and their children). Forms, technique methods used were the same as in the first part.

Conditional probabilities were used to calculate occurrence of each pattern in children when their parents carry combination of two patterns. Under the assumption that the calculated probabilities represent the proportions of the actual patterns in the general population. Z-test was applied to detect significant difference between the conditional probabilities calculated out of the opposite parent patterns e.g (WA and AW).

Fig 1-10 Show examples of the four major patterns of finger prints and their subdivisions.

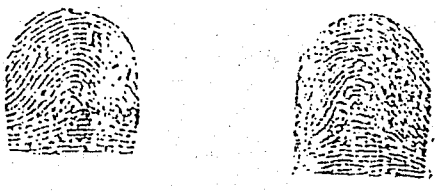

Fig 1-2 : Arch pattern (Flattened and tented).

Fig 3- 4 : Loop pattern (ulnar and radial).

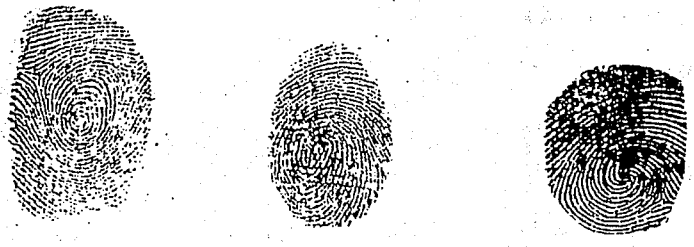

Fig 5-7 : Whorl pattern (circular, Ovale and comma-shaped).

Fig 8-10 : Compound pattern (twinned loop, accidentials and lateral pockets).

3. RESULT

First part:

4000 fingerprints from 2000 individuals (right and left thumb), were taken and classified using a magnifying hand lens.

Table I showed that Arch pattern was the rarest form (5.1 %), but more common in female than male in 2:1

Loop pattern was the commonest (43%) with dominated ulnar loop to radial loop (32.3%, 10.7%) respectively in a ratio of (3:1).

Whorl pattern came second (39.5%) with circular form correspond to (21.7%) followed by ovale (11.1%) then common shaped (7.3 %).

A high percentage of asymmetry between right and left thumb fingerprints of male and female, in male bilateral asymmetry was 65% and female was ~ 65%, as shown in Table II.

Second part:

A total of 1148 print forms were obtained from 135 couples plus 439 of their children as shown in Table III and Fig 2,3,4.

The conditional probabilities showed that the chance for having W-children would be highest when both parents have the pattern WW (0.624) followed by the combination LL (0.446) , CC (0.481) then equally but lower chances with LA (0.341) , LW (0.355), WL (0.322), WC (0.381), CW (0.381).

In having L-children , the chance is high when parents posses CL (0.571), followed by CA (0.428) , then equal but lower chances of LL (0.372), CC (0.333) , AC (0.333) , WA (0.304) , AL (0.361) and LC (0.333).

The Arch pattern appeared in the following order: AA (0.395) AL (0.277) , LA (0.292), CA (0.285), AW (0.272) , LC (0.242), AC (0.222).

The chance of having C-children, is in the following order: LW (0.366), AC (0.333), followed by lower chances of other combinations WL (0.297), WC (0.290) , CW (0.290) , LC (0.242) , LC (0.142).

No differences were found in the inheritance between right and left indices.

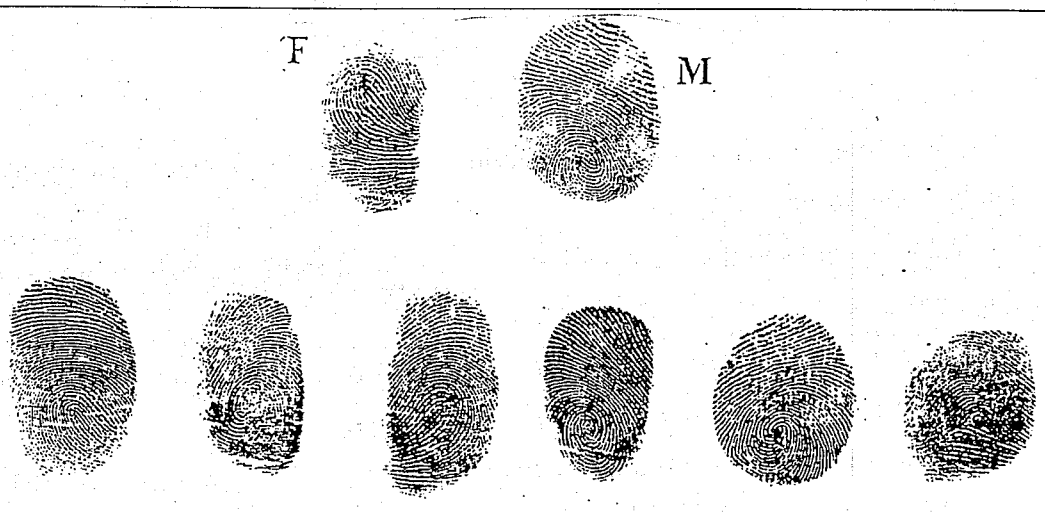

Fig (2) Index fingerprints of family, father (F) possess (L) and mother (M) possess (W), two of children have (L) , three have (W) and one has (C).

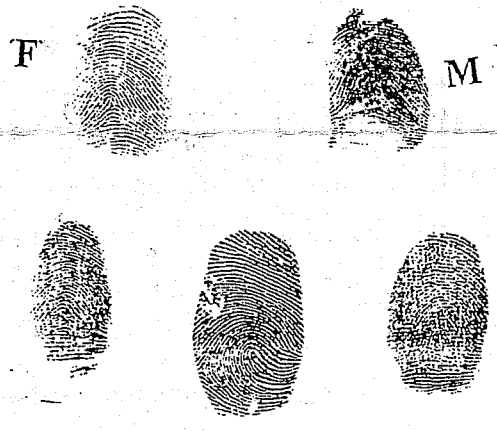

Fig (3) Index fingerprints of family, father (F) has (A) pattern and mother (M) has (A) pattern, two of children have (A), one has loop.

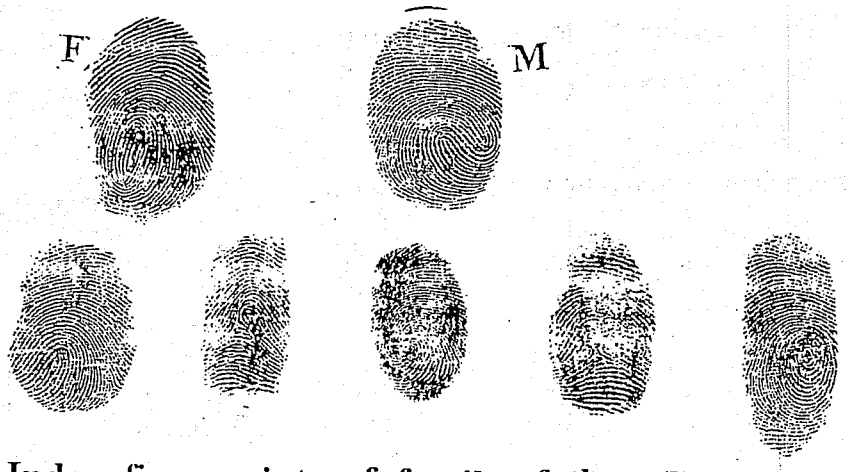

Fig (4) Index fingerprints of family, father (F) has (W) pattern and mother (M) has (C) pattern, three children has (C), one has (W) and one child has (L).

Table I

The percentage of the four major patterns of fingerprints and their subdivisions in the thumb.

Type		Thumb %
Loop	Total	43
	Ulnar	32.3
	Radial	10.7
Whorle	Total	39.5
	Circular	21.1
	Ovale	11.1
	Comma-shaped	7.3
Compound	Total	12.4
	Twinned-loop	11.3
	Accidentials	0.6
	Lat-pockets	0.5
Arch	Total	5.1
	Tented	4.1
	Flattened	1.0

Table II

Percentage of symmetry and asymmetry of fingerprints of the thumb, between male and female.

Thumb	(Same pattern) % Symmetry	(different pattern) % asymmetry
Female	34.6	65.4
Male	35	65

Table III

The conditional probabilities for the fingerprints patterns of children.

Parents	Children			
Father : Mother	**A**	**C**	**L**	**W**
AA	0.395	0.116	0.255	0.232
LL	0.095	0.085	0.372	0.446
WW	0.093	0.033	0.248	0.624
CC	0.111	0.074	0.333	0.481
AC	0.222	0.333	0.333	0.111
CA	0.285	0.095	0.428	0.190
AW	0.272	0.250*	0.272*	0.204
WA	0.152	0.260	0.304	0.282
AL	0.292	0.138	0.361*	0.222
LA	0.292	0.243	0.121	0.341
LW	0.088*	O.366	0.188	0.355
WL	0.099	0.297	0.280	0.322
WC	0.109	0.290	0.218	0.381
CW	0.163	0.290	0.163	0.381
LC	0.242	0.212	0.333*	0.212
CL	0.142	0.142	0.571	0.142

A: Arch L: Loop
W: Whorle C:Compound
P <0.05

4. DISCUSSION

This work is performed on the thumb and index finger because they are most commonly used in many countries, the four major patterns of fingerprints and their subdivisions were studied. Arch pattern showed simplest and less commonly occurred among other patterns, this is in agreement with many studies found in other parts of the world and western Iraq [15,16,17], It is more common in female than male in =2:1 which agreed with Kerrakadze & Gobrashvili [16] and Hammed [17] who found that finger prints of boys are more complicated and contained more epidermal ridges than those of girls, this possibly due to characteristic sex -differences in the body built between male and female.

It had been shown that Loop is the most frequent pattern although ulnar loop is dominated over redial loop in both fingers in=3:1-Whorl pattern came next, dominated by circular whorl, then oval and comma-shaped, followed by compound pattern with twinned loop dominated then accidentals & lateral pocket, also twinned loop in male was more than female possibly due to its complexity and increased surface area of fingers in male.

Comparison study showed a high percentage of pattern asymmetry among male as well as among female, between right and left thumb fingerprints, in contraversy to Michel [18] who reported a bilateral symmetry in the pattern of similar fingers of the two hands in right handed people and multiple sclerosis.

Hereditary of fingerprints is not obvious; genes responsible for shaping up fingerprints has not been either identified well or localized on any particular chromosome. [2,3] But definitely it is influenced by genes which is supplemented by many studies on chromosomal disorders [4,6] and twin studies [5,19].

Our study is confirmed to the index finger, it seems interesting that maternal influence appears clearly on index finger and previous investigations on the thumb clarified that the fingerprints of children are influence by their fathers and not the mothers which means that trial is either partly located or influence by Y chromosome[17].

For unilateral influences of one parent, it is clear that: -

1. Arch pattern is constant and equally influenced by both parents, also for the whorl pattern.
2. Loop & composite influenced more by mothers.

This lead us to conclusion that fingerprint patterns are autosomal and at the same time are Sex-linked. Further studies possibly for other fingers of the hand and sole of the foot (in a

series) could help in approaching a useful method of relating a disputed child to a particular couple relaying on fingerprints.

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الملخص

تضمن الجزء الاول من هذه الدراسة بيان توزيع الطرز الاربعة الرئيسية لبصمات الاصابع وفروعها لسكان مدينة البصرة، واقتصرت الدراسة على اصبع الابهام لكثرة استخدامه في اغراض التعرف على الشخصية في معظم دول العالم.

ومن خلال الدراسة تبين ان أكثر الطرز شيزعا هو العروة ثم الدوامة تليها المركب وأخيرا القوس، ام الطرز الفرعية فقد سادت العروة الزندية وكذلك الدوامة الدائرية، كما لوحظ ان هناك نسبة عدم تماثل فب بصمتي الابهام الايمكن والايسر للذكور والاناث. حيث نستخلص من هذه الدراسة اختلاف توزيع الطرز الاربعة بين سكان المنطقة وكذلك اختلافها بين الجنسين.

اما الجزء الثاني فيتضمن اخذ بصمات اصبعي السبابة اليمنى واليسرى من افراد ١٣٥ عائلة تتضمن ٤٣٩ طفل، ثم تكبير وفحص جميع البصمات وتصنيفها اعتمادا على الطرز الأربعة الأساسية، ثم التحري عن نسبة توريث كل منها بأستخدام أختبار الأحتمالات المشروطة وأختبار التوزيع الطبيعي، وتبين مايلي:-

١. عندما يحمل كل من الأب والأم نفس الطراز، فأن طراز الدوامة هو الأكثر في نسبة التوريث (٦٠%) يليه طراز العروة (٤٠%) ثم القوس (٣٠%)، اما أقلها في نسبة التوريث فهو طراز المركب (٠,٠٧%).

٢. عندما يكون طراز البصمة مختلفا في الوالدين وعلى النحو التالي:-

أ. طراز الدوامة يكون ثابت ومتساي التأثير من جهتي الوالدين.

ب. طراز القوس يكون ثابت التأثير على الاطفال من جهتي الام والاب.

جا اذا كانت الام من طراز العروة، فأن تأثيرها على انجاب الاطفال (طراز العروة) يكون اكبر مما لوكان العكس.

د. اذا كانت الام من طراز المركب فأن تأثيرها يكون أكبر من تأثير الاب على انجاب أطفال من الطراز المركب.