Dermatoglyphic Patterns, 2D:4D, Hirsutism and Palmar Hyperhidrosis among Selected Dialects of Igala Ethnic Group of Nigeria

BY

Paul Idoko UKANU

DEPARTMENT OF HUMAN ANATOMY,

FACULTY OF BASIC MEDICAL SCIENCES,

COLLEGE OF HEALTH SCIENCES,

AHMADU BELLO UNIVERSITY,

ZARIA

MAY, 2019

Dermatoglyphic Patterns, 2D:4D, Hirsutism and Palmar Hyperhidrosis among Selected Dialects of Igala Ethnic Group in Nigeria

BY

Paul Idoko UKANU, BSc. (ABU) 2012

(P15MDHA8001)

A DISSERTATION SUBMITTED TO THE SCHOOL OF POSTGRADUATE STUDIES,

AHMADU BELLO UNIVERSITY, ZARIA

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF

MASTER DEGREE IN HUMAN ANATOMY

DEPARTMENT OF HUMAN ANATOMY,

FACULTY OF BASIC MEDICAL SCIENCES,

COLLEGE OF HEALTH SCIENCES,

AHMADU BELLO UNIVERSITY,

ZARIA

MAY, 2019

DECLARATION

I, UKANU, PAUL IDOKO declare that the work in the dissertation titled **''Dermatoglyphic Patterns, 2D:4D,Hirsutismand Palmar hyperhidrosis among Selected Dialects of Igala Ethnic Group in Kogi State, Nigeria"**was carried out by me in the Department of Human Anatomy, Faculty of Basic medical sciences, Ahmadu Bello University, Zaria. The information used for my literature review was fully acknowledged in the text and references. This dissertation has not been presented in any scientific gathering, neither has it been presented for another degree or diploma at any University.

UKANU PAUL IDOKO _____ _____

SIGNATURE DATE

CERTIFICATION

The dissertation entitled **‘‘Dermatoglyphic Patterns, 2D:4D,Hirsutismand Palmar hyperhidrosis among Selected Dialects of Igala Ethnic Group in Kogi State, Nigeria”**byUkanu Paul Idoko meet the regulation governing the award of Master of Science (M.Sc) degree in Department of Human Anatomy, Faculty of Basic medical sciences, Ahmadu Bello University, Zaria, under the supervision of **Dr. B. Danborno and Dr. J.A. Timbuak.** It is therefore approved for the contribution to knowledge and literary presentation.

Dr. B. Danborno (BSc, MSc., Ph.D.) _____ _____
Chairman, Supervisory Committee, Signature Date
Department of Human Anatomy,
Faculty of Basic Medical Sciences,
College of Medical Sciences,
Ahmadu Bello University

Dr. J.A. Timbuak (BSc, MSc., Ph.D.) _____ _____
Member, Supervisory Committee, Signature Date
Department of Human Anatomy,
Faculty of Basic Medical Sciences,
College of Medical Sciences,
Ahmadu Bello University

Dr. Z.M. Bauchi (BSc, MSc., Ph.D.) _____ _____
Head of Department, Signature Date
Department of Human Anatomy,
Faculty of Basic Medical Sciences,
College of Medical Sciences,
Ahmadu Bello University

Prof. S. Z. Abubakar _____ _____
Dean School of Postgraduate Studies Signature Date
Ahmadu Bello University.

ACKNOWLEDGEMENTS

My greatest gratitude goes to Almighty God who has been my source and strength thus far in my career. I thank you for your faithfulness Lord.

I would like to say a big thanks to my supervisor Dr. B. Danborno for taking out time to go through my work and also making constructive criticism that has really challenged me. I am indeed grateful for allowing me to be a beneficiary of your academic prowess. Dr. J.A. Timbuak had an open door and great enthusiasm for this research work, I am indebted for being under your supervision because your enormous contributions has made this work a success.

My sincere gratitude goes to the entire staff of the Department of Human Anatomy, especially the H.O.D. Dr. Z.M. Bauchi, Prof S.S. Adebisi, Dr. U.E. Umana, Dr. A.U. Dahiru, Dr. W.O. Hamman, Dr. I.A. Iliya, Dr. M. Tanko and Dr. A.N. Agbon for impacting knowledge on me.

I would want to thank management of Kogi State University, Anyigba, for helping me to accessTetfund which was used to fund this study. I really appreciate the academic and non-teaching staff of the Department of Human AnatomyKogi State University for their cooperation during the period of my studies.

My sincere thanks go to all students of Our Lady Secondary School Anyigba who participated willingly in this research, particularly the Principal and member of staff for their cooperation. Finally, I would like to thank my beloved family, for your moral and financial support. Thanks for believing in me and standing by me all this while. I say a big thanks to my dad and mum, Mr and Mrs Andrew Ejeh, for their consistent encouragement and prayers. The Lord bless you richly.

DEDICATION

This thesis is dedicated to my beloved family and members of our team at revival fellowship international.

TABLE OF CONTENTS

Cover Page……i

Fly page……ii

Title page……..iii

Declaration……iv

Certification……...v

Acknowledgement……vi

Dedication……vii

Table of Contents……viii

List of Tables……xii

List of Figures……xiv

List of Plates……..xv

List of Appendices……xvi

List of Abbreviations……xvii

Abstract……....xviii

1.0 INTRODUCTION……..1

1.1 Background of theStudy……1

1.2 Statement of Research Problem……6

1.3 Justification of the Study……....7

1.4 Aim and Objectives of Study……...7

1.4.1 Aim of the study……7

1.4.2 Objectives of the study ……7

1.5 Hypothesis ……..8

1.6 Scope of the Study……..…….....8

2.0 LITERATURE REVIEW…….9

2.1. Development of Epidermal Ridges……..9

2.2 Patterns of Finger Prints……...9

2.3 PALM PRINT PATTERNS…….11

2.3.1 Overview of palm print pattern…….....11

2.3.2 History of palm prints…….12

2.3.3 Palmar regions……..12

2.3.4 Applications of the palm print…….17

2.3.5 Dermatoglyphics in health……...19

2.3.6 Dermatoglyphics in clinical medicine……..20

2.4 Hirsutism…….23

2.4.1 Symptoms…….23

2.4.2 Causes…….....24

2.4.3 Prevalence…….24

2.4.4 Pathophysiology of hirsutism……...26

2.4.5 Diagnosis of hirsutism……...26

2.5 2D:4D……...33

2.5.1 Geographical and ethnic variation of 2D:4D……....35

2.5.2 Correlation between digit ratios and various human trait……....35

2.5.3 Measurements of digit ratio.....36

2.6 Palmar Hyperhidrosis……..37

2.6.1 Epidemiology……..39

2.6.2 Clinical Manifestations……....39

2.6.3 Complications……..39

2.6.4 Management……39

3.0 MATERIALS AND METHOD……...42

3.1 Materials ……42

3.2 Methods……...42

3.2.1 Fingerprint collection……....42

3.2.2 Hirsutism……...45

3.2.3 2D:4D……45

3.2.4 Palmar hyperhidrosis……....47

3.2.5 Measurement of height and weight……...49

3.4 Inclusion/ Exclusion Criteria……....51

3.4.1 Inclusion……..51

3.4.2 Exclusion criteria……51

3.3 Location of Study……...52

3.5 Ethical Approval ……..53

3.6Statistical Analyses ……..53

4.0 RESULTS ……54

4.1 Study Population…….....54

4.2 Anthropometric Variables with Sex……....54

5.0 DISCUSSION……92

6.0 CONCLUSION AND RECOMMENDATION……...103

6.1 Conclusion……..103

6.2 Recommendations……..103

6.3 **Contribution to knowledge**……104

REFERENCES ……106

APPENDICES ……127

LIST OF TABLES

Table 4.1 Descriptive statistics and t- test for overall (n=602)…….....55

Table 4.2 Association between print pattern of the right fingers and Sex (n=602)……56

Table 4.3 Association between print pattern of the left fingers and Sex (n=602)……58

Table 4.4 Association between print pattern of the right fingers and Palmar hyperhidrosis in Females (n=322)…….....59

Table 4.5 Association between print pattern of the left fingers and Palmer hyperhidrosis in females (n=322)……...60

Table 4.6 Association between print patterns of the right fingers and hirsutism in females(n=322)….....62

Table 4.7 Association between print patterns of the left fingershirsutism in females (n=322)…….63

Table 4.8 Distribution of hirsutism according to dialects(n= 322)……....65

Table 4.9 Distribution of hyperhidrosis according to dialects (n= 602)……66

Table 4.10 Association between print pattern of the right fingers and palmar hyperhidrosis (overall n=602)…… 68

Table 4.11 Association between print pattern of the left fingers and palmar hyperhidrosis (overall n=602)…… 69

Table 4.12 Comparison of anthropometric and dermatoglyphic variables according to different hair growth pattern (n=322)…….71

Table 4.13 Comparison of anthropometric and dermatoglyphic variables according to birth order in overall (n=602)……...72

Table 4.14 Association between palmar hyperhidrosis and other parameters in males (n=280)……74

Table 4.15 Association between of print patterns of right fingers and palmar hyperhidrosis in males (n=280)…….75

Table 4.16 Association between of print patterns of left fingers and palmar hyperhidrosis in males (n=280)……..76

Table 4.17 Comparison of anthropometric and dermatoglyphic variables according to birth order in males (n=280)……78

Table 4.18 Correlation matrix for male variables (n=280)……81

Table 4.19Correlation matrix for female variables (n=322)……...82

Table 4.20Correlation matrix for overall (n=602)……..83

Table 4.21 Association between palmer hyperhidrosis and birth order in males (n=280)…85

Table4.22 Association between finger print pattern and birth order in males (n=280)…..86

Table 4.23Comparison between male and female for ridge count overall (n=602) ……...88

LIST OF FIGURES

Figure 2.1: Patterns of finger prints……..10

Figure 2.2: Palmer Regions; Interdigital, thenar andhypothenar……13

Figure 2.3: Pattern of Interdigital region……...14

Figure 2.4: Left palm thenar showing vestiges…….....14

Figure 2.5: Right palm thenar showing vestiges……15

Figure 3.1 : Map of Kogi and Delta States showing Igala Speaking Areas……....52

Figure 4.1: Right total ridge count and left total ridge count in male and female……90

Figure 4.2: Right and left total ridge counts and palmer hyperhidrosis…….....91

LIST OF PLATES

Plate I: Plate to show the hand of an individual with severe palmar hyperhidrosis ……..38

Plate II: Capturing of fingerprints of participants……..44

Plate III: Participant's palm print showing ATD triangle……...44

Plate IV: Second digit and fourth digit length measurement (cm) using digital vernier caliper…….46

Plate V: Subjective observation of palmar hyperhidrosis……48

Plate VI: Weight measurement in kg……...50

Plate VII: Measurement of height (cm)……50

LIST OF APPENDICES

Appendix I: Ethical clearance certificate……....127

Appendix II: Introduction Letter ……..128

Appendix III: Consent Form…….....129

Appendix IV: Questionnaire for Dermatoglyphic pattern, 2D:4D and Hirsutism among among selected dialects of the Igala Ethnic Group in Kogi State……133

LIST OF ABBREVIATIONS

BMI: Body mass index

LATD: Left ATD angle

L2D4D: Left 2D:4D

MH: Mild hirsutism

NH: Normal hair growth

RATD: Right ATD angle

R2D4D: Right 2D:4D

SH: Severe hirsutism

SPSS: Statistical package for social sciences

ABSTRACT

Dermatoglyphics refers to the formation of naturally occurring ridges on certain parts of the body such as palms, fingers, soles and toes.Hirsutism is the occurrence of excessive body hair in female on parts of the body where hair is normally minimal or absent, such as face, chin and chest. 2D:4D is the ratio between the length of the 2nd (index finger) and the 4th (ring finger) which varies due to exposure to androgen. It is sexually dimorphic, as it has a lower value in males as compared to females. Palmar hyperhidrosis is also known as sweaty hands, it is a condition which involves excessive eccrine sweating in the palm. ATD angle is formed by the lines drawn from the digital tri-radius 'a' to the axial tri-radius 't' and from this tri-radius to the digital tri-radius 'd'. Study of the distribution of the Dermatoglyphic pattern, 2D:4D,hirsutism and palmar hyperhidrosis among selected dialects of Igala ethnic group was done in order to see their association with other anthropometric variables. A cross sectional study was conducted and a total of 602 subjects participated in this study, 322 females and 280 males, which were secondary school students between the age range of 13-19years. The subjects fingerprint pattern was obtained by allowing them place the tip of each finger on the stamp pad, which was then imprinted on the questionnaire. The palm print patterns were obtained with the digital camera (TECNO DP7CPRO). The palm print pattern obtained was then printed out and the ATD triangle was measured at the point 't' using a protractor. The ridges were also counted for each digit with the aid of hand lens, from the core to the delta. The degree of hirsutism was determined by modified FerrimanGallway (F&G score).The digit length was measured on the ventral surface of the hand from the basal crease of the finger up to the tip and the occurence of palmer hyperhidrosis was determined in the subjects using the subjective method, the degree of sweating was observed and the subjects were also asked if they sweat on their palm and how often. The study showed that the overall mean age of the subjects was 16.65± 1.75 years. Males have higher occurrence of arch for the I, II, and V right digits while females had more occurrence of arch for the II and IV right digits. Females have more occurrence of loop for the I, II and V right digits while males had higher occurrence of loop for the III and IV right digits, Females have the higher occurrence for whorl in all digits except the III right digit. There was statistical significance for the II, III and V right digits ($p<0.05$).Males have higher occurrence of arch for all fingers on the left except the index finger, females have higher occurrence for loop for all fingers except the left thumb. Females also showed higher occurrence of whorl finger print patterns in all fingers except the left ring finger, and there was statistically significant difference for II, III, IV and V fingers ($p = 0.001$) except for the left thumb where $p= 0.155$. The result revealed that females with palmer hyperhidrosis have higher occurrence of arch for the II, III, and IV digits while females without palmer hyperhidrosis have higher occurrence of arch for the I and IV digit. Females without palmer hyperhidrosis have higher occurrence of loop for all digits except the thumb and little fingers. Females with palmer hyperhidrosis have higher occurrence of whorl finger print pattern on the I and V digits while females without palmer hyperhidrosis have higher occurrence of whorl for the III and IV digits. There was statistical significant for the III, IV and V fingers ($P<0.05$). Females without palmer hyperhidrosis have higher arch finger print pattern for I, IV and V digits while females with palmer hyperhidrosis have higher occurrence of arch for II, and III. Females with palmer hyperhidrosis have higher occurrence of loop finger print pattern for the II, IV and V digits while females without palmer hyperhidrosis have higher occurrence of loop for the I and III. Whorl finger print pattern have higher occurrence in females with palmer hyperhidrosis for the I and III digits while it was higher in females without palmer hyperhidrosis for the II and IV digits. Male subjects with palmer hyperhidrosis have higher occurrence of arch for all fingers except the little finger, loop finger print pattern was higher in males with palmer

hyperhidrosis for the I, II and V fingers while those without palmer hyperhidrosis have higher occurrence of loop for the III and IV fingers. Males without palmer hyperhidrosis have higher occurrence of whorl as compared to those with palmer hyperhidrosis. There was statistically significant for the middle finger ($P< 0.05$). Male subjects with palmer hyperhidrosis have more arch finger print pattern for all fingers. Loop finger print pattern was higher in subjects with palmer hyperhidrosis for the I, II and IV fingers, while those without palmer hyperhidrosis had higher loop for the II and V fingers. Males without palmer hyperhidrosis had higher occurrence of whorl for the I, II and IV fingers while those with palmer hyperhidrosis had more occurrence of whorl for the III and V fingers. The difference was statistically significant for the left index and middle fingers ($P<0.05$) but was not statistically significant for the left thumb, ring and little fingers ($P>0.05$).Females from Omala have the highest occurrence of hirsutism (50%) while females from Igalamela have the lowest occurrence of hirsutism (17%). The association was statistically significant ($P< 0.05$). Females have higher right and left 2D:4D as compared to males, this is due to the fact the estrogen in females tends to increase the length of the index finger while the testosterone in males tends to reduce the length of the index finger. The right 2D:4D was higher than the left 2D:4D in both males and females.The right and left ATD angles were higher in females than in males, with the right ATD been higher than the left ATD in both males and females, this was statistically significant ($p<0.05$).The result revealed that mean value for the left total ridge counts was higher than the right total ridge count in both males and females. The difference was statistically significant ($p=0.001$).In conclusion females have higher 2D:4D, ATD angle, loop and whorl finger print patterns as compared to males. Male subjects have higher occurrence of arch finger print pattern and right and left total right counts as compared to females. Hirsutism was more prevalent in females from Omala while palmer hyperhidrosis was most prevalent in subject from Idah dialect.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background of the Study

Dermatoglyphics is the study of dermal ridges on finger balls, palms and soles, with its qualitative and quantitative traits which are not adaptive and free from paratypic influences, it provides a pertinent area of research to human population (Reddy and Reddy 2006).The development of the ridges begins with the formation of pads in the fingers, and the interdigital, hypothenar and thenar areas of the embryo's palm during the second month of intrauterine life (Rakik, 1988). Epidermal ridges appear on the surface of the hands after the regression of the pads by the end of the fourth foetal month, when significant andcritical growth of another ectodermal derivative, the brain is

also taking place (Rakik, 1988; Danborno and Idris, 2007). After this period, dermatoglyphic patterns remain unchanged. Although the presence of abnormalities in dermatoglyphics constitutes fossilized evidence of a prenatal insult that has occurred in the second trimester of prenatal life or before (Schaumann and Alter 1976; Babler, 1991).Since dermatoglyphic traits

appear to be evolutionarily conservative, it renders them more reliable for studies of the historical relationships of population components. It is also useful as tools for tracing individuals to particular populations. Fingerprints are highly variable and genetically influenced, they have important significance in forensic science, anthropology, ethnology, genetics, and medicine (Schaumann and Alter, 1976; Odokuma and Igbigbi, 2005).

Every individual has a unique fingerprint pattern, which can be of these three types; loops, whorls and arches. In loops the prints recurve back on themselves to form a loop shape, whorls form circular and spiral patterns and arches create a wave-like pattern and includes plain arches and tented arches (Robert, 1972; Udoaka and Udoaka, 2009).

The historical development of fingerprint can be traced back to ancient China which had a common practice of using inked finger on all official documents. In the Western culture, however, the earliest records of the pattern on human hands was done in 1684, by Dr Nehemiah, (Nehemiah, 1684) who wrote a paper describing the patterns he saw on human hands under the microscope, which also included the presence of ridges (Lakshmi and Thenmozhi, 2014). This work was followed by that of Johann Christoph Andreas Mayer in 1788, who described that the arrangement of the skin ridges is never duplicated in two persons (Cummins and Midlo, 1943). In 1823, Jan Evangelist Purkyn described nine fingerprints patterns, which included loops, spirals, circles and double whorls (Harold and Rebecca, 1940). Sir William Herschel began the collecting of fingerprints in 1856, and noted the patterns were unique to each person and were not altered by age (Herschel, 1916). In 1879, Alphonse Bertillon, an assistant clerk in the records office at the Police station in Paris, created a way to identify criminals, this system is sometimes called Bertillonage (Kingston and Kirk, 1965). Juan Vucetich brought an improvement in fingerprint collection in 1891, as he began to note measurements on the identification card of all those arrested and devised is own classification system (Lambourne, 1984). Sir Edmund Richard Henry in 1896, created a system that was used to divide fingerprint records into groups, if they have an arch, whorl or loop pattern (Henry, 1934; Gyenis, 2000).

Fingerprint can also be used to dictate the susceptibility of a fetus to diabetes, this is achieved with the aid of fingerprint marker, which describes a contrast in the growth stimuli influencing the anterior and posterior aspects of the embryonic limb bud (Kahn *etal.,* 2008) Each fingertip's ridge count (RC) reflects the early fetal size of the fingertip'svolar pad (Babler 1991). It was also observed that palm print can be used in gender determination. This is because studies have been conducted on dermatoglyphics and it showed that women have fine epidermal ridges while men have coarse ridges; therefore, the ridge density within a given unit of space is greater in women than in men (Cummins *etal.,* 1941).In a crime scene, if the sex of the perpetrator is established from the prints available at the crime scene, the burden of the investigating officer is reduced as their search for potential suspects will be restricted to a particular sex.

Oral cleft individuals have an increased frequency of ulnar loops as the ridge configuration as compared to the control group (Mathew *etal*., 2005).There is an increase in the ulnar loop patterns among diabetes mellitus patients compared to control population (Bali and Eswaraiah, 2005). The loop patterns and arch pattern was mostly seen on the thumb in diabetes mellitus patients compared to healthy individuals (Barta *etal.,* 1978). Dermatoglyphics can be used as a predictor tool to analyze the occurrence of breast cancer. It was observed in left hand thumb, ulnar loop, twinned loop ulnar and twinned radial loop was maximum in control group and whorlswere maximum in breast cancer patients when compared to normal group. Dermatoglyphic pattern can predict the occurrence of breast cancer and this dermatoglyphics can serve as a non-invasive, anatomical marker and a predictor tool to determine the individuals with breast cancer (Abilasha, 2015).Some disease conditions associated with dermatoglyphics pattern include Diabetes Mellitus (Barta *etal.*, 1978; Oladipo and Ogunowo 2004), sickle cell disease (Oladipo *etal.*,2007), breast cancer (Seltzer *etal.*,1990), obesity (Regoly-Merci*etal.*,1982), rheumatoid arthritis (Ravendranath *etal.*,2006), schizophrenia (Gyenis *etal.*,1990, Paez *etal.*,2001) and cancer (Umana *etal.,* 2013). The application of palm prints has been of great help to man as it can be used for; identification of individuals

and diagnosis of diseases. This was highly used in Chinese medicine, not only to diagnose physical diseases but also mental diseases (Yunyu*etal*., 2002). Palm prints can also be used in blood relation identification, in which the paternity of a child would be determined (Li*etal*.,2000).

Hirsutism on the other hand refers to excessive terminal hair appearing in a malepattern in females (Gallway, 1961; Hartz*etal.,* 1979; Kaufman, 1996). This excessive hair may be seen in response to androgen in women and in children producing male pattern of hair growth, which may be congenital or acquired (Azziz, 2003) localized or diffused in this scenario various sites are involved in different patients and races (Gallway, 1961; McKnight, 1964, Bode *et al.,* 2012).

Hirsutism is distributed with family history, as there is an Increase in hirsutism prevalence among the relatives of hirsute patients (Mcknight, 1964,). Hirsutism can be inherited, as it is a genetically transmitted trait, it can also occur due to high level of the male hormone called androgen, which makes them have deep voice and also small breast (Paul *etal.,* 2002; Danborno *etal*., 2007; Ekback, 2017). Hirsutism can

also occur due to medications, which leads to excessive growth of hair on the face or body. Examples of such drugs include; anabolic steroids and minoxidil (Loriaux, 2012; Abdul-Aziz *et al.,* 2015)). It occurs only in 10% of most population, except in the far-East Asian women who present hirsutism less frequently (Escobar *et al.,* 2011; Carmina *et al.,* 1992) and its seen more in European and the Maori women (Williamson *etal.*,2001).

Hirsutism is associated with some conditions like, menstrual disorders (Jalali and Hajian, 2002), Polycystic ovarian syndrome (Mithal *etal.,* 1988, Zargar *etal.,* 2002, Farnaghi and Seyrafi, 2002), hypertrichosis (Noorbala and Kefaie, 2010) obesity (Puri, 2012). Hirsute women have an increase in the concentration of serum androgen and metabolic markers than non-hirsute women (Jin *etal.*, 2011). Hirsutism is more common in patients with increased BMI, this may be a sign of an underlying metabolic disorder, which will lead to the greater risk of the development of cardiovascular disease and type-2 diabetes (Abdul-Aziz *etal.,* 2015).Free testosterone and free androgen index is positively significant in patients with hirsutism and in patients with polycystic ovarian syndrome, hence free androgen index can be used instead of free testosterone in hirsutism and polycystic ovarian syndrome for diagnosis (Gungor*etal.*, 2011).

2D: 4D ratio is the ratio between the length of the 2nd (index finger) and the 4th (ring finger) which varies due to exposure to androgen (Zheng *etal.*,2011, Mayhew *etal,* 2007).It is calculated by dividing the length of the index finger of a given hand by that of the ring finger of the same hand. 2D:4D ratio is sexually dimorphic, as it has a lower value in males as compared to females (Manning *etal.,* 1998). It has been found to be related to physical and behavioral traitslike; individuals with lower ratio show a high tendency to aggression (Benderlioglu and Nelson., 2004; Bailey and Hurd, 2005; McIntyre *etal.*,2007), lower digit ratio tends to be associated with physical fitness or ability to compete in men and women (Manning*etal.*, 2001, Pokrywka,*etal.*, 2005; Paul, *etal.*,2006; Honekopp, *etal.,* 2006), with birth weight (Danborno *etal.*, 2010), body size and proportion at birth in men, and men with higher digit ratio were shorter at birth (Ronalds *etal.*,2002). 2D:4D ratios are also associated with disease conditions; an individual with low digit ratio is at high risk of having prostate cancer in males (Manning *etal.*, 2002; Sudhakar *etal.*, 2015), increased risk of obesity and metabolic syndrome in males with high digit ratio (Fink *etal.*,2007),other

disease conditions include congenital adrenalhyperplasia, polycystic ovarian syndrome, depression and developmentalpsychopathology, autism. (Manning *et al.,* 2001; Brown *et al.,* 2002; Okten *et al.,* 2002; Cattrall *etal.*,2005; Fink *etal.,* 2007).

Triradius is the point of confluence from where the ridges usually radiate in three different directions. They are termed a, b, c and d moving in the radioulnar direction and t is usually found near the proximal palmar margin (Miller *etal.,* 1966). The atd angle is formed by the lines drawn from the digital tri-radius 'a' to the axial tri-radius 't' and from this tri-radius to the digital tri-radius 'd' (Waseem, 2016).

It has been investigated that the ATD angle is associated with disorders which includes; autism (Arrieta *etal.*,1990; Wolman *etal.*,1990; Milicic *etal.*,2003), schizophrenia (Balgir *etal.*,1993; Paez *etal.*,2001; Avila *etal.*,2003), cleft lip/palate (Woolf and Gianas, 1976; Balgir, 1993; Kohli and Bhalla, 2000; Neiswanger *etal.*,2002) and genetic heart conditions (David, 1981; Pursnani*etal*,1989).

Palmer hyperhidrosis is a condition which denotes excessive sweating in the palm, the excessive sweating can lead to embarrassment, frustration, social withdrawal, and low self-esteem (Leung*etal*.,1999).

The various parameters would be studied among selected dialects of Igala ethnic group. The Igala language is a Yoruboid language spoken in the eastern part of Kogi State, parts of Delta, Edo and Anambra states of Nigeria. The Igala people have a population of about two millionand are surrounded by different ethnic groups like the Ebiras, Binis, Idoma , Tiv, and Igbo (Arokoya, 2012). There exist variation in the dialects of the Igala ethnic group (Linguistic anthropology) and also there cultural practices (Cultural anthropology), hence there is a need to investigate if this can be connected to their morphology and some physical traits. The dialect of the Igala ethnic group used in this study were those from Ankpa, Dekina, Idah, Ibaji, Igalamela, Ofu, Omala, and Olamaboro.

1.2 Statement of Research Problem

Dermatoglyphics studies have been carried out in several ethnic groups with no work among the Igala ethnic group. There has been a high level of crime and drug use, hence with the use of finger prints, detection of individuals involves in crime and also those involve in the use of drugs can be made. The

study of 2D:4D have been carried out in various ethnic groups with no work among the Igala ethnic group. Women suffer psychosocial effects due to hirsutism, women with hirsutism are at risk of having irregular periods, as it has been observed that women with the trait are at risk of having polycystic ovary syndrome and Cushing's syndrome and also at risk of been infertile and hence the need to study the prevalence in the Igala ethnic group. Since some variations such as linguistic and cultural variation occurs in the Igala ethnic, there is a need to see how these variations can be linked to the occurrence of traits such as dermatoglyphic patterns, hirsutism, 2D:4D and some anthropometric parameters in the Igala ethnic group.

1.3 Justification of the Study

Fingerprint analysis in use since the 20th century, has led to many crimes being solved as items from the crime scene can be subjected to DNA analysis, and this has led to the detection of the individual responsible for the crime. Palmar print pattern has been used to detect women who are at risk of developing breast cancer in China, by using the characteristics of the dermatoglyphics of the relative. The trait of hirsutism is genetically determined, women with hirsutism have the tendency of having polycystic ovarian syndrome. Result from study could showcase women who are at risk of having irregular menstruation and infertility, and proper counselling and onward recommendation would be made available to them.

1.4 Aim and Objectives of the Study

1.4.1 Aim of Study

The aim of the study is to investigate the distribution of dermatoglyphic pattern, 2D:4D, hirsutism, and palmar hyperhidrosis among selected dialects of the Igala ethnic group

1.4.2 Objectives of study

The objectives of the study are to investigate:

i. Finger and palm print patterns among selected dialects of the Igala ethnicgroup

ii. 2D:4D in the different dialects of the Igala ethnic group

iii. prevalence of hirsutism in the different dialects among Igala women

iv. association of finger and palm print pattern, 2D:4D, hirsutism and palmar hyperhidrosis in the different dialects of the Igala ethnic groups.

v. relationship of height to weight, BMI, 2D, 4D, 2D:4D and tri radii angle in the population studied

vi. relationship of weight to BMI, weight, 2D, 4D, 2D:4D and tri radii angle in the population studied

vii. relationship of BMI to 2D, 4D, 2D:4D and tri radii angle in the population studied

viiithe distribution of ridge counts in male and females

1.5 Research Hypothesis

i. There would be differences in palm and finger print pattern in the selected dialects of the Igala ethnic group due to genetic variation which occurs in thedifferent dialects.

ii. There will be relationship between hirsutism and 2D:4D among Igala women.

1.6Scope of the Study

This work is limited to only people from Ankpa, Dekina, Idah, Ofu, Olamaboro, Omala, Ibaji, and Igamela dialects of the Igala ethnic group, Kogi State. The variables collected include Finger prints of both hands, palm prints of both hands, palmar hyperhidrosis for both hands, height, weight, digit lengths and hirsutism.

CHAPTER TWO

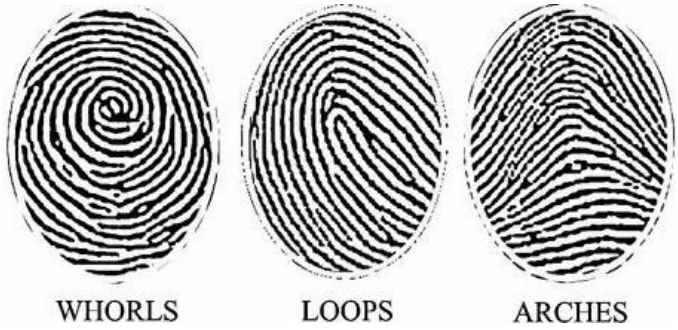
2.0 LITERATURE REVIEW

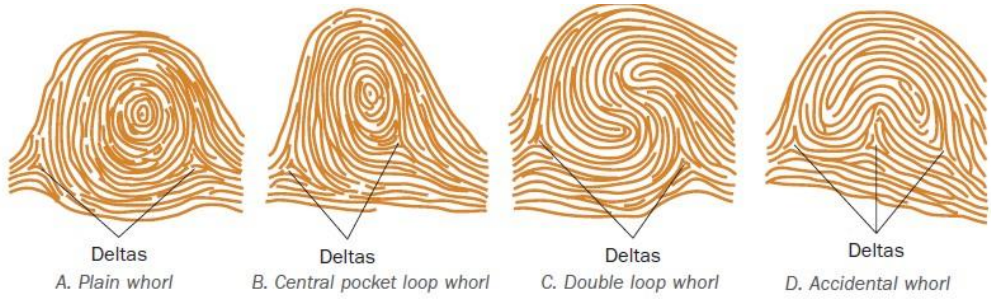
2.1 Development of Epidermal Ridges

The differentiation of epidermal ridges takes place early in fetal development. The ridge pattern is genetically determined and is affected by environmental factors (Bonnevie, 1924). Environmental factor such as external pressure on fetal pads and embryonic fetal finger movements could influence ridge formation (Schaumann and Alter, 1976). Dermatoglyphics traits such as finger ridge count develop within 10^{th} to 17^{th} week post conception (Babbler, 1991). The type of pattern that develops in palm and soles including the digits are genetically determined, and any developmental anomalies that occur in the embryo affect the development of ridge pattern (Moore and Persaud, 2009). Abnormal dermatoglyphic patterns have been observed in several none chromosomal disorders and other diseases whose origin may be influenced directly or indirectly by genetic inheritance (Gupta *etal*.,1984) Ridge formation is influenced by individual differences in developmental stability and first and second trimester insults on the embryo brings about dermatoglyphic changes (Schaumann and Alter, 1976; Marko, 1992).

2.2 Patterns of Finger Prints

Finger print patterns are of three types, which include; a) Arches b) Loops c) Whorls(United states Department of Justice –FBI, 1984).





(Araceli *et al.*, 2001)

Fig.2.1 Different types of whorl finger print pattern

a) Arches: These are found in five percent of finger print patterns. The ridges run from one side to another in a pattern, making no backward turns. Ordinarily there is no delta in an arch pattern. There are four types of arch patterns 1) Plain arches 2) Radial arches 3) Ulnar arches 4) Tented arches (Jalali and Hajian, 2002).

b) Loops: This type of finger print pattern occurs in about 60 to 70% of finger prints. One or more ridges enters on either side of impression, recurves, touches or crosses the line running from the delta to the core and terminates on or in the direction of the side, where the ridge or ridges entered. In ulnar loop the ridges open on the ulnar side, in radial loops the ridges open on the radial side (Jalali and Hajian, 2002).

c) Whorls: These are seen in about 25 to 35 % of finger print patterns. In a whorl some of the ridges make a turn through at least one circuit. Any finger print pattern which contains two or more deltas will be a whorl pattern. There are six types of whorls: a) concentric whorl - the ridges are arranged in concentric rings around the core. b) Spiral whorl - the ridges spiral around the core in clockwise or anticlockwise direction. c) Mixed whorl- it contains circles and spirals in same pattern. d) Central pocket whorl-it contains a smaller pocket within a loop. e) Twin whorl-in these ridges arising from each core open towards the opposite margin of the finger. f) Accidental whorls-these represents combination of two or more of above configurations (Jalali and Hajian,2002).

2.3 Palm Print Patterns

2.3.1 Overview of palm print pattern

Palm print refers to an image acquired of the palm region of the hand. It can be either an online image or taken offline where ink and paper is used to take the image (Zhang, 2004). An online system captures palm print images using a palm print capture sensor that is directly connected to a computer for real-time processing, while an offline palm print identification system usually processes previously captured palm print images, which are often obtained from inked palm prints that were digitized by digital scanner (Zhang and Shu, 1999; Duta*etal.*, 2001; Shi *etal.*,2001; Igbigbi and Msamati, 2001; You *etal.*, 2002).

There are many unique features in a palm print image that can be used forpersonal identification. Principal lines, wrinkles, ridges, minutiae points, singular pointsand texture are regarded as useful features for palm print representation (Shu andZhang, 1998; Penrose and Loesch, 1970)

2.3.2 History of palm prints

Throughout history, the examination of handprints was only a method used todifferentiate one illiterate person from another, since they could not write their own names. In 1858, Sir William Herschel, working for the civil service of india, recorded a handprint on the back of each worker in order to differentiate employees from others who might claim to be employees when pay day comes. This was the first recorded systematic capture of hand and finger images that were uniformly obtained for thepurpose of identification (Peter, 2004). The first known automated finger identification system (AFIS) built to support palm prints is believed to have been built by a Hungarian company. In late 1994, latent experts from the United States benchmarked the palm system and invited the Hungarian company to the 1995 International Association for Identification conference. In 2004, Connecticut, Rhode Island and California established statewide palm print databases that allowed law enforcement agencies in each state to submit unidentified latent palm prints to be searched against each other's database of known offenders (NEC Solutions America, 2004). Australia currently houses the largest repository of palm prints in the world, while the Federal Bureau of Investigation houses the largest collection of criminal history information in the world. This informationprimarily utilizes fingerprints as a biometric feature allowing identification services to federal,state and local users through the Integrated Automated Fingerprint Identification System. Law enforcement agencies indicate that at least 30 percent of the prints lifted from crime scenes from knife hilts, gun grips, steering wheels, and window planes, are of palms, not fingers (Shaila, 2003).

2.3.3 Palmar regions

There are three major palmer regions which includes; interdigital region, thenar region and hypothenar region.

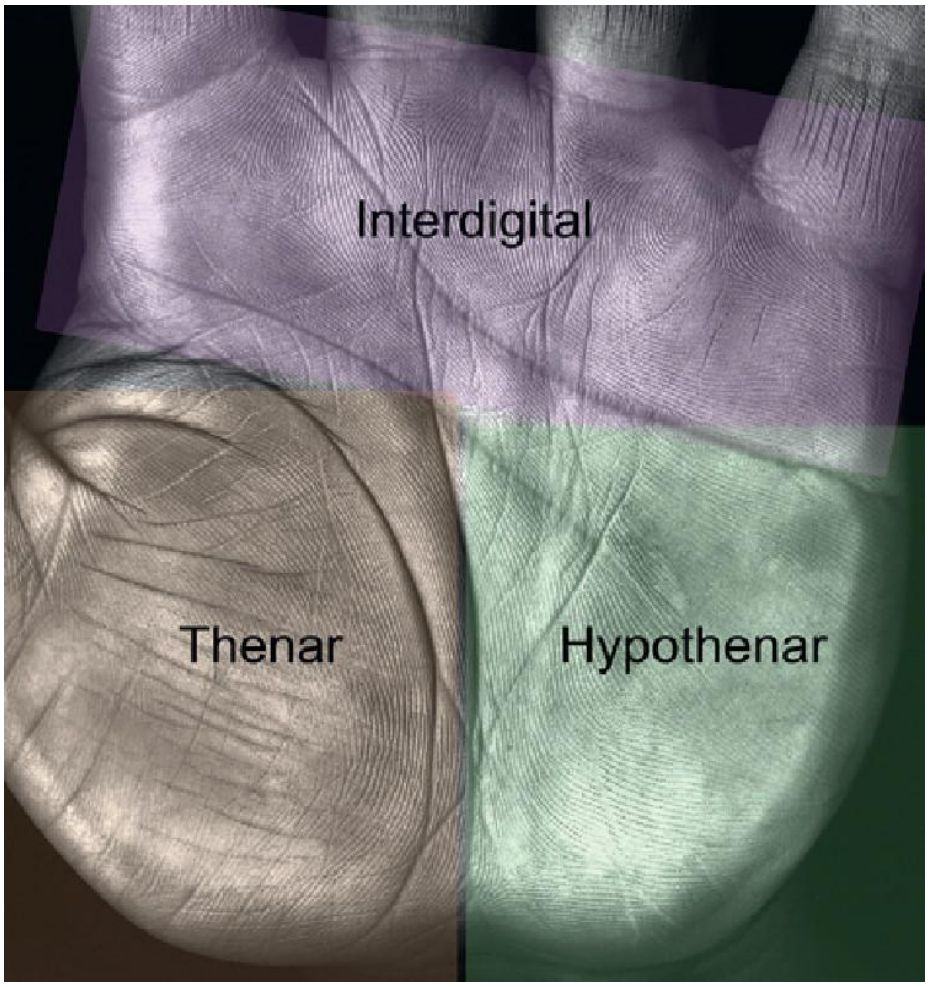


Fig 2.2: Palmer Regions; Interdigital, thenar and hypothenar.

(Maceo*etal.*, 2013)

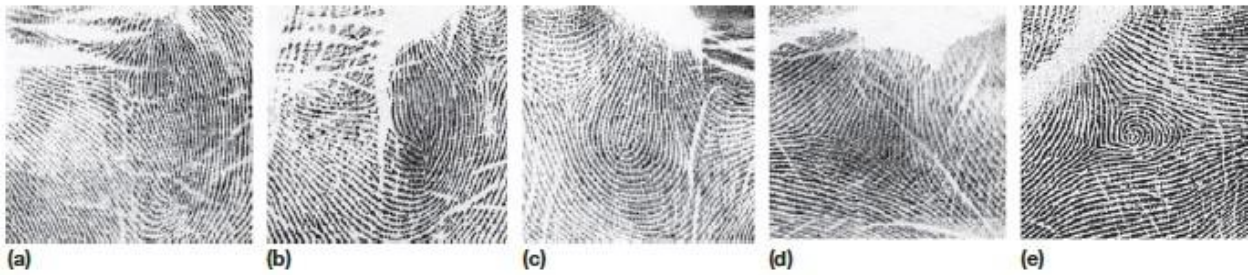
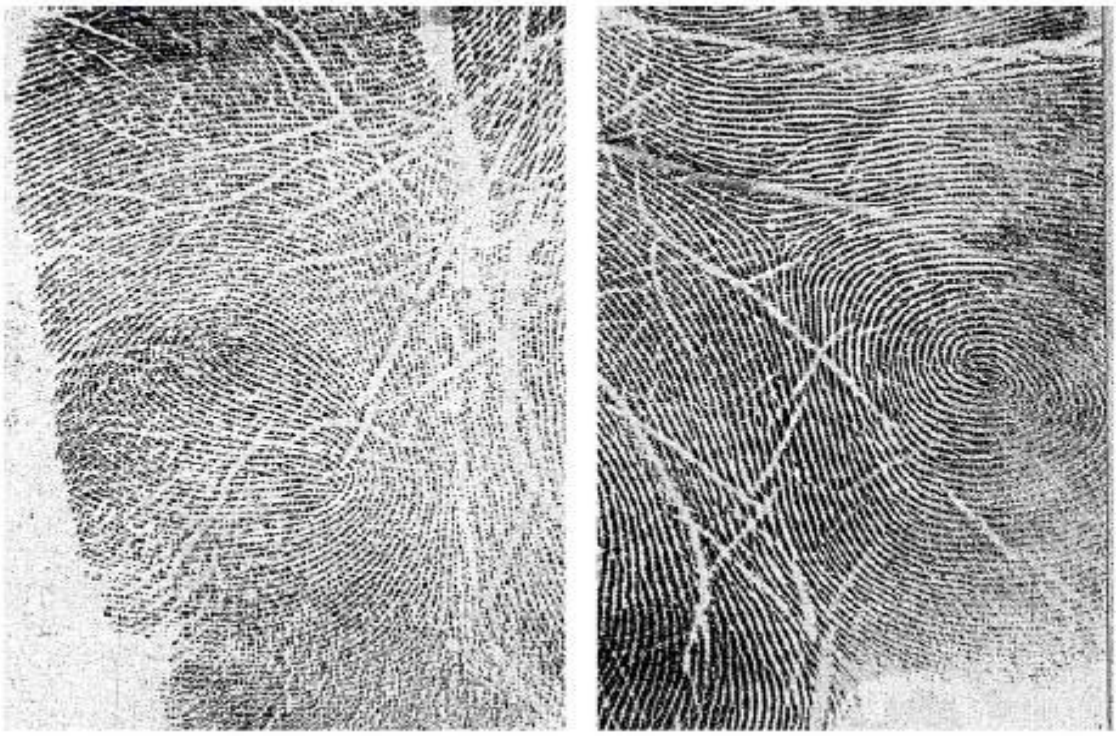


Fig 2.3: Pattern of Interdigital region (a and b) Tented arch, (c) loop, (d) column (e) whorl (Maceo*etal.*, 2013)



(a) (b)

Fig 2.4: (a and b) Left and right hypothenar region ((Maceo*etal.*, 2013)

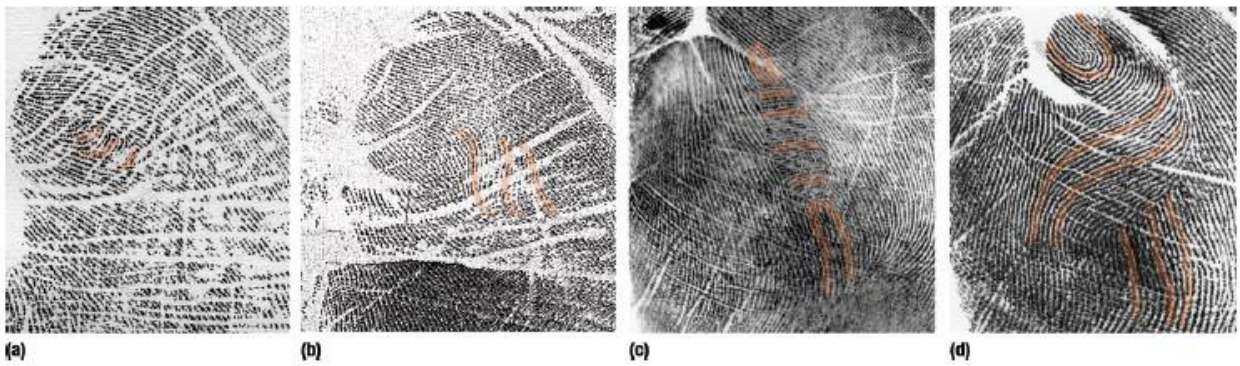


Fig 2.5: (a,b,c and d) Right palm thenar showing vestiges (Maceo*etal.*,2013)

2.3.3.1 Interdigital Region

i. Deltas

The interdigital region is the most complex area of the palm; it contains anywhere from three to seven deltas. These deltas often existed in various combinations with tented arches, loops, columns, or whorls in the interdigital region. Seven possible delta positions were documented. Four of the delta positions were situated at or near the base of each finger (finger deltas) and were labeled Index (I), Middle (M), Ring (R), and Little (L). The remaining three delta positions occurred between the fingers and were labeled Index/Middle (I/M), Middle/Ring (M/R), and Ring Little (R/L). Occasionally, more than one delta was locatedina position (e.g., two deltas under the ring finger). In palms containing only three interdigital deltas, the most common configuration was a delta under the index, middle, and little finger each (the ring finger delta was absent): Interdigital regions with four or more deltas often contained at least one pattern area in the interdigital region. The more patterns present in the interdigital region, generally the higher the number ofdeltas present (Penrose and Loesch, 1970).

ii.Patterns

These patterns include tented arches, loops, columns, and whorls. In the interdigital region, however, a tented arch was a ridge flow over an interdigital delta that formed a loop-like pattern. Columns are a series of three or more ending ridges flanked on one orboth sides by a delta (Maceo*etal.*, 2013)

iii.Hypothenar

The hypothenar region also contains a variety of patterns. Like fingers, the loops found in the palms flow in a certain direction. If a loop is pointing toward the outer edge of the palm is called an ulnar loop. A loop pointing toward the center of the palm is called a radial loop, and a loop pointing toward the base of the palm is called a proximal loop. The ulnar loops are further described by the origin of the ridge flow. If the ridges flow into an ulnar loop pattern from the top of the palm, it is called an ulnar loop –top. If the ridges flow into an ulnar loop pattern from the bottom of the palm, it is called an ‘ulnarloop – base (Wertheim and Maceo, 2002).

iv.Thenar

The thenar region displays fewer overall patterns than the other regions of the palm. There is, however, one pattern unique for thenar – the vestige. A vestige is a ridge flow that runs opposite to the main flow of the ridges. A vestige can be small andindependent, or it may be quite large and accompanied by loops, columns, or whorls. The loops and columns were counted together; hence the combined classification of 'loop/column.' A loop/column above the vestige was termed 'proximal loop/column' because the nose of the loop or ending ridges of the column point toward the base of the palm. Occasionally, both a loop and a column appeared above the vestige. The loop/column below the vestige was termed a 'distal loop/column' because the nose of the loop or the ending ridges of the column generally pointed toward the top of the palm(Maceo*etal.*, 2013)

2.3.4 Applications of the palm print

2.3.4.1Personalidentification

Finger print identification is the most extensively used technique in automatic personal identification based on biostatistics (Shriram and Vikar, 2012). However, automatic finger print identification is mainly based on finger print detail. Palm print includes much more information than the finger print. It is accordingly used to compensate finger printdeficiency.Palm prints have the following characteristics:

i. The most basic elements of the palm print and the finger print are the same.Therefore, palm prints are unique and will not change in life. They are impossible to fake.
ii. The palm print is much larger than the finger print. Details can be easily obtained.
iii. The palm prints include other characteristics (main palmar flexion creases, triradius) aside from its uniqueness and stableness.
iv. Certain geometric characteristics can be obtained when palm prints are taken (Gang and Bian, 1999)

At the 2000 Sydney Olympics, a high resolution palm scanner was used as a safety measure. At the entrances of sensitive sites, people who enter must place their hands on a scanner which reads the handprint and identifies them.

2.3.4.2The use of palmprinting in diagnosis

Using the palm print to diagnose certain diseases is an asset of Chinese traditional medicine. This method was formed after thousands years of clinical practice. Not only can it be used to diagnose physical disease, it can also be used for diagnosis of mental disease (Hlaing, 2012). Research in recent decades has found that at least 50 diseases have palm print associations (Yunyu *etal*., 2002). They include single gene genetic disease, multi-gene genetic disease, and chromosome disease. Chinese researchers have done much work in this field. For instance, abundant material has been accumulated in case-control studies on acyesis and schizophrenia palm print characteristics (Li *et al.,* 2000). Examination for dermatoglyphic disorderhas become a routine in diagnosis of abnormalities in chromosome number andstructure (Balgir and Murthy, 1982).

2.3.4.3Bloodrelationidentification

Past research has demonstrated that the epidermal ridge patterns are under genetic influence (Yunyu *et al.,* 2002). The hereditary basis of dermal patterns has been studied, which has sincebeen confirmed by numerous genetic studies, such as the study of Longo *et al.* (2012) and that of Zainab (2017) in her study to see how dermatoglyphic patterns are inherited. A high degree of similarity of dermatoglyphic traits has been found between monozygotic twins, whereasconsiderably less agreement exits between dizygotic twins. These observations have been utilized diagnostically in determining zygosity of twins due to close resemblance of dermatoglyphics among close relatives than among unrelated persons (Kong *et al.,* 2006). The possibility of using dermatoglyphic analysis as a complementary means in establishing paternity has been suggested (Schaumann and Alter, 1976; Rastogi andPillai, 2010)

Li *et al.* 2000 were the first to discover that dermatoglyphics of the palm print has something to do with health and intelligence. This is decided by a single gene. He summarized the evolution and causes of

dermatoglyphics of primates and divided dermatoglyphics of interdigital areas into groups. He was the first to build a heredity model of the left and right asymmetry in humans which can be used to determine whether a person is thefather of another (Jain *et al.,* 2004).

2.3.4.4Selectionofathletes

Dermatoglyphic studies in the field of sport at home and abroad has proved thatdermatoglyphics canbe regarded as a new genetic reference index in selecting athletes. Many researchers divide athletes into groups according their achievements and compare between athlete groups and the general population (Shao, 1992).

2.3.5 Dermatoglyphics in health

Finger print is unique based on the genetic characteristics of each individual, dermatoglyphics is used in identification of an individual. Identification is a set of physical characteristics, functional or psychic, normal or pathological that defines an individual (Rastogi and Pillai, 2010).

As a result of the unique nature of finger prints, these can be used to identify the criminals at crime scene, dead or unconscious person in blast injuries or mass disaster injuries, accidental exchange of new born babies, in prevention of impersonation of cheques, bank notes and even for national identification (Hassan *etal.,* 2011). Dermatoglyphics can be used to determine or exclude parentage under circumstances of uncertainty of paternity of child (Cummins and Midlo, 1943). Temperament and character can be correlated with finger print pattern. Whorl signifies stubbornness, it is a sign of faithless and unreliable character, loop signifies lack of perseverance, arch denotes merciless crude behavior. A person with ulnar loop on all fingers is clear spirited, mild mannered and strong willed person (melancholic), cool in judgment and ruthless in business. An individual having whorls on all fingers is restless, doubtful, sensitive, clever, eager for action and inclined to crime. But mixture of whorls and loops signifies a neutral character, kind, obedient, truthful but often undecided and impatient. Arches and radial loops occurs in person who is ambitious, cool, stubborn, disobedient, defiant and rebellious (Cummins and Midlo, 1943)

There is a correlation between cephalic (head) size, form of an individual and type of finger print pattern. The Chinese are brachycephalic (having a relatively short broad head) and have increased frequency of whorls and arches, whereas the Europeans are dolichocephalic (having a long head) and tend to have reduced frequency of whorls and increase in arches. There is association between whorls and blood group B, a loop and blood group A, person with blood group O have more loops and fewer whorls. In general females have narrow ridges, more arches and fewer whorls (Cummins and Midlo, 1943;John*etal.*, 2003)

2.3.6 Dermatoglyphics in clinical medicine

Cummins(1936) was the first person to show the possible use of dermatoglyphics in clinical medicine. However, in recent decades a considerable improvement has been made to achieve the concept of the relationship between the types of fingers ridges and some individual disorders (Verma *et al.*, 1995; Shamsudin*etal.*, 1997; Simsek*etal.*, 1998).

Dermatoglyphics is related to some diseases which are purely due to genetic disorder

i. Down's syndrome (trisomy21); These patients have mainly ulnarloops,significantlydifferent ATDangle, single transverse palmer crease (simian line),lower ridge count along digital midlines (Rajangam*etal.*, 1995; Miglinets, 1991).
ii. Turner's syndrome; Predominance of whorls, although the pattern of frequencydepends on the particular chromosomal abnormality (Reed*etal.*, 1977).
iii. Klinefelter's syndrome; Excess of arches on digit 1, more frequent ulnar loops on digit 2, over all fewer whorls, lower ridge count for loops and whorls and totalreduction of finger ridge count (Komotz and Yoshida, 1976).
iv. Patau syndrome; Excess of arches on the finger tips and single palmar crease in60% people (Komotz and Yoshida, 1976).
v. Edwards's syndrome (trisomy 18); 6-10 Arches on finger tips and single palmarcrease in 30% people (Komotz and Yoshida, 1976).

vi. In inborn blindness there are abnormal triradii and excess of arches on finger prints (Vishvanathan*etal*, 2002).

vii. Noonan syndrome. Increased frequency of whorls on finger tips and the axial triradius 't' and increased incidence of single transverse palmer crease (Rott *etal.*, 1975).

Dermatoglyphics is also associated to some diseases which have genetic background,

they include;

1. Neurologicaldiseases:

Since brain and skin develop from same ectoderm, dermatoglyphic variations areinformative for early developmental brain disturbances (Schaumann and Alter, 1976).

a) Alzheimer's disease: There is increased frequency of ulnar loops and decreased frequency of whorls and arches, radial loop on the 4th and 5th digits are morefrequent like in Down's syndrome (Weinre, 1995).

b) Schizophrenia: There is significant increase in whorls and decrease in loops in male Schizophrenics and there is significant reduction in arches all in patients(Gupta and Tutakene, 1986)

c) Cerebral palsy: There is increased frequency of arches, radial loops and whorl pattern and decreased pattern of ulnar loop, decrease in TFRC and 'ab' ridgecount (Simsek*etal.*, 1998)

d) Neurofibromatosis: There is increased frequency of central pocket whorls on the little fingers of both hands and left little finger shows increase in TFRC and 'ab'ridge count (Pallotta*etal.*, 1989)

e) Epilepsy: These patients show significant changes in 'ab' ridge count, TFRC, AFRC, atd, tad, td angles, lateral deviation, C-line, finger ridge count and distaldeviation (Lal and Surekh, 2012)

2. Heartdiseases

a) Congenital heart diseases: There is overall increased incidence in hypothenar pattern with increase in atd angle. There is increased frequency in Sydney line in ventricular septal defect and Tetrology of Fallot, distal displacement of axialtriradius is increased in PDA (David, 1981; Nair, 1986)

b) Rheumatic heart disease: There is decreased frequency of arches in males and increased frequency of whorls in females. There is increased frequency ofpatterns in 3rd interdigital area in males and decreased 'td' ridge count, increasedmultiple axial triradius in females (Annupurna*etal*., 1978)

c) Coronary heart disease: The etiology of coronary heart disease is multifactorial, with genetic predisposition having an important role. In these patients there is significant decrease in loops and increase in whorls in males. The palmer pattern is significantly decreased in thenar area in females, 3rd interdigital area in both males and females, increase in '4' palmar triradii in males and '5' palmar triradii in females and significant decrease in '6'palmer triradii in both sexes (Chimne andKsheersagar, 2012)

3. Diabetesmellitus

In type 1 DM there is increased frequency in whorls, and decreased ulnar loop,increased frequency of Sydney line, and increased incidences of arches in females (Sant *etal*., 1980). In Maturity onset diabetes mellitus, there is decrease in mean value of TFRC, AFRC, increase in arches and decrease in whorls (Ravendranath and Thomas, 1995).

2.4 Hirsutism

Hirsutism is the occurrence of excessive hair in women in areas where hair is normally minimal or absent such as the face, chin and chest (Kaufman, 2002; Brodell and Mercurio, 2010). Hirsutism is usually as a result of underlying endocrine imbalance which may be adrenal, ovarian, or central (Blume-Peytavi,*etal*., 2007), it affects between 5-15% of all women across all ethnic background (Aziz, 2003).

2.4.1 Symptoms

A woman with the mildest form of hirsutism may notice significant hair growth that is mature on the upper lip, chin, sideburn area, around of the nipples or lower abdomen. In more advanced cases, mature hair would grow on the upper back, shoulders, sternum, and upper abdomen. It begins mostly during puberty, but if hirsutism starts before puberty, the cause could be hormonal (Trueb, 2002). Also the impact of hirsutism on a woman may be profound and can result in psychological distress that threatens her feminine identity. The condition may therefore result in altered self-perception, depression, somatization, hostility and cognitive symptoms (Hajheydari *etal.*, 2007;Ekback*etal.*,2013; Pate*etal.*,2013)

2.4.2 Causes

Hirsutism can be caused by the following;

i. Genetic: This is when the trait is inherited from parents to the offspring
ii. Hormone: hirsutism can also occur due to high level of male hormone called androgen, which makes the hirsute female have deep voice and also small breast.
iii. Medications: Hirsutism can also occur due to medication which leads to excessive growth of hair on the face or body. Examples of such drugsincludes anabolic steroids and minoxidil.
iv. Cushing's syndrome: This is the excessive production of cortisol by theadrenal glands
v. Insulin resistance (American Society of Reproductive Medicine,1944; Fauci,2008)

2.4.3 Prevalence

The prevalence of hirsutism is higher in mediterannian and South Americans than Indians and Mongoloids (Zargar*etal.*,2002; Hunter and Carek, 2003; De Berker*etal.*,2004; DeUgarte*etal.*,2006; Noorbala and Kefaie, 2010).

Prevalence of Hirsutism

Table 1: Prevalence of hirsutism from different countries

Countries	**Percentage**
United States	8%
India (Kashmir)	1 – 5%
Spain	5.9%
Italy	4.5%
Saudi Arabia	9%
Denmark	8%
Finland	7.5%
Sweden	7.8%
Ireland	7.6%

(DeUgarte*etal.,* 2006)

2.4.4 Pathophysiology of hirsutism

The hair growing cycle is comprised of 3 phases:

· Anagen (growth phase)

· Catagen (involution phase)

· Telogen (rest phase)

Depending upon the body size, hormonal regulation plays an important role in the hair growth cycle. Androgens increase hair follicle size, hair fibre diameter and the proportion of time terminal hairs spend in the anagen phase. Androgen excess in women leads to increased hair growth in most androgen sensitive sites, but will manifest with the loss of hair in the scalp regionby reducing the time scalp hairs spend in anagen phase. Hair can be categorized as either: Vellus (fine, soft and not pigmented) or Terminal (long, coarse and pigmented). The number of hair follicles does not change over an individual's lifetime, but follicle size and type of hair can change in response to numerous factors, particularly androgens.

Androgens are necessary for terminal hair and sebaceous gland development andmediate differentiation of pilosebaceous units (PSU`s) into either a terminal hair follicleor a sebaceous gland (Rajneesh and Rajput, 2013). In the former case, androgens transform the vellus hair into a terminal hair, in the latter, the sebaceous component proliferates and the hair remains vellus (Rajneesh and Rajput, 2013). When caused by increased androgen activity, hirsutism is often accompanied by virilization, which may manifest as loss of menses, increased muscle mass, voice deepening, and clitoralhypertrophy (Elghblawi, 2008; Bode*etal*., 2012).

2.4.5 Diagnosis of hirsutism

In the diagnosis of hirsutism, physical examination and laboratory investigations can be used to make correct evaluation of hirsutism. The history should include the onset and progression of hirsutism, the pattern of menstruation, weight gain, and the use of androgenic drugs, such as anabolic and androgenic steroids, and valproic acid (Wuttke *et al,* 2006; Alsantali and Sharpiro, 2009).

There are also several clinical findings that suggests one of the rare and more serious causes of Hirsutism: - Abrupt onset, short duration, or progressive worsening of hirsutism, onset in the third decade of life or later, rather than near puberty, symptoms or signs of virilization, moderately elevated (or higher) serum androgen concentrations, e.g., in young women raise possibility of an androgen secreting hormone (Rajneesh and Rajput, 2013, Panidis*etal.*, 2013).

According to the Endocrine Society Clinical Practice Guidelines (Martin *et al.*, 2008), testing for androgen is recommended in women with moderate-to severe hirsutism or hirsutism of any degree when it is associated with any of the following: sudden onset, rapidprogression of menstrual irregularity, infertility, central obesity, clitoromegaly (anabnormal enlargement of the clitoris that is mostly congenital or acquired) oracanthosis nigrican (a dark to brown hyperpigmentation of the skin). The initial tests for hirsutism should include early morning plasma total testosterone and free testosterone. In scenarios where testosterone levels are more than 1.5-2 times the upper normal limit, or if a history of rapid virilization is found, dehydroepiandroster one sulphate (DHEA-S) and androstenedione should be measured to identify an adrenal or ovarian source of hyperandrogenemia (Kim *et al.*, 2011; Somani*etal.*, 2014)

2.4.5.1 Laboratory testing

Serum androgens

Serum testosterone values – above 150 ng/dL

Serum free testosterone values – above 2

Serum dehydroepiandrosterone sulfate

(DHEA – S) values- above 700 mcg/dL

Serum prolactin above 20 g/L

Serum luteinizing hormone

Follicular Phase 2.0 – 15.0 U/L

Ovulatory Phase 22.0 – 105.0 U/L

Luteal Phase 0.6 – 19.0 U/L

Postmenopausal 16.0 U/L – 64.0 U/L

Pelvic Ultrasonography

Testing for Cushing's syndrome

Abdominal CT or MRI

Laparoscopy or laparotomy

Ovarian and adrenal vein sampling

Dexamethasone suppression testing

Clinical investigation tools

GnRH agonist testing. (Rajneesh and Rajput, 2013)

2.4.5.2 Hirsutism profile

It is the tests performed on a female to identify the cause of increase hair growth. It includes the estimation of 3- alpha- androstanediol, androstenedione, DHEA- S, total & free testosterone.

2.4.5.3 Ferriman – Gallway score (F - G)

This is the established and most prevalent system of measuring hirsutism. It was introduced in 1961 and initially it was based on the presence of hair production in 11 different areas namely the upper lip, chin, chest, upper back, lower back, upper abdomen, lower abdomen, arm, forearm, thigh, and lower leg. The survey was conducted at a medical clinic in UK and the cases were 430 successive females stated to be primarily of white ethnicity and aged 15 to 74 years (American Society for Reproductive Medicine, 1944)

It is a semi quantitative system for the clinical assessment of the presence and severity

of hirsutism in the premenopausal woman. Each of eleven body areas is graded separately from no hirsutism (grade 0) to minimal hirsutism (grade 1) to marked hirsutism (grade 4). A normal hirsutism score is less than 8 (Gallway, 1961; Goodman*etal.*, 2001; Rajneesh and Rajput, 2013).

2.4.5.3 Hatch and colleagues' method

This is also a variation of the Ferriman-Gallway technique. Hatch and his fellow experts maintained the conventional score card of 0 to 4 but referred to only nine of the body locations assessed by Ferriman and Gallway. The lower legs and lower arms were not included in their research (Bulent *et al.,* 2010)

2.4.5.4 Lorenzo's study of hirsutism

This study was conducted among 300 random women (irrespective of racial differences) from a public health survey in Michigan. Its score pattern was based on only five body regions which includes; chin, upper lip, chest, abdomen, and thighs and the count was the conventional 0 to 4. This survey did not record a hirsutism tally over 5 among any of the cases studied. Hence, from this analysis some experts concluded that the general score varies with the area of survey (Satyanand*etal.,* 2010).

2.4.6 Management

Some variety medical and surgical treatments recommended based on your diagnosis and severity of hirsutism (American Society of Reproductive Medicine, 1944). The therapeutic options of hirsutism can be divided into systemic, topical, and dermato-cosmetic therapies (Alsantali and Shapiro, 2009).

2.4.6.1 Cosmetic hair removal for hirsutism

Cosmetic hair removal does not provide long term relief from excess hair. The results are only short lived and have to be repeated regularly to maintain a lack of hair. However, the main advantage is that they can be applied at home quickly and easily (Blume *etal.,* 2007; Frank, 2012; Oner and Muderris, 2013). In addition, cosmetic hair removal methods are cheap and widely available. A facial cream containing eflornithine hydrochloride (Vaniqa™) may be used in combination with the previously mentioned cosmetic therapies to slow the growth of excessive facial hair. Its safety in pregnancy or effectiveness on other body parts has not been established (America Society of Reproductive Medicine, 1944). Cosmetic therapy is of two types, which includes;

· Temporary hair removal

· Permanent hair removal

2.4.6.2 Temporary hair removal

I. Shaving

Most women are rather reluctant to shave excess hair – particularly on the face. However, shaving is one of the quickest, cheapest and most effective ways of removing facial hair. Where the hair growth in the beard and moustache are modest the results from shaving can be very good.

The main disadvantage:-

1. Hair quickly regrows so shaving has to be done on a regular basis.
2. Shaving can cause a rash on sensitive skin (Escobar-Morreale*etal.*,2011)

ii. Bleaching

Bleaching facial hair, and sometimes body hair, is a popular approach to hiding hirsutism for light skinned individuals. The bleaching is intended to reduce the color contrast between the hair fiber and the skin. The less contrast in color, the less visible the hair is. For dark skinned individuals bleaching is usually more of a disadvantage as it can actually increase the color contrast between the hair fiber and the surrounding dark skin (Tirabassi*etal.*, 2013).

2.4.6.3 Chemical depilation

Chemical depilatories can be an effective way to remove hair and the results last longer than with shaving. In essence, the chemicals are very alkaline in nature. The alkaline chemicals weaken the hair fiber so that it breaks off a little below the skin surface when the cream is rubbed or washed away (Alajlan *et al.*, 2005; Trimpe, 2009;).

2.4.6.4 Plucking

Plucking hair to remove can work quite well. Small areas may be individually plucked with tweezers. Larger areas of hair can be plucked using battery operated epilators that mechanically pluck the hair. The result can be very good. However, one of the main disadvantages of plucking hair is that it will grow back and sometimes it can grow back thicker than it was before. Plucking hair injures the hair follicles. Threading is a particular form of hair plucking, it involves passing twisted threads across the skin such that the catch hair between the threads which is then plucked (Hunter and Carek, 2003).

2.4.6.5 Permanent hair removal

There are two types of permanent hair removal: Electrolysis and Photoepilation (using Laser and intense pulse light (IPL). Photoepilation seems to be superior to the conventional methods, such as shaving, waxing and electrolysis. A Cochrane review of photoepilation of unwanted hair growth showed that alexandrite and diode lasers are more effective, whereas little evidence was obtained for the effect from IPL, Nd: YAG, or rubylasers (Haedersdal and Gotzsche, 2006). However, some longer wavelength lasers (Nd:YAG), or IPL, appear to provide benefits in patients who have darker skin types and therefore have less risk of burning and dyspigmentation, but rare, adverse effect of photoepilation, particularly in dark-skinned individuals (Alajlan, 2005; Radmanesh, 2009)

1. **Electrolysis**:It is the method in which a very fine needle is inserted into the hair follicle. A mild electric current is sent through the needle to permanently destroy the hair follicle's ability to produce hair. Since follicles are treated one at a time, it is somewhat impractical to use electrolysis to treat very large areas of the body (Martin*etal.*, 2008).

2. **Lasermethod:**This method is used on large areas of body. This involves a beam of light is passed through the skin to the hair follicle to destroy it. People with light skin and dark hair usually achieve the best results with laser hair removal(Haedersdal and Getzsche, 2006)

2.4.6.6 Pharmacotherapy antiandrogens

Spironolactone (Aldactone), a diuretic or “waterpill,” is often prescribed in combination with birth control pills. It has been found to directly block the effects of androgens in hair follicles and has been used to treat hirsutism (American Society of Reproductive Medicine, 1944) analdosterone antagonist, has several actions including inhibition of the androgen receptor, suppression of adrenal androgen biosynthesis, and inhibition of the 5α-reductase enzyme.

Spironolactone is generally well tolerated withfew side-effects, such as menorrhagia, lethargy, stomach upset, dry skin, heart burn, fatigue (Goldman and Ausiello, 2007; Rajneesh and Rajput, 2013).

Flutamideis a pure non-steroidal antiandrogen that acts as an androgen receptorblocker.

Studies have shown that flutamide 250-500 mg/d is more effective than finasteride (Falsetti *etal.,* 1999) andtriptorelin (Pazos *etal.,* 1999) a long acting gonadotropin releasing hormone antagonist.

Finasterideis a potent inhibitor of the type 2isoenzyme of 5-α-reductase, which blocks the conversion of testosterone to 5-α-dihydrotestosterone. Finasteride has been shown to lower hirsutism scores by 30%-60% in addition to reducing the average hair diameter (Townsend and Marlowe, 2004; Franks, 2012)

2.5 2D:4D

2D:4D refers to the ratio between length of the 2nd (index finger) and the 4th (ring finger) which varies due to exposure to androgen and it is measured from the midpoint of the bottom crease where the fingers join the hands to the tip of the fingers (Mayhew *etal.,* 2007; Zheng *etal.*,2011; Honekopp and Watson, 2011). This ratio is calculated by dividing the length of the index finger of a given hand by that of the ring finger of the same hand, it is sexually dimorphic, as it has a lower value in males as compared to females (Manning *etal.,* 1998; Weisberg *etal.,* 2011), with a normal range of 0.947± 0.029 in males, and 0.965±0.026 in females (Loehlin*etal.,* 2012). It has been suggested that 2D:4D is affected by exposure to androgens such as testosterone, as a study conducted using mice showed that Mice with higher testosterone and low estrogen levels had more male-like digits (low 2D:4D), while mice with higher estrogen levels or low testosterone levels had higher, more feminine digits ratios, that is high 2D:4D (Manning, 2000; William*etal.,* 2000; Zhengetal.,2011; Auger*etal.*,2013). It is the most strongly dimorphic

of all the human digit ratios combinations (Manning *etal.*,2000; McFadden and Shubel, 2002), the differences in the finger length ratio is said to reflect the influence of prenatal testosterone during development (Manning, 2002; Manning *et al.*,2003). The correlation between the two digits is due to two major factors, the firstbeen the common genes (Hoxa and Hoxd) which regulates the ontogeny of thereproductive system, as well as the growth and patterning of the fingers (Kondo *etal.*, 1997; Peichel *etal.*, 1997). The second is that allelic variation in androgen receptor sensitivity influences digit ratio, most masculine finger ratios are associated with androgen receptor alleles with fewer CAG base pair microsatellite repeats in the terminal domain (Manning *etal.*, 2003). Children with congenital adrenal hyperplasia (CAH) tends to show masculine or lower digit ratio due to increased exposure to levels of androgens from early gestation to neonatal period (Berenbaum and Reinisch, 1997), whereas children with Klinefelter's syndrome, depicts higher or feminine digit ratios, which is attributed to a low testosterone exposure (McAnulty and Michele, 2006; Manning, 2013).When the mother is involve in smoking during pregnancy, it elevates the prenatal testosterone and in turn is associated to low or masculine 2D:4D in children (Coyne *etal.*,2007). Both male and female with high level of developmental androgen, depicts more masculine finger length ratios than control (Brown*etal.*,2002, Okten*etal.*, 2002). Digit ratio has continuously shown more dimorphism on the right hand than the left in humans (Manning*etal.*,1998; William *et al.*, 2000; McFadden and Shubbel, 2002). When both right and left hand digit ratios were used to investigate the relationships between digit ratio and psychological factors, stronger effects were observed on the right hand as compared to left (William *etal.*,2000; Brown *etal.*,2002; Csatho *etal.*, 2003a, 2003b). Men with smaller 2D:4D are perceived as being more masculine and dominant by female observers (Neave *etal.*, 2003). More significant correlations have been found between more masculine (small) digit ratios and achievement, ability, and speed in a variety of sports and visual spatial ability (Manning and Taylor, 2001; Manning, 2002; Pokrywka *etal.*, 2005). Most male- like digit ratios have been observed to be associated to deleterious traits such as increased rates of autism, immune deficiency and reduced verbal fluency (Manning, 2002). Cognitive or personality traits are also associated with digit ratio, as men tends to be more aggressive than women (Austin*etal.*, 2002)

2.5.1 Geographical and ethnic variation in 2D:4D

In a study to see the geographical and ethnic distribution of 2D:4D among the Han, Berber, Uygur and Jamaican children subjects. Manning*etal.*,(2000) observed that Han children had the highest mean values of 2D:4D, they were followed by the Berbers, then the Uygurs, while the Jamaican children had the lowest mean values of 2D:4D (Manning *etal.*,2000; Manning*etal.,* 2004). A 2008 study by Lu *et al.* showed that the mean value of 2D:4D of the Hui and the Han in Ningxia were lower than those in European countries such as Britain. More so, in 2007 Manning et al reported that 2D:4D varied across ethnic groups with higher ratios for Whites, Non-Chinese Asians, and Mid-Easterners and lower ratios in Chinese and Black samples (Manning*etal.,* 2007)

2.5.2 Correlation between digit ratios and various human traits

2D:4D have been reported to be associated with various traits such as musical abilities, numerical and spatial skills and sporting capabilities (Luxen and Buunk, 2005; Austin *et al.,* 2002). Lower 2D:4D ratios showed a relationship with better arithmetic, visual and spatial skills (Luxen and Buunk, 2005).Males that showcase higher or feminine digit ratio personalities are at risk of having low sperm counts, increased risk of heart disease, obesity and metabolic syndrome (Oyeyemi *etal.,* 2014). Moreso, prenatal testosterone levels have been implicated in migraine, autism, dyslexia, infertility and breast cancer (Oyeyemi *etal.,* 2014). Individuals with lower digit ratio tend to be more aggressive than those with higher 2D:4D (Hampson and Sankar, 2012; McIntyre*etal.,* 2007).

Higher ratios as in females or feminine digit ratios in males showed correlation with eating disorders, anxiety and depression (Manning *etal.,* 2013). It has been reported male vulnerability to behaviour disorders in childhood and female vulnerability to emotional disorders in adolescence (Peters*etal.*,2002; Martel, 2009).

2.5.3 Measurement of digit ratios

Digits ratios can be measured by using the following techniques;

a. Digital Caliper

Here the length of the second digit (index finger) and the fourth digit (ring finger)are measured from the fingertip to the midpoint of the basal crease, on the ventral surface of the hand using digital vernier caliper. The 2D:4D is thenobtained by dividing the values (Bailey and Hurd, 2005).

b. X- Rays

X-rays of the individual was taken and used for the measurement of the digitratio, but an ethical clearance is required in regards to exposure to radiation

c. Using Photographs

Photographs are taken using a digital camera with hand held in a supine positionand fingers completely extended (Krishnakumar*etal.,* 2014)

d. Using Photocopies

Digits ratios can also be measured by taking photocopies of the hands, but results from the photocopies tends to be lower than values from directmeasurement (Manning*etal.,* 2005)

e. Using Scanners

Flat –bed scanners are used, the subject is asked to place both hands on the scanner with all the fingers in both the hands, straight and visible. Then small marks are drawn on the basal creases of the index and ring finger, in order to increase the accuracy. Also, prints of the scanned images can be taken, on which direct measurements are made using calipers (Evardone and Alexander, 2009).

2.6 Palmar Hyperhidrosis

This is also known as sweaty hands; it is a condition which involves excessive ecrrine sweating in the palm. It usually starts in childhood or adolescence (Leung *etal.*,1999)



Plate I: Plate to show the hand of an individual with severe palmar hyperhidrosis(Leung and Barankin, 2014)

2.6.1 Epidemiology

The estimated incidence of occurrence of palmar hyperhidrosis is 0.6 to 2.8% of the population (Higashimoto, *etal.*,2006). The sex ratio is approximately equal, but it occurs in 30 to 50% of individual with family history (Vazquez-Lopez and Relgosa, 2005).

2.6.2 Clinical manifestations

Palmar hyperhidrosis often begins in childhood, and becomes more severe in adolescence and young adulthood. The degree of sweating is variable, ranging in severity from moderate moisture to severe dripping (Ro *etal.*,2002). The sweating can be aggravated during periods of stress, embarrassment, fear, anger, excitement and anxiety (Leung*etal.*,1999; Ro*etal.*,2002)

2.6.3 Complications

Palmar hyperhidrosis adversely affects the quality of life, as affected patients tend to avoid shaking hands with people. As such they may become socially withdrawn and have low self-esteeem. They may also have difficulty in grasping certain objects such aspens, while the papers they hold may become wet and the metals they hold maybecome rusted. This may impose restrictions on the kinds of task they would be able toperform.

Palmar hyperhidrosis may aggravate eczematous dermatitis (Leung, 2011). Affected patients tend to be at risk of having contact dermatitis and miliari (Leung *etal.*,1999). Hyperhidrosis may lead to maceration of the skin and predisposition to various bacterial and fungal infections

2.6.4 Management of palmar hyperhidrosis

The treatment of palmar hyperhidrosis would depend on how severe the sweating is and which previous treatment have been successful;

a. Topical treatments: Some mild to moderate cases can respond to topical treatments such as aluminium chloride hexahydrate (Driclor).

Driclor should always be applied to the skin that is as dry as possible in order to maximize the benefit and at the same time minimize the side effects. It is normally applied just after a shower, prior to bedtime, the hand is then washed first thing in the morning without using soap. Corticosteroid cream can beapplied intermittently in cases were irritation arise (Leung, 2011).

b. Iontophoresis

This may be considered for cases which do not respond to topical treatments. The affected area is immersed in tap water, salty water or glycopyrrolate solution, then a gentle electric current is passed across the skin surface for 10 to 20minutes.Glycopyrrolate iontophoresis has the highest success rate, as up to 80% ofaffected people respond well to this treatment (Chia*etal.*,2012)

c. Botulinum toxin type A (botox) injections

Botox injections can be used to treat sweaty hands safely and effectively, but this is expensive as it is not subsidized under Medicare-PBS, hence the use is limited(Vazquez and Relgosa, 2005; Lecoufflet*etal.*,2014)

d. Oral medications

Anticholinergic tablets such as oxybutynin and propantheline bromide can be used in the treatment of palmar hyperhidrosis. However, side effects such asconstipation, dry mouth and drowsiness are common (Woloske*etal.*,2014).

e. Surgery

Endoscopic thoracic sympathectomy (ETS) is a surgical treatment which is used for various forms of hyperhidrosis. It is conducted by a neurosurgeon under general anaesthesia, and has a very high success rate in the treatment of palmar hyperhidrosis but has a risk of compensatory sweating. Compensatory sweating occurs in areas such as the back or lower limbs weeks to months after

ETSsurgery. Compensatory hyperhidrosis can be difficult to treat and usually persists for life (Tang*etal.*,2014; Lau*etal*.,2014).

CHAPTER THREE

3.0 MATERIALS AND METHODS

3.1 Materials

The following materials were used:

i. Stamp Pad and Ink

ii. Digital Camera (TECNO DP7CPRO, CHINA)

iii. Avenger digital caliper (Micro Mak USA).

iv. Hand Lens

v. Stadiometer

vi. Protractor

vii. Questionaires

3.2 Methods

A total of 602 subjects were recruited in the study, 322 were females while 280 were males. They were from Ankpa, Dekina, Idah, Ofu, Olamaboro, Omala, Ibaji and Igalamela dialects of the Igala ethnic group who were within theage range of 13-19 years. They were recruited by random sampling technique, they were informed about the study and those who gave their consent were included in the study.

3.2.1. Fingerprint collection

The subjects fingerprint pattern was obtained by allowing them place the tip of each finger on the stamp pad, which is then imprinted on the questionnaire. This was done for both the left and right hand. The palm print patterns were obtained with the digital camera (TECNO DP7CPRO) at a distance of 8cm from the hand, the subjects were asked to stretch forth their palm and the palm print patterns were captured with the camera. This was done for both the right and left hand, an image size (320×240) of the palm print pattern obtained was then printed out and the ATD triangle was measured at the point ‘t’ using a protractor. The ridges were also counted for each digit with the aid of hand lens, from the core to the delta.



Plate II: Capturing of fingerprints of participants

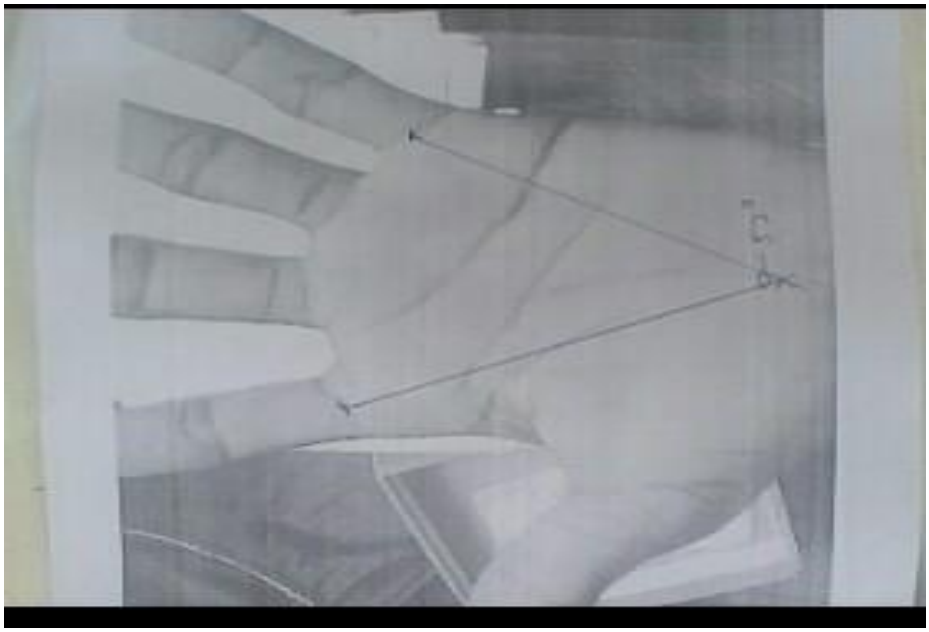


Plate III: Participant's palm print showing ATD triangle

3.2.2 Hirsutism

The degree of hirsutism was determined by modified Ferriman Gallway (F and G score), it quantifies the presence of terminal hair over eleven body parts: the upper lip, chin, chest, upper and lower abdomen, thighs, upper and lower back, and upper arms. The score varies from 0 (no hair) to 4 (extensive hair growth) in each area.The questionnaire (See Appendix IV) showing the degree of hair in different parts of the body was given to the subjects, which they used to assess themselves.

Total score < 8: normal hair growth

Total score 8-14: mild hirsutes

Total score ≥ 15: moderate to severe hirsutes (Gallway, 1961)

3.2.3 2D:4D

The digit length was measured on the ventral surface of the hand from the basal crease of the finger up to the tip, in accordance to Manning *etal*(1998) using an Avenger digital caliper (MicroMak USA) measuring to 0.01mm.



Plate IV: Second digit and fourth digit length measurement (cm) using digital vernier caliper

3.2.4 Palmar Hyperhidrosis

The occurrence of palmer hyperhidrosis was determined in the subjects using the subjective method, the degree of sweating was observed and the subjects were also asked if the sweat on their palm and how often.



Plate V: Subjective observation of palmar hyperhidrosis

3.2.5 Measurement of height and weight

Standing height was measured to the nearest 0.1cm with the maximum distance taken from the base of the foot to the highest point on the head using a stadiometer, with the subject standing erect on a horizontal resting plane, without shoes, having the palms turned inwards and finger pointed downward, heels held together, toes apart and the head held in Frankfurt plane as reported by Mauthausen and Gausen (1959).

Weight was measured to the nearest 0.1kg using weighing scale. The subjects were asked to climb the scale without shoes and with light clothing according to the methods of Menezes and Khany (1998). Body mass index was then calculated as weight/height^2 (kg/m^2).



Plate VI: Weight measurement in kg



Plate VII: Measurement of height (cm)

3.4 Inclusion and Exclusion Criteria

3.4.1 Inclusion criteria

The following were used as inclusion criteria

i. all Igala subjects

ii. apparently healthy subjects

iii. subjects who are adolescents (between 13-19 years)

3.4.2 Exclusion criteria

The following were used as exclusion criteria

i. non Igala subjects

ii. subjects who are non- adolescent

iii. subjects with hand deformities.

3.3 Location of Study

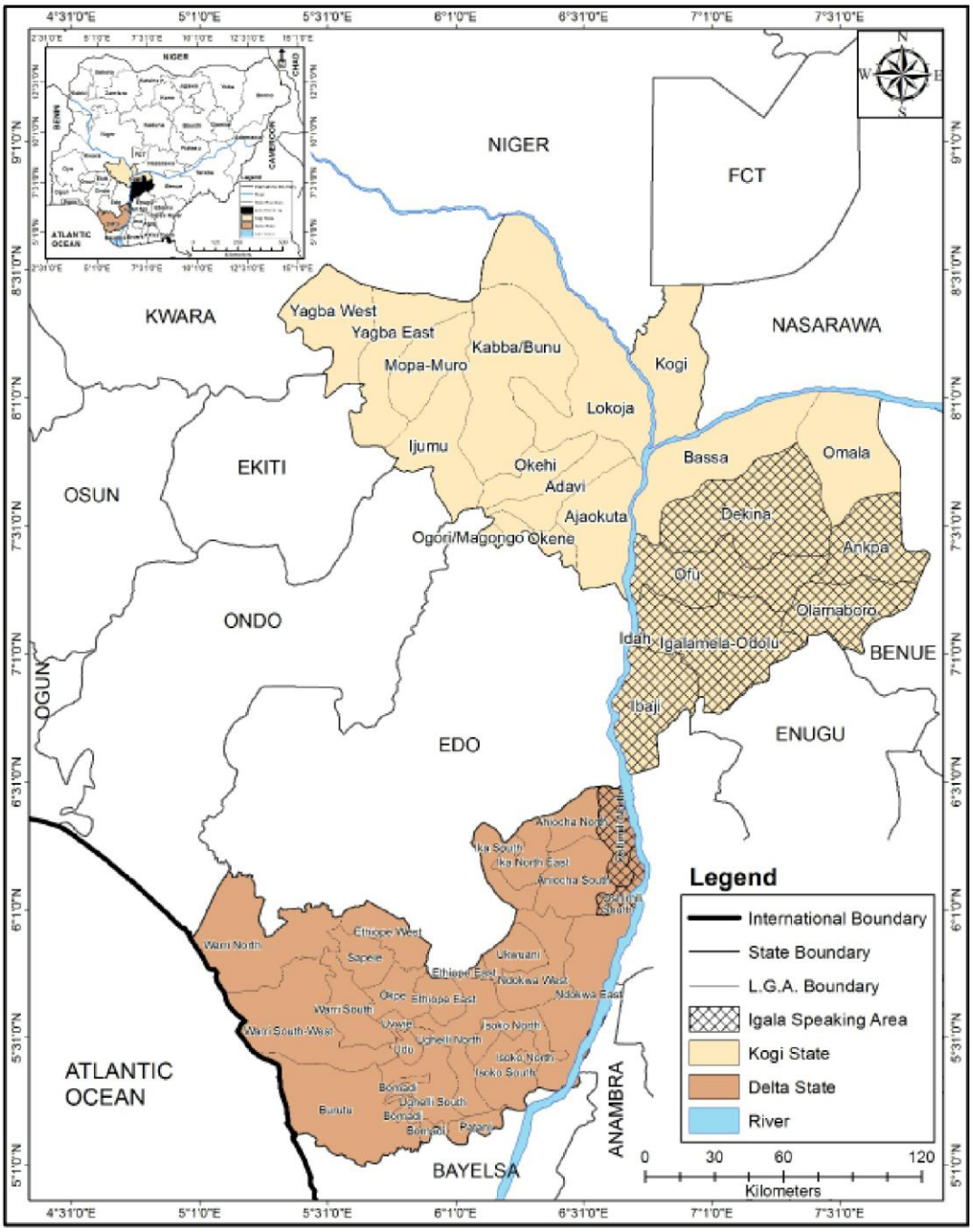


Figure 3.1: Map of Kogi and Delta States showing Igala Speaking Areas

Source: Modified from the Administrative Maps of Kogi and Delta States

3.5 Ethical Approval

Ethical approval with the Number (954524802) was obtained from the Faculty of Medicine's Committee on Ethics (See Appendix I) and permission to conduct the study was also obtained from the authorities of participating schools. Only subjects who gave informed consent to participate in the research were included in the study.

3.6 Statistical Analyses

Data were expressed as mean±standard deviation and percentages. Student's t-test was used to test the difference in the mean and percentages of all variables of the finger and palmar print pattern of the different Igala dialects. Chi square was used to see the distribution of hirsutism among the selected Igala dialects. One-way analysis ofvariance (ANOVA) was used to evaluate difference in anthropometric variables according to pubertal categories. $P<0.05$ was deemed significant and SPSS (statistical package for social sciences) version 20(IBM, New York) was used for the statistical analyses.

CHAPTER FOUR

4.0RESULTS

4.1Study Population

A total of 602 secondary school subjects participated in this study (n= 602) involving males and females from selected dialects of Igala ethnic group in Kogi State. The age range was between 13 to 19 years of age with the mean and standard deviation of16.65± 1.75 years. (Table 4.1)

4.2 Anthropometric Variables with Sex

Data was collected from secondary school students using a pre-designed questionnaire. Descriptive statistics of the entire sample population is shown on Table 4.1, the minimum age of subjects in this study is 13 years while the maximum age is 19 years. The results revealed that sex is significantly related to anthropometric parameters. The females showed higher mean values for height, weight and BMI which were statistically significant ($P<0.05$). Females have higher right and left 2D:4D as compared to males, the right 2D:4D was higher than the left 2D:4D in both males and females. The right and left ATD angles were higher in females than in males, with the right ATD been higher than the left ATD in both males and females. This was statistically significant ($P<0.05$).

Table 4.2 shows the association between print pattern right fingers and sex. The table revealed that males have higher occurrence of arch for the I, II, and V right digits while females had more occurrence of arch for the II and IV right digits. Females have more occurrence of loop for the I, II and V right digits while males had higher occurrence of loop for the III and IV right digits, Females have the higher occurrence for whorl in all digits except the III right digit. There was statistical significance for the II, III and V right digits ($P<0.05$).

Table 4.1: Descriptive statistics and T-test of variables in overall population

Variables	All (n=602)		Male(n=280)		Female (n=322)		t	P
	Mean±SD	Min–Max	Mean±SD	Min–Max	Mean±SD	Min–Max		
Age(years)	16.65±1.75	13.00-19.00	16.64±1.63	13.00-19.00	16.67±1.85	13.00-23.00	0.15	0.879
Height(cm)	149.616±10.38	120.0-175.0	146.72±11.85	120.0-175.0	152.13±8.13	125.00-75.0	6.61	0.001
Weight(kg)	50.47±8.05	26.0-89.0	46.58±7.23	26.0-70.0	53.85±7.17	29.00-89.00	12.36	0.001
Bodymassindex (kg/m²)	22.61±3.58	12.80-8.90	21.74±3.38	12.8-38.9	23.37±3.58	13.00-7.00	5.71	0.001
Rightseconddigit(cm)	6.46±0.92	5.00-8.80	5.85±0.73	5.00-7.70	6.99±0.72	5.00-8.80	19.31	0.001
Rightfourthdigit(cm)	6.64±0.68	5.00-8.60	6.34±0.68	5.00-8.00	6.91±0.55	5.60-8.60	11.38	0.001
Right2D4Dratio	0.97±0.08	0.85-1.30	0.92±0.04	0.85-1.05	1.01±0.08	0.86-1.30	17.44	0.001
Leftseconddigit(cm)	6.34±0.85	5.00-8.20	5.81±0.74	5.00-8.20	6.79±0.65	5.00-8.00	17.31	0.001
Leftfourthdigit(cm)	6.68±0.67	0.72-8.50	6.44±0.64	5.10-8.50	6.89±0.63	0.72-8.50	8.54	0.001
Left2D4Dratio	0.94±0.07	0.77-0.97	0.90±0.04	0.80-1.00	0.97±0.06	0.77-0.97	17.56	0.001
RightATDangle(º)	46.70±8.36	32.00-7.00	45.24±8.04	35.00-66.00	45.49±8.02	35.00-66.00	-9.51	0.001
LeftATDangle(º)	44.11±8.018	21.00-3.00	42.76±7.72	32.00-62.00	42. 998±7.6	32.00-62.00	-10.1	0.001

Table 4.2: Association between print pattern of right fingersand sex (n=602)

Patterns	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**
	I n(%)		**II n(%)**		**III n(%)**		**IV n(%)**		**V n(%)**	
Arch	224(69)	212 (76)	194(60)	222(79)	121(38)	98(35)	225(70)	83(30)	212(66)	225(80)
Loop	67(21)	47(17)	93(29)	37(13)	192(60)	172(61)	77(24)	160(57)	65(20)	46(16)
Whorl	31(10)	21(8)	35(11)	21(8)	9(3)	10(4)	20(6)	37(13)	45(14)	9(3)
$\chi 2$	3.151		26.707		0.640		97.148		24.830	
P- value	0.207		0.001		0.726		0.001		0.001	

Key: I- Right hand thumb, II- Righthand 2nd digit, III-Right hand 3rd digit, IV-Right hand 4th digit, V-Right hand 5th digit χ^2-Chi-square F-Female (322)M- Male (280)

Table 4.3 shows the association between print pattern left fingers of males and females. The result revealed that males have higher occurrence of arch for all fingers on the left except the index finger, females have higher occurrence for loop for all fingers except the left thumb. Females also showed higher occurrence of whorl finger print patterns in all fingers except the left ring finger, and there was statistically significant difference for II, III, IV and V fingers($P = 0.001$) except for the left thumb where $P= 0.155$.

Table 4.4 shows the association between print pattern of theright fingers and palmer hyperhidrosis in females. The result revealed that females with palmer hyperhidrosis have higher occurrence of arch for the II, III, and IV digits while females without palmer hyperhidrosis have higher occurrence of arch for the I and IV digit. Females without palmer hyperhidrosis have higher occurrence of loop for all digits except the thumb and little fingers. Females with palmer hyperhidrosis have higher occurrence of whorl finger print pattern on the I and V digits while females without palmer hyperhidrosis have higher occurrence of whorl for the III and IV digits. There was statistical significant for the III, IV and V fingers ($P<0.05$)

Table 4.5 shows the association between the print patternof the left fingers with palmer hyperhidrosis in females. The result revealed that most of the females without palmer hyperhidrosis have higher arch finger print pattern for I, IV and V digits while females with palmer hyperhidrosis have higher occurrence of arch for II, and III. Females with palmer hyperhidrosis havehigher occurrence of loop finger print pattern for the II, IV and V digits while females without palmer hyperhidrosis have higher occurrence of loop for the I and III. Whorl finger print pattern have higher occurrence in females with palmer hyperhidrosis for the I and III digits while it was higher in females without palmer hyperhidrosisfor the II and IV digits. There was statistical significant for the I and II fingers ($P<0.05$).

Table 4.3: Association between print pattern of left fingers and sex (n=602)

Patterns	F	M	F	M	F	M	F	M	F	M
	I n (%)		II n (%)		III n (%)		IV n (%)		V n (%)	
Arch	246 (76)	225(80)	225 (70)	146(52)	72(22)	118(52)	44 (14)	69 (25)	225 (70)	241 (86)
Loop	38(12)	35 (13)	46 (14)	21(8)	194(60)	145 (6)	195 (61)	109 (39)	79 (25)	31 (11)
Whorl	38(12)	20 (7)	51 (16)	113(4)	56(17)	17 (6)	83 (26)	102 (36)	18 (6)	8 (3)
$\chi 2$	3.734		46.89		36.30		29.02		22.52	
P-value	0.155		0.001		0.001		0.001		0.001	

Key: I-Left hand- thumb, II-Left hand-2nd digit, III- Lefthand 3rd digit, IV- Left hand 4th digit V-Left hand 5th digit χ^2= Chi-square F- Female (322) M- Male (280)

Table 4.4Association between print pattern of right fingers and palmer hyperhidrosis in females (n=322)

Patterns	ABS I n (%)	PRS	ABS II n (%)	PRS	ABS III n (%)	PRS	ABS IV n (%)	PRS	ABS V n (%)	PRS
Arch	257(74)	179(70)	231(67)	185(73)	158(46)	150(59)	158(46)	150(59)	273(79)	164(64)
Loop	63(18)	51(20)	84(24)	46(18)	154(44)	83(33)	154(44)	83(33)	60(17)	51(20)
Whorl	27(8)	25(10)	32(9)	24(9)	35(10)	22(8)	35(10)	22(8)	14(4)	40(16)
$\chi 2$	1.03			3.36	10.63		10.63		27.00	
P-value	0.598			0.187	0.005		0.005		0.001	

Key: I- Right hand-thumb, II-Right hand 2nd digit, III-Right hand 3rd digit, IV-Right hand 4th digit, V-Right hand 5th digit χ^2= Chi-SquareABS- Absent PRS- Present

Table 4.5:Association betweenprint patternsofleft fingersand palmer hyperhidrosis in females (n=322)

Patterns	ABS	PRS	ABS	PRS	ABS	PRS	ABS	PRS	ABS	PRS
	I n (%)		II n (%)		III n (%)		IV n (%)		V n (%)	
Arch	273(79)	198(78)	197(57)	174(68)	90(26)	100(39)	70(20)	43(17)	271(78)	195(77)
Loop	44(13)	29(11)	27(8))	40(16)	231(67)	108(43)	166(48)	138(54)	62(18)	48(19)
Whorl	30(8)	28(11)	123(35)	41(16)	26(7)	47(18)	111(32)	74(29)	14(4)	12(4)
$\chi 2$		1.06	31.63			38.02		2.43		0.28
P-value		0.59	0.001			0.001		0.297		0.871

Key: I.- Left hand thumb, II-Left hand 2nd digit, III- Lefthand 3rd digit, IV- Left hand 4th digit, V-Left hand 5th digit , χ^2=Chi-square

ABS- Absent PRS- Present

Table 4.6: shows the association between print pattern of right fingers and hirsutism in female subjects. The results revealed that females with severe hirsutism have of the highest occurrence of arch, follow by females with mild hirsutismwhile females with normal hair growth have the least occurrence of arch. Females with severe hirsutism have the highest occurrence of loop finger print pattern, follow by those with normal hair growth while those with mild hirsutism have the least occurrence of loop. Whorl finger print pattern was more in females with mild hirsutism while those with severe hirsutism have the least occurrence. The association was statistically significant for the right thumb, index, middle and ring fingers ($P<0.05$).

Table 4.7 shows the association between print pattern of left fingers and hirsutism in female subjects. The result revealed that females with severe hirsutism have the highest occurrence of arch, follow by females with normal hair growth, while females with mild hirsutism have the least. Loop finger print pattern have more occurrence in females with severe hirsutism and was least in females with normal hair growth. Females with mild hirsutism have the highest occurrence of whorl finger print pattern, followed by females with severe hirsutism, while females with normal hair growth have the least occcurrence of the whorl finger print pattern. The association was statistically significant for all fingers ($P< 0.05$)

Table 4.6 Association between print pattern of right fingers and hirsutism in females(n=322)

Patterns	**NH**	**MH**	**SH**	**NH**	**MH**	**SH**	**NH**	**MH**	**SH**	**NH**	**MH**	**SH**	**NH**	**MH**	**SH**
	I			**II**			**III**			**IV**			**V**		
	n (%)			**n (%)**			**n (%)**			**n (%)**			**n (%)**		
Arch	155(68)	24(59)	44(82)	152(67)	26(63)	16(30)	95(42)	25(61)	13(24)	91(40)	20(49)	45(83)	149(66)	28(68)	44(82)
Loop	49(22)	7(17)	9 (16)	46(20)	9(22)	38(70)	118(52)	11(27)	41(76)	100(44)	10(24)	7(13)	50(22)	9(22)	9(17)
Whorl	23(10)	10(24)	1(2)	29(13)	6(15)	0(0)	14(6)	5(12)	0(0)	36(16)	11(27)	2(54)	28(12)	4(10)	1(1)
χ^2	13.97			56.03			24.44			38.69			6.89		
P-value	0.007			0.001			0.001			0.001			0.142		

χ^2=Chi-square NH= Normal hair growth MH= Mild hirsutism SH= Severe hirsutism

Table 4.7 Association between print pattern of left finger and hirsutism in female (n=322)

Patterns	NH	MH	SH	NH	MH	SH	NH	MH	SH	NH	MH	SH	NH	MH	SH
		I			II			III			IV			V	
	n (%)			n (%)			n (%)			n (%)			n (%)		
Arch	123(54)	19(46)	41(76)	77(34)	14(34)	14(26)	77(34)	14(34)	14(26)	58(26)	10(24)	11(20)	171(75)	21(51)	42(78)
Loop	29(13)	10(24)	6 (11)	112(49)	15(37)	39(72)	112(49)	15(37)	39(72)	89(39)	19(46)	41(76)	40 (18)	12(29)	10(19)
Whorl	75(33)	12(30)	7(13)	38(17)	12(29)	1(2)	38(17)	12(29)	1(2)	80(35)	12(30)	2(4)	16 (7)	8 (20)	2(3)
χ^2		14.29			18.82			18.82			28.05			13.69	
P-value		0.006			0.001			0.001			0.001			0.008	

χ^2=Chi-square NH= Normal hair growth MH= Mild hirsutism SH= Severe hirsutism

Table 4.8 shows the distribution of hirsutism in the different dialects of Igala ethnic group. The result revealed that females from Omala have the highest occurrence of hirsutism (50%), while females from Igalamela havethe least occurrence of hirsutism (17%). The association was statistically significant (P=0.037).

Table 4.9 shows the distribution of palmer hyperhidrosis in the entire population. The result revealed that subjects from Idah have the highest incidence of palmer hyperhidrosis (48%) while those from Ofu (33%) have the lowest occurrence of palmer hyperhidrosis. The association was not statistically significant (P= 0.827)

Table 4.8: Distribution of hirsutism according to dialects (n= 322)

Parameter	D n(%)	OF n(%)	OL n(%)	IB n(%)	OM n(%)	AN n(%)	IG n(%)	ID n(%)	$\chi 2$	P
SH	16(11)	3(10)	3(14)	13(27)	6(27)	3(16)	2(11)	7(30)	27.447	0.037
MH	14 (9)	6(21)	3(14)	6(13)	5(23)	4(22)	1(6)	2(9)		
NH	114(79)	19(69)	15.00	28(60)	11(50)	11 (61)	15(83)	14 (61)		

χ^2-Chi- square SH- Severe hirsutism MH- Mild hirsutism NH- Normal hair growth D- Dekina OF- Ofu OL- Olamaboro IB- Ibaji OM- Omala AN- Anpka IG- Igalamela ID- Idah

Table 4.9 Distribution of hyperhidrosis according to dialects (n= 602)

Parameter	D	OF	OL	IB	OM	AN	IG	ID	$\chi 2$	P
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)		
ABS	80 (56)	19(67)	14 (66)	31(66)	13(59)	10 (56)	11(64)	12 (52)	4.322	0.827
PRS	64 (44)	9 (33)	7(34)	16(34)	9 (41)	8 (44)	7(36)	11 (48)		

ABS- Absent PRS- Present

Table 4.10 shows theassociation between print patternof right fingers with palmerhyperhidrosis in the overall population. The result revealed that the subjects without palmer hyperhidrosis have higher occurrence of arch finger print pattern for all the fingers except the little finger. Females without palmer hyperhidrosis have higher occurrence of loop finger print pattern for all fingers except the little finger, whorl finger print pattern was higher in subjects without palmer hyperhidrosis than in those with palmer hyperhidrosis. The association was statistically significant for right middle, ring and little fingers ($P< 0.05$), but was not statistically significant for right thumb and index ($P= 0.187$) respectively.

Table 4.11 shows the association of print pattern of left fingers with palmer hyperhidrosis in the overall population. The result revealed that the subjects without palmer hyperhidrosis have higher occurrence of arch finger print pattern for the I, IV and V fingers, while females with palmer hyperhidrosis have higher occurrence of arch for the II and III fingers. The loop finger print pattern was higher in subjects with palmer hyperhidrosis for the II, IV and V fingers, while subjects without palmer hyperhidrosis the association was statistically significant for left index and middle finger ($p< 0.05$), but was not statistically significant for left thumb, ring and little finger ($P> 0.05$). The result also revealed that subjects with palmer hyperhidrosis had higher arch for the left middle finger, and higher loop for the index finger than those subjects without palmer hyperhidrosis. The association was statistically significant ($P< 0.05$)

Table 4.10: Association between print pattern ofright fingers and palmar hyperhidrosis (overall n=602)

Patterns	**ABS**	**PRS**	**ABS**	**PRS**	**ABS**	**PRS**	**ABS**	**PRS**	**ABS**	**PRS**
	I n (%)		**II n (%)**		**III n (%)**		**IV n (%)**		**V n (%)**	
Arch	231(67)	185(73)	231(67)	185(73)	93(27)	126 (49)	158(46)	150(59)	273(79)	164(64)
Loop	84(24)	46(18)	84(24)	46(18)	241(69)	123(48)	154(44)	83(33)	60(17)	51(20)
Whorl	32(9)	24(9)	32(9)	24(9)	13(4)	6(2)	35(10)	22(8)	14(4)	40(16)
X2	3.356		3.356		32.504		10.631		27.007	
P-value	0.187		0.187		0.001		0.005		0.001	

ABS= Absent PRS= Present χ^2= Chi- square

Table 4.11: Association between print pattern of left fingers and palmar hyperhidrosis (overall n=602)

Variables	ABS	PRS	ABS	PRS	ABS	PRS	ABS	PRS	ABS	PRS
	I n (%)		II n (%)		III n (%)		IV n (%)		V n (%)	
Arch	273(79)	198(78)	197(57)	174(68)	90(26)	100(39)	70(20)	43(17)	271(78)	195(76)
Loop	44(13)	29(11)	27(8)	40(16)	231(67)	108(42)	166(48)	138(54)	62(18)	48(19)
Whorl	30(9)	28(11)	123(35)	41(16)	26(8)	47(18)	111(32)	74(29)	14(4)	12(5)
$\chi 2$	1.06		31.63		38.02		2.43		0.28	
P	0.589		0.001		0.001		0.297		0.871	

ABS= Absent PRS= Present χ^2 = Chi- square

Table 4.12 shows the comparison of anthropometric and dermatoglyphic variables according to the different hair growth pattern. The result revealed that female with normal hair growth had a higher mean value for most of the parameters as compared to those with mild and severe hirsutism. The difference was statistically significant height, left 2D, left 4D, right ATD angle and left ATD angle ($p<0.05$), but was not statistically significant for age, weight, right 2D, right 4D and right 2D:4D. The result also revealed that subjects with severe hirsutism have lower mean value for weight and BMI as compared to those with normal hair growth and mild hirsutism.

Table 4.13 shows the comparison of anthropometric and dermatoglyphic variables accordingtobirth order in overall population. The result revealed that the subjects with 2^{nd} birth order had a higher mean value for most of the parameters such as R2D, R4D, L2D and L4Das compared to 1^{st}, 3^{rd} and 4^{th} born. The association was statistically significant ($p < 0.05$). The result also revealed that 3^{rd} born had higher height as compared to 1^{st}, 2^{nd} and 4^{th} born, the association was statistically significant ($p=0.001$).

Table 4.12: Comparison of anthropometric and dermatoglyphic variables according to the different hair growth pattern (n=322)

Variables	NH(n=227) Mean± SD	MH(n=41) Mean± SD	SH(n=54) Mean± SD	F	P-value
Age (years)	16.74± 1.83	16.46±1.75	16.48± 1.98	0.719	0.488
Height (cm)	153.[1]4± 8.00	150.17±8.57	149.83±7.72	4.873	0.008
Weight (kg)	54.25± 7.14	52.70±7.42	53.02± 7.08	1.246	0.289
BMI (kg/m²)	23.26± 3.55	23.41±3.54	23.77± 3.78	0.454	0.636
R2D (cm)	7.03± 0.72	7.01± 0.75	6.83± 0.71	1.683	0.188
R4D (cm)	6.91± 0.56	6.95± 0.56	6.87± 0.53	0.253	0.777
R2D:4D	1.02± 0.09	1.01± 0.08	0.99± 0.05	2.269	0.105
L2D (cm)	6.85± 0.66	6.70±0.65	6.62± 0.58	3.041	0.049
L4D (cm)	6.96± 0.43	6.69±0.96	6.87± 0.42	4.665	0.010
L2D:4D	0.98± 0.08	1.13±0.98	0.96±0.05	3.255	0.040
RATD ANG (º)	46.99± 8.15	45.39 ±6.21	39.28 ±5.34	22.911	0.001
LATD ANG (º)	44.48± 7.69	42.81±6.65	36.83±5.51	24.727	0.001

HT=height, WT= weight, BMI=body mass index, R2D:4D= right 2nd digit to 4th digit ratio, L2D:4D=left 2nd digit to 4th digit ratio, RATD= right atd angle, LATD= left atd angle NH- normal hair growth MH-mild hirsutism SH- severe hirsutism

Table 4.13: Comparison of anthropometric and dermatoglyphic variables according to birth order in overall (n=602)

Variables	1st (n=133) Mean± SD	2nd (n=159) Mean± SD	3rd (n=54) Mean± SD	4th (n=256)	F	P
Age (years)	15.95± 1.67	17.28±2.03	16.61± 1.58	16.64± 1.48	15.121	<0.001
Height (cm)	147.60±10.28	151.79±9.05	153.15±10.29	148.57±10.84	7.153	<0.001
Weight(kg)	48.96± 6.73	54.36± 9.133	51.37± 7.64	48.66± 7.18	20.352	<0.001
BMI(kg/m²)	22.61± 3.62	23.56± 3.73	22.05± 4.06	22.14± 3.24	5.761	<0.001
R2D (cm)	6.32± 0.77	7.04± 0.87	6.43± 0.84	6.18± 0.89	35.493	<0.001
R4D (cm)	6.64± 0.69	6.87±0.56	6.60± 0.64	6.52± 0.71	9.051	<0.001
R2D:4D	0.95± 0.05	1.02± 0.10	0.97±0.06	0.94± 0.06	43.726	<0.001
L2D (cm)	6.23± 0.66	6.79± 0.79	6.39± 0.84	6.10± 0.86	25.682	<0.001
L4D (cm)	6.68± 0.52	6.823± 0.80	6.74± 0.62	6.58± 0.66	4.572	<0.001
L2D:4D	0.93± 0.05	0.97± 0.08	0.95± 0.06	0.92± 0.06	24.671	<0.001
RATDANG(º)	53.38± 8.71	43.05± 8.71	44.04± 5.41	46.07± 6.52	50.862	<0.001
LATDANG(º)	50.50± 8.22	40.13± 8.18	41.74± 5.42	43.77± 6.04	54.373	<0.001

HT=height, WT= weight, BMI=body mass index, R2D:4D= right 2nd digit to 4th digit ratio, L2D:4D=left 2nd digit to 4th digit ratio, RATD= right atd angle, LATD= left atd angle

Table 4.14 shows the association between palmer hyperhidrosis and other parameters in male. The result revealed that subjects with palmer hyperhidrosis had higher mean value for most of the parameters. The difference was statistically significant for right atd angle, but was not statistically significant for age, weight, right 2D:4D, left 2D:4D and left ATD angle. The result also revealed that subjects without palmer hyperhidrosis had higher mean value for BMI, R4and L4D, and the difference was not statistically significant.

Table 4.15 shows the association between print pattern of the right fingers and palmer hyperhidrosis in males. The result revealed that male subjects with palmer hyperhidrosis have higher occurrence of arch for all fingers except the little finger, loop finger print pattern was higher in males with palmer hyperhidrosis for theI, II and V fingers while those without palmer hyperhidrosis have higher occurrence of loop for the III and IV fingers. Males without palmer hyperhidrosis have higher occurrence of whorl as compared to those with palmer hyperhidrosis. There was statistically significant for the middle finger ($P< 0.05$).

Table 4.16 shows the association between left finger print patterns and palmer hyperhidrosis in males. The result revealed that male subjectswith palmer hyperhidrosis have more arch finger print pattern for all fingers. Loop finger print pattern was higher in subjects with palmer hyperhidrosis for the I, II and IV fingers, while those without palmer hyperhidrosis had higher loop for the II and V fingers. Males without palmer hyperhidrosis had higher occurrence of whorl for the I, II and IV fingers while those with palmer hyperhidrosis had more occurrence of whorl for the III and V fingers. The difference was statistically significant for the left index and middle fingers ($P<0.05$) but was not statistically significant for the left thumb, ring and little fingers ($P>0.05$).

Table 4.14: Association between palmer hyperhidrosis and other parameters in males (n=280)

Variables	Absent (n=166) Mean± SD	Present (n=114) Mean± SD	T	P
Age (years)	16.64± 1.66	16.65± 1.59	-0.0532	0.958
Height (cm)	145.71± 11.48	148.20±12.26	-1.739	0.083
Weight (kg)	46.42± 6.68	46.82± 7.96	-0.463	0.644
BMI (kg/m²)	21.94± 3.01	21.44± 3.85	1.227	0.221
Right 2D (cm)	5.87± 0.76	5.81± 0.69	0.674	0.501
Right 4D (cm)	6.38± 0.70	6.28± 0.64	1.140	0.255
Right 2D:4D	0.92± 0.04	0.92± 0.04	-0.929	0.354
Left 2D (cm)	5.85± 0.74	5.76± 0.73	0.986	0.088
Left 4D (cm)	6.48± 0.65	6.38± 0.63	1.305	0.193
Left 2D:4D	0.80± 0.04	0.90± 0.04	0.060	0.953
Right ATD ANG (º)	44.42± 8.10	46.45± 7.84	-2.089	0.038
Left ATD ANG (º)	42.10± 7.89	43.71± 7.39	-1.719	0.087

HT=height, WT= weight, BMI=body mass index, 2D= Second digit length R2D:4D= right 2nd digit to 4th digit ratio, L2D:4D=left 2nd digit to 4th digit ratio, RATD= right atd angle, LATD= left atd angle

Table 4.15: Association between right finger print patterns and palmer hyperhidrosis in males (n=280)

Patterns	**ABS**	**PRS**	**ABS**	**PRS**	**ABS**	**PRS**	**ABS**	**PRS**	**ABS**	**PRS**
	I n (%)		**II n (%)**		**III n (%)**		**IV n (%)**		**V n (%)**	
Arch	112(67)	78(68)	95(57)	68(60)	63(38)	60(53)	76(46)	56(49)	116(70)	73(64)
Loop	34(21)	24 (21)	46(28)	37(33)	90(54)	48(42)	60(36)	40(35)	36(22)	26(23)
Whorl	20(12)	12(11)	25(11)	9(7)	13(8)	6(5)	30 (18)	18(16)	14(8)	15(13)
$\chi 2$	0.157		3.439		5.984		0.386		1.837	
P	0.925		0.179		0.005		0.824		0.399	

ABS= Absent PRS= Present χ^2= Chi-square

Table 4.16: Association of left finger print patterns and palmer hyperhidrosis in males (n=280)

Patterns	ABS	PRS	ABS	PRS	ABS	PRS	ABS	PRS	ABS	PRS
	I		II		III		IV		V	
	n (%)		n (%)		n (%)		n (%)		n (%)	
Arch	118(71)	84(74)	87(52)	67(59)	48(29)	51(45)	42(25)	32(28)	111(67)	85(75)
Loop	25(15)	19(17)	20(12)	24(21)	92(55)	42(37)	71(43)	54(47)	41(25)	17(15)
Whorl	23(14)	11(10)	59(36)	23(20)	26(16)	21(18)	53(32)	28(25)	14(8)	12(10)
$\chi 2$	1.159		9.434		9.966		1.784		4.015	
P	0.560		0.009		0.007		0.410		0.134	

ABS= Absent PRS= Present χ^2 = Chi-square

Table 4.17:Shows comparison of anthropometric and dermatoglyphic variables according to birth order in males. The result revealed that first born had higher mean values for BMI and right 2D:4D, the difference was not statistically significant (P>0.05). The result also showed that secondborn had higher mean values for height, R2D, R4D and L2D, the difference was statistically significant (P=0.001). The result further revealed that thirdborn had higher mean values for weight and right ATD angle, the difference was not statistically significant (P>0.05). While fourthborn had higher mean values for age and left ATD angle, and the difference wasnot statistically significant (P>0.05)

Table 4.17: Comparison of anthropometric and dermatoglyphic variables according to birth order in males (n=280)

Variables	1st (n=60) Mean± SD	2nd (n=50) Mean± SD	3rd (n=16) Mean± SD	4th(n=154) Mean±SD	F	P
Age (years)	16.35± 1.77	16.38±1.70	16.63± 1.86	16.84± 1.77	1.883	0.133
Height (cm)	145.93±12.06	146.54±10.65	157.63±11.27	145.96±11.73	5.036	0.002
Weight (kg)	47.15± 7.34	47.04± 5.86	48.36± 11.38	46.03± 7.06	0.818	0.485
BMI (kg/m²)	22.24± 3.67	21.84± 2.29	19.33± 3.35	21.84± 2.29	3.243	0.023
Right 2D (cm)	6.06± 0.88	6.20 ± 0.53	5.68± 0.73	5.67± 0.66	9.726	0.001
Right 4D (cm)	6.50± 0.86	6.70± 0.54	6.16± 0.61	6.18± 0.58	10.083	0.001
Right 2D:4D	0.93± 0.03	0.93± 0.03	0.92± 0.03	0.92± 0.04	2.646	0.049
Left 2D (cm)	6.01± 0.75	6.10± 0.56	5.79± 0.89	5.65± 0.73	6.861	0.001
Left 4D (cm)	6.57± 0.68	6.30± 0.61	6.44± 0.81	6.30± 0.60	6.773	0.001
Left 2D:4D	0.91± 0.03	0.90± 0.03	0.90± 0.04	0.89± 0.04	4.916	0.002
RATD ANG (º)	45.40± 8.74	44.42± 7.30	45.44± 9.32	45.43± 7.92	0.211	0.889
LATD ANG (º)	43.65± 8.34	41.84± 6.90	42.31± 9.04	43.14± 7.63	0.382	0.766

HT=height, WT= weight, BMI=body mass index, 2D= Second digit length R2D:4D= right 2nd digit to 4th digit ratio, L2D:4D=left 2nd digit to 4th digit ratio, RATD= right atd angle, LATD= left atd angle

Correlation matrix for anthropometric variables

Table 4.18 showed correlation matrix of the various parameters in males. The result revealed that age showed a strong significant correlation with weight and BMI, but also showed an inverse negative correlation with right 2D. Height showed a strong significant correlation with weight and a negative inverse correlation with right 4D. There was a strong significant correlation between weight and BMI. Right 2D:4D showed a significant strong correlation with left 2D:4D, there was a also a strong significant correlation between left 2D and left 4D. Left 2D:4D showed an inversely negative correlation with right ATD angle and left ATD angle, while right ATD angle showed the strongest significant correlation with left ATD angle.

Table 4.19 Shows the correlation matrix of various parameters in females. The result revealed that left ATD angle showed a strong significant correlation with right ATD angle, and also showed a weak positive correlation with age, height weight and BMI. Age showed a strong significant correlation with weight, followed by R2:4D, R2D and BMI. Height correlated weakly with eight of the parameters, but showed an inverse weak correlation with BMI and right ATD angle. Weight showed a significant strong correlation with BMI, and also showed an inverse correlation with L4D. Right 2D:4D showed a significant correlation with left 2D and an inverse negative correlation with left 4D.

Table 4.20 showed the overall correlation matrix for the studied subjects and their anthropometric characteristics. Pearson's correlation coefficient was used to correlate the parameters. Ninety-nine (99%) of the parameters correlated at $P < 0.01$, $P < 0.001$ and $P< 0.05$. Age showed an inverse and non-significant correlation right 4D and left 4D, age also correlated positively and strongly with height. Height showed a significant and strong correlation with weight followed by left 2D, left 2D:4D, left 4D and then right 2D:4D, height also showed an inverse weak correlation with right ATD, left ATD and BMI. Weight showed a strong positive correlation with BMI, right 2D:4D, L2D and R2D, but showed an inverse weak correlation with right ATD and left ATD. There was a strong and significant positive correlation between right 2D and right4D, followed by left 2D, and then right 2D:4D, but showed an

inverse weak correlation with right ATD angle and left ATD angle. Right 4D showed a positive and strong correlation with left 2D and left 4D, but showed an insignificant weak correlation with right ATD angle and left ATD angle. Right ATD angle and left ATD angle showed the strongest positive correlation ($r = 0.988$, $P < 0.001$)

4.18 Correlation matrix for male variables (n=280)

Pattern	AGE	HT	WT	BMI	R2D	R4D	R2D4D	L2D	L4D	L2D4D	RATD	LATD
AGE	___	0.057	0.187**	0.148*	-0.067	-0.057	-0.070	-0.197**	-0.161**	-0.247**	-0.013	-0.024
HT		___	0.569**	-0.505**	0.003	-0.021	0.017	0.243**	0.242**	0.164**	0.026	-0.032
WT			___	0.405**	0.405	0.014	-0.008	0.130*	0.131*	0.075	-0.037	-0.035
BMI				___	0.03**	0.040	-0.034	-0.134**	-0.131*	-0.104	-0.005	0.002
R2D					____	0.950**	0.530**	0.566**	0.531**	0.463**	-0.106	-0.127
R4D						____	0.249**	0.534**	0.539**	0.341**	-0.117	-0.141
R2D4D							____	0.33**	0.203**	0.537**	-0.005	-0.009
L2D								___	0.964**	0.751**	-0.049	-0.064
L4D									___	0.554**	-0.021	-0.036
L2D4D										___	-0.098	-0.111
RATD											___	0.983**
LATD												____

HT=height,WT=weight,BMI=bodymassindex,R2D:4D=right2nddigitto4thdigitratio,L2D:4D=left2nddigitto4thdigit ratio,RATD=rightATDangle,LATD=leftATDangle.**.Correlationissignificantatthe0.001level(2-tailed),*Correlationis significantatthe0.05level(2-tailed).

Table 4.19 Correlation matrix for female variables (n=322)

Pattern	AGE	HT	WT	BMI	R2D	R4D	R2D4D	L2D	L4D	L2D4D	RATD	LATD
AGE		0.09	0.44***	0.33***	0.39***	0.02	0.46***	0.35***	-0.0	0.014	0.067	0.072
HT			0.23***	-0.51**	0.25***	0.14*	0.19***	0.31***	0.124*	0.005	-0.014	0.003
WT				0.71***	0.41***	0.07	0.45***	0.36***	0.014	-0.011	0.026	0.031
BMI					0.18**	-0.05	0.26***	0.10	-0.073	0.008	0.022	0.014
R2D						0.64***	0.64**	0.78***	0.245***	-0.023	0.044	0.053
R4D								0.38***	0.323***	-0.031	-0.048	-0.039
R2D4D								0.62***	-0.008	0.001	0.111	0.115*
L2D									0.367***	-0.033	0.005	0.013
L4D										-0.034	0.025	0.028
L2D4D											0.038	-0.028
RATD												0.984***

HT=height, WT=weight, BMI=body mass index, R2D:4D=right 2nd digit to 4thdigit ratio, L2D:4D=left 2nd digit to 4th digi tratio, RATD=right ATD angle LATD=left ATD angle. ***.Correlation is significant at the 0.001level (2-tailed),**Correlation is significant at the 0.01leve l(2-tailed), *Correlation is significant at the 0.05level(2-tailed)

Table 4.20: Moment correlation for overall (n=602)

Variables	HT	WT	BMI	R2D	R4D	R2D4D	L2D	L4D	L2D4D	RATD	LATD
AGE	0.069	0.296***	0.245***	0.154***	-0.012	0.250***	0.079*	-0.073	0.139***	-0.442***	-0.446***
HT		0.473***	-0.409***	0.241***	0.147***	0.237***	0.360***	0.256***	0.293***	-0.272***	-0.280***
WT			0.597***	0.438***	0.223***	0.476***	0.439***	0.207***	0.425***	-0.378***	-0.391***
BMI				0.223***	0.093*	0.263***	0.123**	-0.015	0.167***	-0.138***	-0.142***
R2D					0.830***	0.726***	0.787***	0.486***	0.709***	-0.270***	-0.315***
R4D						0.230***	0.588***	0.510***	0.362***	-0.031	-0.067
R2D4D							0.660***	0.233***	0.790***	-0.403***	-0.438***
L2D								0.703***	0.827***	-0.320***	-0.358***
L4D									0.364***	-0.068	-0.092*
L2D4D										-0.386***	-0.419***
RATD											0.988***

HT=height, WT=weight, BMI=body mass index, R2D:4D=right 2nd digit to 4thdigit ratio, L2D:4D=left 2nd digit to 4 th digit tratio, RATD=right ATD angle LATD=left ATD angle. ***.Correlation is significant at the 0.001level (2-tailed),**Correlation is significant at the 0.01leve l(2-tailed), *Correlation is significant at the 0.05level(2-tailed)

Table 4.20 shows association between palmer hyperhidrosis and birth order in males. The result revealed that third born males had higher occurrence of palmer hyperhidrosis, while first born males had the lowest occurrence of palmer hyperhidrosis. The difference was not statistically significant (P= 0.533).

Table 4.21 shows association between finger print pattern and birth order in males. The result revealed that fourth born males had the highest occurrence of arch, while first born had the least occurrence of arch. Loop finger print pattern was higher in first and third born while whorl finger print pattern was had higher occurrence in fourth born males. The difference was not statistically significant (P= 0.840).

Table 4.21: Association between palmer hyperhidrosis and birth order in males (n=280)

Parameter	1st n (%)	2nd n (%)	3rd n (%)	4th n (%)	$\chi 2$	P
ABS	40(66)	28(56)	8(50)	90 (58)	2.195	0.533
PRS	20(34)	22(44)	8 (50)	64(42)		

χ^2 - Chi- square ABS- Absent PRS- Present

Table 4.22 Association between finger print pattern and birth order in males (n=280)

Parameter	1st n (%)	2nd n (%)	3rd n (%)	4th n (%)	χ2	*p*
Arch	39 (65)	33(66)	11(69)	107(69)	2.746	0.840
Loop	15(25)	12(24)	4(25)	27(18)		
Whorl	6(10)	5(10)	1(6)	20(13)		

χ^2 - Chi- square

Table 4.23 Shows comparison between males and females for ridge counts. The result revealed that the mean values for ridge counts were higher in males than in females for most for the fingers, and the difference was statistical significant for all the fingers except the right little, left thumb and left little finger. The result also revealed that the mean values for ridge counts for the right index and left little finger were higher in females as compared to male. It was not statistically significance.

4.23 Comparison between male and female for ridge count overall (602)

Variables	All (n=602) Mean ± SD	Min – Max	Male (n=280) Mean± SD	Female (n=322) Mean± SD	T	*p*
Right thumb count	5.49± 9.02	0.00-30.00	6.49±10.71	4.63±7.15	-2.537	0.011
Right index count	6.20± 9.24	0.00-28.00	5.58±10.03	6.72±8.47	1.509	0.132
Right Middle count	11.76± 9.63	0.00-26.00	14.36±10.87	9.50±7.76	-6.371	0.001
Right ring count	9.41± 9.81	0.00-25.00	15.22±9.89	4.35±6.333	-16..2	0.001
Right little count	3.80± 6.54	0.00-24.00	4.31± 8.07	3.35±4.78	-1.807	0.071
Left thumb count	4.37± 8.86	0.00-32.00	5.03±10.38	3.80±7.25	-1.708	0.088
Left index count	9.29± 11.81	0.00-30.00	13.35±13.81	5.77±8.28	-8.284	0.001
Left middle count	13.57± 9.87	0.00-28.00	14.77±12.27	12.53±7.02	-2.792	0.005
Left ring count	14.28± 8.11	0.00-27.00	16.24±9.81	12.58±5.76	-5.676	0.001
Left little count	3.29± 6.67	0.00-25.00	2.89±7.41	3.64±5.95	1.384	0.167

t- Independent student t-test

Figure 7 shows the comparison between right total ridge counts and left total ridge counts. The result revealed that mean value for the left total ridge counts was higher than the right total ridge count in both males and females. The difference was statistically significant (p=0.001)

Figure 8 shows the comparison of right and left total ridge counts with palmer hyperhidrosis. The result revealed that subjects without palmer hyperhidrosis had higher right and left total ridge counts as compare to those with palmer hyperhidrosis. The difference was statistically significant (p=0.001).

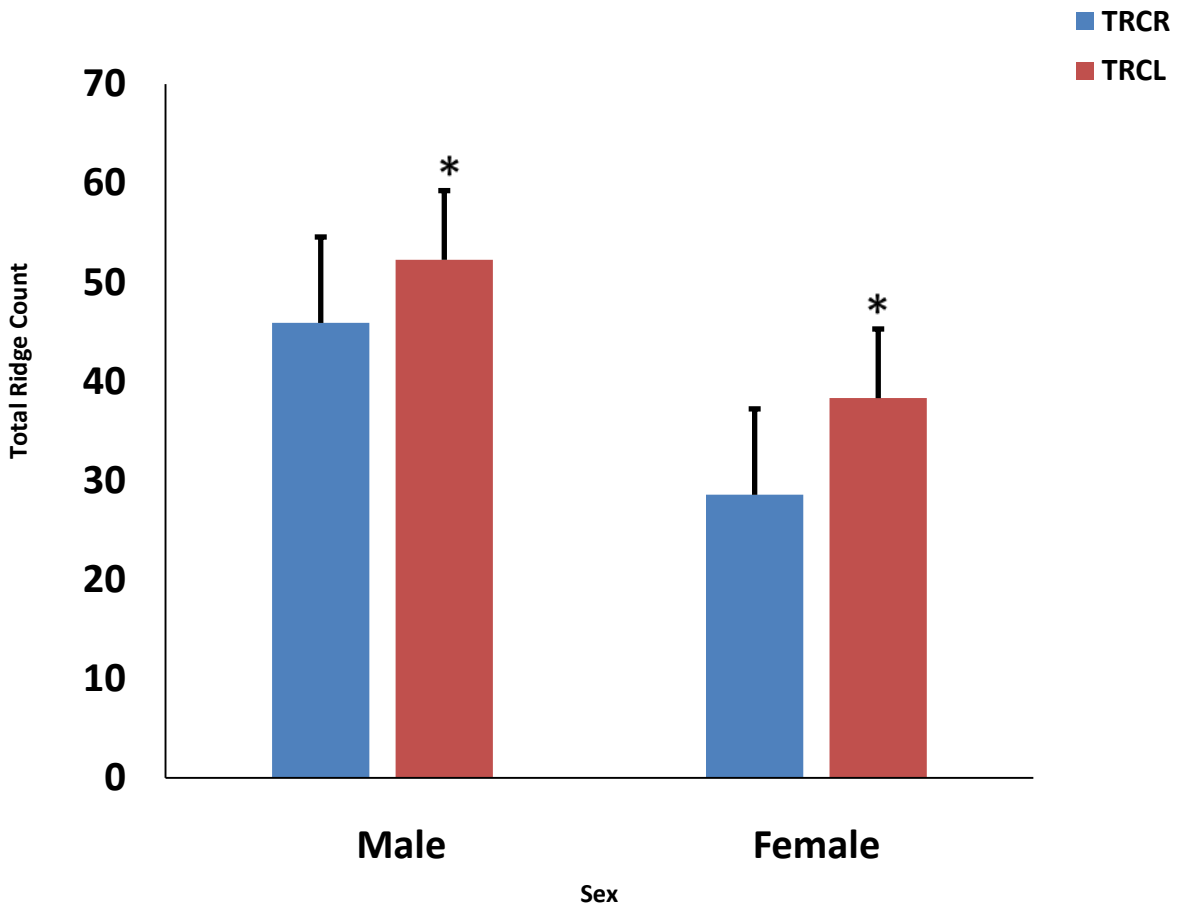
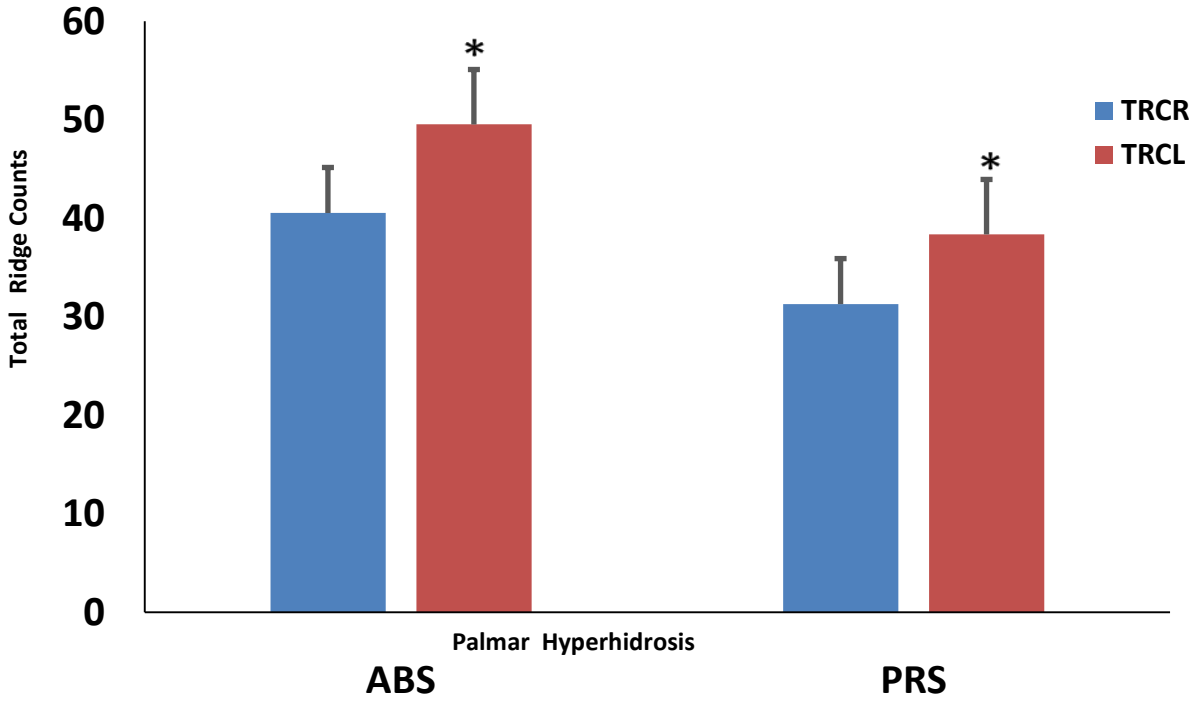


Figure 4.1: Right total ridge count and left total ridge count in male and female

TRCR- Right total ridge count TRCL- Left total ridge count



ABS- Absence of palmer hyperhidrosis, PRS- Presence of palmer hyperhidrosis TRCR- Right total ridge count TRCL- Left total ridge count

CHAPTER FIVE

5.0DISCUSSION

Finger and palm print patterns are important in the identification of individuals, it also has an increasing attention in medical practice (Yunyu *et al.*, 2002). Each individual possesses a unique ridge configuration which remains unchanged from womb to tomb, and this has been utilized as a means of personal identification (Fuller, 1973). Fluctuating asymmetry is an indicator of genetic and environmental stress, it can be assessed by variations in ridge patterns, ridge counts and ATD angle (Milne *et al.*, 2003; Graham *et al.*, 2010). 2D:4D a potential marker for androgen exposure shows sexual dimorphism, as it correlates negatively to testosterone and positively to estrogen in the foetus (Danborno *et al.*, 2010) Usually males have lower ratios as compared to females, and digit ratios have been reported to be associated with spatial skills, handedness, personalities and prevalence of obesity, autism, myopia, and depression (Bailey and Hurd, 2005; Rebecca and Benson, 2006; Mayhew *et al.*, 2007; Knickmeyer *et al.*, 2011; Saravanakumar and Prathibha, 2016). It is known that there are differences in 2D:4D between ethnic groups (Manning *et al.*, 2002; Manning *et al.*, 2004).

Hirsutism is an international issue and approximately 5% to 15% of women have been reported to be hirsutes (Azziz, 2003). Excess hair is an issue of concern for women and can have a significant effect on self-esteem and decreased quality of life (Himelein, 2006; Lapidoth *et al.*, 2010; Pate 2013). Palmer hyperhidrosis can result to an individual living in embarrassment, frustration, social withdrawal and low self-esteem (Leung, 1999; Freedberg *et al.*, 2003).

Result from this study showed that females presented a statistically significant higher mean values for height and BMI, this may be due to high level of adiposity in the females and high secretion of growth hormone at the adolescent age (Jackson *et al.,* 2002) and this is in agreement with the report of Encuesta Nacional de Salud (2003) among a population of Chile which showed that females had 27.8 kg/m^2 print while males had 24.3 kg/m^2 for body mass index. The result of the current study showed that arch finger pattern was the most prevalent (57%), followed by loops (31%) and whorl (12%). This is in agreement with the study of Igbigbi and Msamati (1999) to establish digital dermatoglyphic pattern of Malawians, the study revealed that arches were the most prominent finger print pattern in both sexes, followed by radial loop in males and whorls in females, but differs from the findings ofUjaddughe (2015) in their study of dermatoglyphic patterns and sex distribution in Esan ethnic group of Edo state, Nigeria and observed that the loop pattern had the highest frequency (61.7%) followed by whorl (24.9%) and then arch (12.8%). Males have higher occurrence of arch (58.5%) as compared to females (55.5%), females have higher occurrence of the loop (32.6%) as compared to males (28.7%) while whorl finger print pattern was higher in females (12.1%) than in males (9.2%). This is contrary to the findings Ekanem *et al*., (2008) in their study of the dermatoglyphic patterns of Annang ethnic group in Akwa Ibom state of Nigeria and they observed that the ulnar loops were the most predominant digital pattern in females (50.1 %) than in males (39.6 percent), followed by whorls (42.9 %) in males, then arches (31.1 percent) in females and radial loop (2.1 %) in males.

The study showed that female subjects with severe hirsutism had the highest occurrences of arch (50.6%) for the ten fingers, followed by females with normal hair growth while those with mild hirsutism had the lowest occurrence of arch (48.9%). Loop finger print pattern was higher in females with severe hirsutism (44.2%) bilaterally and least in those with mild hirsutism (28.5%). Females with mild hirsutism showed higher occurrences of whorl finger print pattern than those with severe hirsutism for the ten fingers. There is no present study showing the relationship between finger print patterns and hirsutism, as this is the first

of its kind.Females with severe hirsutism had the higher mean value for weight and BMI as compared to females with normal hair growth and mild hirsutism, this may be a sign of underlying metabolic disorder such as high blood pressure and waist circumference. High blood pressure or hypertension is a long term medical condition in which the blood pressure in the arteries is persistently elevated, which can be due to overweight or the absence of exercise which can lead to obesity (Campbell *et al.,*2015). Waist circumference is a measurement taken around the abdomen at the level of the umbilicus, it has been used to predict visceral fat(Sahar *et al.,*2015). Since both conditions are associated with accumulation offat (Sahar *et al.,*2015; Christian *et al.,* 2016)the high level of adiposity in this conditions is what brings about the increase in the weight and body mass index of females with hirsutismand this can lead to the greater risk of the development of cardiovascular disease and type -2 diabetes(Farahnaz *et al.,* 2012), this may be the reason while most of the females with severe hirsutism were showing masculine-like somatype.This is in line with the study of Abdul-Aziz *et al.,* (2015)in which there was a positive correlation between body mass index andhirsutism. The result from this study also revealed that females with mild

and severe hirsutism had lower mean values for right and left 2D:4D as compared to the non-hirsute females. This is due to the fact that hirsutism occurs due to testosterone in females and hence this gives the hirisute females a masculine type of 2D:4D, and is in agreement with the study of Maria *et al.,* (2010) in which their result showed a weak positive correlation between right and left 2D:4D and hirsutism. The high level of the testosterone in the hirsute females tends to reduce the length of their index finger giving them a lower 2D:4D (Danborno *etal.,* 2010; Ibegbu *et al.,* 2012).The mean values for right and left ATD angles were lowest in females with severe hirsutism as compared to that of females with normal hair growth and mild hirsutism, there is every likelihood that the high level of androgen in females with severe hirsutism tends to reduce the ATD angle as same scenario was observed in the male subjects (who normally have high level of androgen), their ATD angle were lower has compared to that of the females. Previous reports such as that of Jaja *et al*., (2008) and Adebanji *et al.,* (2014) have shown that the higher

the androgen level the lower the ATD angle using Nigerian subjects as a case study. A study conducted by Danborno *et al.,* (2007) to observe the distribution of hirsutism in various ethnic group in Nigeria, revealed that Igala subjects had the highest percent for hirsutism (100%), Igbo subjects (81%), Tiv (74%), Yoruba (52%) while the Hausa and Ebira subjects had the lowest (50%). Though the current study did not consider hirsutism in other ethnic group, but it can be deduced that the Igala female subjects have more of its prevalence, this may be as a result of hormonal factor, genetic factor or even environment. The present study have help to reveal the dialects amongst the Igala ethnic group that have the highest occurrence of hirsutism, it showed that females from Omala dialect had the highest prevalence of hirsutism while females from Igalamela had the lowest prevalence of hirsutism, hence females from the Omala dialect have high tendency of having deep voices, irregular menstruation, masculine-like somatotype and also infertility due to the high level of androgen in them. Thepresent studyalso revealed that female from Omala had more occurrence of mild hirsutism while those from Igamela had the lowest report of mild hirsutism, perhaps females from the Omala dialects have a genetic make up for rapid hair growth, this makes their hair follicles spend longer time in the anagen phase (rapid growth stage) of hair growth, which then give them more hair in androgen sensitive areas such as the face, the cheek and the chin.

The study showed that right 2D:4D and the left 2D:4D were significantly higher in females than in males this is due to the fact that the testosterone in males tends to reduce the length of the index finger in males giving them a lower 2D:4D, while the oestrogen in the females tends to enhance the length of the index finger, giving them higher 2D:4D. This is in line with the report of Danborno *et al* (2010) in their study to see the relationship between digit ratio and birth weight in Nigerians, and also the report of Ibegbu *etal.*, (2012) in their study to see the distribution of 2D:4D in the Ebira ethnic group of Nigeria. Both studies revealed that 2D:4D was higher in females as compared to males. Allison *et al.,* (2004) in their study to correlate 2D:4D with physical aggression in men but not in women, reported that males had lower digit ratio as compared with female, as digit ratio is negatively correlated to prenatal testosterone, but positively

to oestrogen exposure. Hence males usually have lesser digit ratio when compared to females (Manning 2002; Peters *et al.,* 2002; McFadden and Shubel, 2002, Bull and Benson, 2006). 2D:4D have been shown to correlate with various human traits, as lower 2D:4D showed a relationship with better arithmetic, visual and spatial skills (Luxen and Buunk, 2005) as such it can be deduced from this study that the male subjects have high tendency to perform better in mathematics and spatial ability as compared to female since males are associated with lower 2D:4D. Oyeyemi *et al.*,(2014) have reported that higher or feminine digit ratio personalities are at risk of having low sperm counts, increased risk of heart disease, obesity and metabolic syndrome, butmale subjects from the current study showed a lower and a masculine digit ratio and hence they are not at risk of coming up with low sperm counts, increased risk of heart disease, obesity and metabolic syndrome since the males didn't show a feminine type of 2D:4D.

This study also showed that the right and left ATD angles were higher in females as compared to males, this is in line with the study reported by Jaja *et al.*,(2008) in their study of the digital patterns of the Ijaws of south-south Nigerian, observed that females significantly had higher ATD angles than males. This is also in agreement with the study reported by Adebanji *et al.*,(2014) in their study of finger and palmar dermatoglyphics among the Yoruba in Jos, Nigeria. The study revealed that the mean ATD angle, right hand value (39.95^0) was higher than that of the left hand value (38.62^0).

The result of the study also showed that first born males had the highest BMI as compare to males with other birth order, and right and left ATD angles in male subjects had the highest mean value in fourth born. This is not in agreement with the report of Mukherjee (1990) in his study among 145 sibslings of Bengali speaking population and found that 47 coefficient of 47 dermatoglyphic traits varied widely with birth order, but ATD angle showed negligible correlation with birth order.

The studied population showed that subjects with palmar hyperhidrosis had more occurrence of arch (59.6%) while loop was higher in subjects without palmar hyperhidrosis (33.2%) and there was equal

occurrence for whorl in subjects with palmar hyperhidrosis (12.4%) and those without palmar hyperhidrosis (12.4%). Previous study has been conducted to see general assumption of psychological behavior based on finger print pattern (Kishore and Veer, 2012). Report have shown that individuals with more number of whorls tend to be independent and very individualistic, those with more number of loop tend to lack concentration and are emotionally responsive while those with more number of arches tends to be crude, insensitive hard hearted and defiantly stubborn (Campbell, 1998). Hence from the current study it can be deduced that subjects with palmar hyperhidrosis may tend to have a behavioral pattern that is associated with crudeness, stubbornness and strong heartedness, since they had more occurrence of arch finger print pattern. While subjects without palmar hyperhidrosis may have the tendency of been associated with behavioral pattern such as absent mindedness and emotional responsiveness, since they have more occurrence of the loop finger print pattern. Relating this behavioral pattern with sex, arch finger print pattern was higher in females with palmar hyperhidrosis (60.4%) as compared to males with palmar hyperhidrosis (57.5%), hence behavioral pattern of crudeness, stubbornness and strong heartedness would be higher in females with palmar hyperhidrosis as compared to males with palmar hyperhidrosis since they had higher occurrence of arch. Loop finger print pattern was higher in males without palmar hyperhidrosis (31.1%) as compared to females without palmar hyperhidrosis (30.1%) and with this it can be deduced that behavioral patterns such as absent mindedness and emotional responsiveness would be higher in males without palmar hyperhidrosis as compared to their female counter part. While the whorl finger print pattern was higher in males without palmar hyperhidrosis (16.7%) as compared to females without palmar hyperhidrosis (12.7%), hence behavioral traits such as the crave for independence and been individualistic would be higher in males without palmar hyperhidrosis as compared to their female counter part. There is presently no study to show relationship between palmar hyperhidrosis and finger print pattern as this is the first of it kind.

The current study revealed that male subjects with palmer hyperhidrosis had a higher mean value for weight as compared to those without palmer hyperhidrosis but tend to have a lower BMI. This contradicts the study of Fernado *et al.* (2011) who investigated the prevalence of hyperhidrosis among medical students which showed that there was a positive correlation between BMI and hyperhidrosis. Males with palmer hyperhidrosis also showed higher mean value for right and left ATD angles as compared with those without palmer hyperhidrosis, there is no present study to show such correlation.

The result of the current study also showed that subjects of the overall population from Idah had the highest incidence of palmer hyperhidrosis, while those from Ofu had the lowest occurrence of palmer hyperhidrosis. There is no present report on this, as this finding is the first of its kind. The study also revealed that fourth born and above subjects had the lowest weight as compared to subjects of other birth order, this contradicts the result of Howe *et al.,* (2014), which showed that first born had lower birth weight as compared to later born.

The Pearson's Moment correlation for the overall population for this study showed that age showed a strong positive correlation with height, that is the subjects tend to get taller as they increase in age. This may be due to the fact that the study population are still in their growth stage, as their growth plate still increases (Fox News Health, 2016). There was a positive correlation between age and weight and BMI, as the population tends to have increase in body calorie with age, this is in agreement with the study of Matthew *et al.,* (2016). The study also revealed a positive correlation between age and right 2D:4D and left 2D:4D, this is in agreement with the study of Williams *et al., (*2003).

The result revealed a negative correlation between age and right ATD angle and left ATD angle for the overall population. In other word ATD angles tends to decrease with age, this is because the palm grow much more in length than breadth (Penrose, 1954). There was also a strong positive correlation between

right 2D:4D and left 2D:4D, this is in agreement with the report of Gareth *et al* (2017), in which the study showed a strong correlation between right 2D:4D and left 2D:4D.

There was a positive correlation between height and weight for the overall population, this is in agreement with the study conducted by Matthew *et al.,* (2016) and also a negative correlation between height and BMI which is in line with the study of Diverse Population Collaborative Group (2005).The study also revealed a positive correlation between height and second digit length bilaterally, and also a positive correlation between height and fourth digit length on both right and left hand. This is in line with the study of Meera *et al.,* (2015). There was also a positive correlation between height and R2D:4D and L2D:4D, this contradicts the study of Meera *et al.,* (2015) to see cross sectional study of second to fourth digit ratio with physical attributes in south indian population, the result showed that there was no positive correlation between height and right and left 2D:4D. There was a negative correlation between right and left atd angles with weight and BMI, this contradicts the study of Nikha *et al.,* (2015) to see dermatoglyphic analysis of fingertip and palmer print patterns of obese children in India, their result showed that 29% of obese individual showed increase in ATD angle. The study showed that there was a strong positive correlation between age and height in the females, this is in agreement with the report by Markosyan and Arzumanyan (2017) in their study to see the age of menarche and related factor. It was observed from their study that age had a positive relationship with height, as height tends to increase until menarche.

The result of the study also showed a significant positive correlation between age and weight in females, this is in agreement with the Matthew *et al.,*(2016) to study body mass index relates weight to height differently in women and older adults in England, the result revealed an increase in weight with increase in age, as the female tends to secrete more estrogen with age and this brings about excessive fat tissue (Greenfield, 2012). There was a positive strong correlation between age and BMI in females, this is in line with the study of Matthew *et al.,*(2016) to study body mass index relates weight to height differently in women and older adults in England, the result revealed an increase in BMI with age, and they tend to

have increase in body calorie (Greenfield, 2012). The result of the current study showed that there was a significant strong positive correlation between age and right 2D:4D, age also showed a positive correlation with left 2D:4D. This is in agreement with previous study by Williams *et al.,* (2004) in which 2D:4D showed an association with age (McIntyre *et al.,* 2005; McIntyre *et al.,* 2006; Trivers *et al.,* 2006; Trivers *et al.,* 2013),this is also in line with the report of Robert *et al.,* (2005) in their study to see 2D:4D and other finger ratios in Jamaican children. They conducted the study in two phases, the first was done in 1998 where they measured and recorded the 2D:4D of the children, the second phase was conducted in 2002 using the same subjects. They measured and recorded their 2D:4D, but observed that the 2D:4D for 2002 was higher than that of 1999, this shows that 2D:4D have a positive correlation with age. The result of the study showed a positive correlation between height and weight in females, in other word the taller the females the weightier they become, this is in agreement with the report from Exemplar for Internal Assessment Resource (2017) to see if there is a relationship between the height in cm and the weight in kg for athletes in the data supplied from the Australian institute of sport, the result showed a strong correlation between height and weight, this may be because the taller an individual becomes, the person tends to have more muscle and larger bones (Exemplar for Internal Assessment Resource, 2017). There was a negative correlation between height and BMI, this is in line with the result of Diverse Population Collaborative Group (2005), their result also showed a negative correlation between height and BMI. This study also revealed a positive correlation between R2D:4D and height, weight and BMI in females, this is contrary with the study conducted by Meera *et al.,* (2015) to make a cross sectional study of second and fourth digit ratio with physical attributes in South Indian population, their result showed a negative correlation between R2D:4D and height, weight and BMI in females. The study also revealed that there was a significant positive correlation between right ATD angle and left ATD angle, this contradicts the result of Waseem and Vijay (2016) in their study there was no correlation between right and left ATD. The current study showed that the mean ridge count is significantly greater on each digit in males except for the right index and left little finger, and this is in agreement with the report by (Igbigbi

et al., 2018) which showed that males had a higher mean value of ridge count for most of the fingers than females. The mean ridge count on the left hand is significantly higher than that on the right hand in both sexes, this is contrary to the report by (Ezzat *et al.*, 2017) in which the mean ridge count for the right hand is significantly greater than that on the left hand in both sexes**.**

CHAPTER SIX

6.0 CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

Result obtained from the total sample of 602 participants showed that females have higher 2D:4D ratios in both right and left hands respectively.The study revealed that females had higher 2D:4D bilaterally as compared to males, the study also showed that there was a positive correlation between second and fourth digit length and height in males and females bilaterally. Arch was higher in males than in females, while loop and whorl finger print patterns were higher in females than in males, with third and fourth born having the highest prevalence of arch, while first and third born had the highest occurrence of loop. Whorl was more prevalent in fourth born.

The result from the study showed that females from Omaladialect had the highest prevalence of hirsutism. Palmer hyperhidrosis was most prevalent in subject from Idah dialect. The right and left ATD angles were higher in females than in males. It was also higher in non-hirsute females than hirsute females on both hands. First born subjects of the overall population had the highest right and left ATD angles as compare to others.

6.2 Recommendations

Based on the findings of the present study, the following recommendations are formulated.

i. Further studies should be conducted to observe genetic variation of the Igala ethnic group, as most of the parameters in this study are genetically determined.

ii. Studies should be conducted to see the prevalence of polycystic ovarian syndrome among the various Igala ethnic group, as it tends to be seen among hirsutes

6.3 Contribution to Knowledge

i. This study has been able to establish a relationship between finger print pattern and palmar hyperhidrosis with χ^2 of 3.356, 3.356, 32.504, 10.631, and 27.007 for the right fingers and 1.059, 31.627, 38.024, 2.427 and 0.277 for the left. (P< 0.001)

ii. This study has established a relationship between hirsutism and dialect in the Igala ethnic group as females from Omala had the highest occurrence (χ^2=27.447, P=0.037)

iii. The study established an association between palmar hyperhidrosis and right and left total ridge counts, TRCR had a mean value of 45.90±32.22 for males and 28.56±19.98 for females and TRCL had a mean value of 52.27±35.99 for males and 38.31±19.63 for females. (P<0.001)

iv. The study established a relationship between finger print pattern and hirsutism in females, with SH having the highest occurrence of arch, NH having the highest occurrence of loop and MH having the highest occurrence of whorl with χ^2 of 13.970, 56.032, 24.442, 38.67 and 6.894 for the right fingers and 14.294, 18.817,18.817, 28.052 and 13.692 for the left (P< 0.001)

v. The study established a relationship between fingerprint pattern and sex, with males having higher occurrence of arch (58.5%), females having higher occurrence of the loop (32.6%)and whorl finger print pattern was higher in females (12.1%) with χ^2 of 3.151, 26.707, 0.640, 97.148 and 24.830 for the right fingers and 3.734, 46.89, 36.30, 29.02 and 22.52 for the left fingers.

vi. The study also established a relationship between 2D:4D and sex, with females having higher 2D:4D than males with t-value of 17.44 for right and 17.56 for the left hand.

REFERENCES

Abdul-Aziz, A., Nayaf, M.S. and Mauloodd, K.J. (2015).The relationship of body mass index and hirsutism in adult females.*OurDermatologyOnline,*6(3):276-279

Abilasha, S., Harisudha, R. and Janaki, C.S (2015). Dermatoghlphics: A predictor tool to analyze the occurrence of breast cancer. *InternationalJournalof Medical ResearchandHealthScience,* 3 (1):28-31.

Adebanji, M.A., Linus, C.S., Gabriel, G.A., Linus, E.A. and Olusolade, F.S (2014). Finger and palmar dermatoglyphics study among the Yorubas in Jos, Nigeria. *Annalsof Bioanthropology,*2(2):49-53.

Akdogan, M., Tamer, M. and Cure, E. (2007).Effect of spearmint (MenthaspicataLabiatae) teas on androgen levels in women with hirsutism.*PhytotherapyResearch,* 21(5):444-447.

Alajlan, A., Shapiro, J., Rivers, J.K, *etal.*(2005) Paradoxical hypertrichosis after laser epilation.*Journal ofAmerican Academy of Dermatology*53(1):85-88.

Allison, A.B. and Peter, L.H (2004). Finger length ratio (2D:4D) correlates with physical aggression in men but not in women.*BiologicalPsychology,*10: 10-15.

Alsantali, A. and Shapiro, J. (2009).Management of hirsutism.*SkinTherapyLetter,* 218(3): 231-236.

American Society for Reproductive Medicine.(1944). Hirsutism & polycystic ovarian syndrome.*GuideforPatients,AmericanSociety,*2:1-3

Annupurna, V., Ahuja, Y. R, Reddy, G.D., Rao, V.S. and Rao, P.N (1978). Dermatoglyphics studies in rheumatic heart disease.*HumanHeredity,* 28:72-78.

Auger, J., Le Denmat, D., Berges, R., Doridot, l., Salmon, B. and Cavinen, L. (2013). Environmental levels of oestrogenic and antiandrogenic compounds feminize digit ratio in male rats and their unexposed male progeny. *ProceedingsofRoyal SocietyofLondon,* 280.

Austin, J., Manning, J.T., McInroy, K. and Mathews, E. (2002).A preliminary investigation of the associations between personality, cognitive ability and digit ratio.*PersonalityandIndividualDifferences,*33(7): 1115-1124

Araceli, R., Blanca, G., and Barbara, A. (2001). Drmatoglyphics and abnormal palmar flexion creases as markers of early prenatal stress in children with idiopathic intellectual disability. *Journal of Intellectual Disability Research,* 45 (5): 416-423.

Arokoya, B. (2012). A comparative phonology of the Olukumi, Igala, Owe and Yoruba Languages.*Comparison and Reconstruction,* 2 : 2-4

Arrieta, M., Martinez, B., Criado, B., Simon, A., Salazar, A. and Lostao, C. (1990).Dermatoglyphic analysis of autistic Basque children.*AmericanJournalof MedicalGenetics,*35: 1-9.

Avila, M.T., Sherr, J., Valentine, L.E., Blaxton, T.A. and Thaker, G.K (2003). Neurodevelopmental interactions conferring risk for schizophrenia: A study of dermatoglyphic markers in patients and relatives.*SchizophreniaBulletin*,29:595-605.

Azziz, R. (2003). The evaluationand management of hirsutism.*Obstetricsand Gynaecology*,101(5): 995-1007

Babler, W.J. (1991). Embryologic development of epidermal ridge and their configuration.*BirthDefectsOriginalArticleSeries*, 27 (2) 95 – 112.

Bailey, A.A. and Hurd, P.L. (2005). Finger length ratio predicts physical aggression in men not women.*BiologyPsychology*, 68:215-222.

Balgir, R.S. and Murthy, R.S. (1982). Dermatoglyphic studies in schizophrenia: A review. *IndianJournalofPsychiatary*, 24(3): 248-257.

Balgir, R.S. (1993). Dermatoglyphics in cleft lip and cleft palate anomalies.*Indian Paediatrics*,30:341-346

Bali, R.S. and Eswaraiah, G. (2005). Palmer flexion creases and dermatoglyphics among diabetic patients.*AmericanJournalofPhysicalAnthropology*,47(1):11-13

Barta, L., Regloy, M. and Kammerer, L.(1978). Dermatoglyphic features in diabetes mellitus.*ActsPaedAaacadScientiarumHungarica*,19: 31 – 34.

Barth, J.H., Catalan, J., Cherry, C.A. and Day, A. (1993). Psychological morbidity in women referred for treatment of hirsutism. *JournalofPsychosomatic Research*,37(6):615-619.

Benderlioglu, Z. and Nelson, R.J. (2004).Digits length ratios predicts reactive aggression in women but not in men.*HormonesandBehavior*, 46:558-564.

Berenbaum, S.A. and Reinisch, J.M. (1997). Early androgen effects on aggression in children and adults with congenital adrenal hyperplasia.*Psychoneuroendocrinology*,22, 505-515

Blume-Peytavi, U., Gieler, U., Hoffman, R. and Shapiro, J. (2007). Unwanted facial hair: affects, effects and solutions.*Dermatology*,215 (2):139-146

Bode, D., Seehusen, D. and Baird. (2012) Hirsutism in women.*American Family Physician*, 85(4)373-380

Bonnevie, K. (1924). Studies on papillary pattern of human fingers.*JournalofGenetics.* 15:1-11.

Bulent, O., Sheila, B., and Ricardo, A. (2010).Visually scoring hirsutism.*Human Reproduction Update*, 2: 2-3

Bull, R. and Benson, P.J. (2006). Digit ratio (2D:4D) and the spatial representation of magnitude.*HormonesandBehavior*,50(2): 194-199

Brodell, L.A., and Mercurio, M.G. (2010). Hirsutism: Diagnosis and management.*Gender Medicine,* 7: 79-89.

Brown, W.M., Hines, M., Fane, B.A. and Breedlove, S.M. (2002). Masculinized finger length patterns in human males and females with congenital adrenal hyperplasia.*HormonesandBehavior,*42: 380-386.

Campbell, E.D. (1998). Finger prints and palmar dermatoglyphics. (Online) Available: *http://www.edcampbell.com/PalmD-History.htm.*

Campbell, N.R., Lackland, D.T., Lisheng, L., Nilsson, P., and Zhang, X. (2015).Using the global burden of disease study to assist development of nation specific fact sheets to promote prevention and control of hypertension and reduction in dietary salt: a resource from the world hypertension league.*Journal of Clinical Hypertension,* 17(3):165-167.

Carmina, E., Koyama, T., Chang, L., Stanczyk, F. and Lobo, R.(1992).Doesethnicity

influence the prevalence of adrenal hyperandrogenism and insulin resistance inpolycystic ovary syndrome? *AmericanJournalof Obstetricand Gynecology,*167:1807-1812.

Cattrall, F.R., Vollenhoven, B.J. and Weston, G.C. (2005).Anatomical evidence for in utero androgen exposure in women with polycystic ovary syndrome.*FertilityandSterility, 84:1689-1692.*

Chia, H.Y., Tan, A.S., Chong, W.S. and Tey, H.L. (2012).Efficacy of iontophoresis with glycopyrronium bromide for treatment of primary palmar hyperhidrosis.*Journal ofEuropeanAcademyofDermatologyandVenereology,* 26: 1167-1170.

Chimne, H.D. and Ksheersagar, D.D. (2012).Dermatoglyphics in angiographically proven coronary artery disease.*JournalofAnatomicalSocietyIndia,*61(2):262-268.

Christian, O., Taiwo, H., Ibrahim, D., Anas, A., Ofem, E., and Fabian, P. (2016).Performance of waist circumference and proposed cut –off points for defining overweight and obesity in Nigeria.*Annals of African Medicine,* 15(4): 185-193.

Cummins, H., and Midlo, C. (1926). Palmar and plantar epidermal configurations: Dermatoglyphics in European *Americans.AmericanJournalofPhysical Athropology,*9: 471 – 502.

Cummins, H., Waits, J., and McQuitty J.T. (1941). The breadths of epidermal ridges on the finger tips and palms: a study of variation.*AmericanJournalofAnthroplology,* 68:127–50

Cummins, H. and Midlo, C. (1943).Fingerprints,palmandsoles:Anintroductionto dermatoglyphics.*Dover New York.*Pg 3-4.

Coyne, S.M., Manning, J.T., Ringer, L. and Bailey, L. (2007). Directional asymmetry (rightleft differences) in digit ratio (2D:4D) predict indirect aggression in women. *Personalityandindividualdifferences*,43(4): 865-872

Csatho, A., Osvath, A., Bicsak, E., Manning, J. and Kallai, J. (2003a). Sex role identity related to the ratio of second to fourth digit length in women. *Biological Psychology*,62: 147-156.

Csatho, A., Osvath, A., Bicsak, E., Manning, J. and Kallai, J. (2003b). Spatial navigation related to the ratio of second to fourth digit length in women. *Learningand IndividualDifferences*,13, 239-249.

Danborno, B. and Idris, G. (2007).Digital dermatoglyphics of Hausa ethnic group of Nigeria.*JournalofExperimentalandClinicalAnatomy*,6 (1&2): 36 – 40.

Danborno, B., Dasa, L.M. and Ekanem, P.A. (2007). The study of hirsutism in Nigeria: A case study of female students at the Ahmadu Bello University, Zaria.*JournalofExperimentalandClinicalAnatomy*, 6(1&2): 6-8.

Danborno, B., Adebisi, S.S., Adelaiye, A.B. and Ojo, S.A. (2010). Relationship between digit ratio (2D:4D) and birth weight in Nigerians.Anthropologist, 12(2): 127-130.

David, T.J. (1981). Dermatoglyphic in congenital heart disease.*Journalof MedicalGenetics*,18: 344-349.

De Berker, A.R., Messenger, A.G. and Sinclair, R.D. (2004).Disorders of hair. In: Burns T, Breathnach S, Cox N, Griffiths C, eds. Rook'sTextbookofDermatology. *7th ed. Oxford: Blackwell Science*, 23-26

DeUgarte, C.M., Woods, K.S., Bartolucci, A.A. and Azziz.A. (2006). Degree of facial and body terminal hair growth in unselected black and white women: towards a population definition of hirsutism. *JournalofClinicalEndocrinologyand Metabolism*,91:1345-1350.

Diverse Population Collaborative Group (2005). Weight-height relationships and body mass index: Some observation from diverse populations collaboration. *American JournalofPhysicalAnthropology*,128: 220-229.

Duta, N., Jain, A.K. and Mardia, K.V. (2001).Matching of palmprint.*PatternRecognition*, 23(4): 477-485

Ekanem, E., Eluwa, M., Udoaffah, G., Ekanem, T., and Akpantah, A. (2008). Digital dermatoglyphic patterns of Annang ethnic group in Akwa Ibom State of Nigeria. *International Journal ofBiological Anthropology*, 3(1).

Ekback, M., Lindberg M., Benzein E. and Arestedt, K. (2013). Health-related quality of life, depression and anxiety correlate with the degree of hirsutism. *Dermatology*, 227(3):278-284

Ekback, M.P (2017). Etiology and treatment of hirsutism.*Journal of endocrinology, Diabetes and Obesity*, 5(3): 1110

Elghblawi, E. (2008). Idiopathic hirsutism: excessive bodily and facial hair in women. *BritishJournalof Nursing*,17: 192-197.

Escobar-Morreale, H., Carmina, E., Dewailly, D., Gambineri, A. and Kelestimur, F (2011). Epidemilogy, diagnosis and management of hirsutism: a consensus statement by the androgen excess and polycystic ovarian syndrome society. *Human ReproductionUpdate*,18(2):146-170.

Evardone, M. and Alexander, G.M (2009). Anxiety, sex linked behaviour, and digits ratios (2D:4D).*Archivesofsexualbehaviour*,38(3):442-455

Exemplar for Internal Assessment Resource (2017). Is there a relationship between the height in cm and the weight in kg for athletes in the data supplied from the Australian institute of sport.*HighArchived*,1: 2

Ezzat, A., El-Sawwa and Mahmoud, M. (2017). Dermatoglyphics patterns among Lebanese medical students of Bau. *International Journal of Anatomy Research,* 5(4): 4546-4552.

Farahnaz, F., Jamshid, N., and Noushin, J. (2012). Hirsutism and body mass index in a representative sample of Iranian people.*AryaAtherosclerosis*,1: 1-15.

Farnaghi, F. and Seyrafi, H. (2002).Descriptive study of patients with hirsutism in Razi Hospital, Tehran.*IranianJournalofDermatology*,1:21-25.

Falsetti, L., Gambera, A., and Legrenzi, L. (1999).Comparison of finasteride versus flutamide in the treatment of hirsutism. *European Journal of Endocrinology,* 141: 361-367

Fauci, A., Braunwald, E. and Hauser, S.L. (2008).*Harrison'sPrinciplesofInternal Medicine.17th ed*, 9-12.

Fernando, L.M., Luiz, C.L., Rodrigo, P. and Katiuscia, K. (2011).Prevalence of hyperhidrosis among medical students.*RevistaDoColegioBrasileiroDe Cirurgioes*,38 (6): 2-5

Fink, B., Manning, J.T., Williams, J.H. and Podmore-Nappin, C. (2007).The 2nd to 4th digit ratiodevelopmental psychopathology in school-aged children. Personalityand Individual Difference, 42:369-379.

Fox news health (2016). Can adult grow taller?*TheWallStreetJournal*,1:2-3.

Fuller, I.C (1973). Inherited predisposition to cancer? A dermatoglyphic study.*British JournalofCancer*,28: 186-189

Franks, S. (2012). The investigation and management of hirsutism.*JournalofFamily PlanningandReproductoryHealthCare*, 38(3):182-186.

Freedberg, I.M., Eisen, A.Z., Wolff, K., Austen, K.F., Goldsmith, L. and Katz, S.I (2003).*Fitz Patrick DermatologyinGeneralMedicine(6thed)McGraw-Hill. p 700*

Gallway, F. (1961).Clinical assessment of body growth in women.*JournalofClinical EndocrinologyandMetabolism.* (11):1440-1447.

Galton, F. (1892). Finger prints.*FacsimileEd.NewYorkandLondon:MacMillon,*4-15

Gang, S and Bian, Z. (1999).The study of automatic personal identification using palm print.*TsinghuaUniversityJournal,*9(1), 95–97.

Gareth, R., Wynford, B. and Williams, D. (2017). Familial digit ratio (2D:4D) associations in a general population sample from Wales. *EarlyHumanDevelopment*,112: 1419.

Goldman, L. and Ausiello, A.(2007).*Goldman'sCecilMedicine. 24th ed*. 1604-1607.

Goodman, N., Bledsoe, M., Cobin, R., Futterweit, W., Goldzieher, J., Petak, S., and Smith, K. (2001).American association of clinical endocrinologists hyperandrogenism guidelines.*Endocrine Practice,*7(2):120-134

Gungor., G., Erden., C., Nihal, U., Sevilay, S., Ozdemir, H., Tugrul, C. and Metin, Y. (2011).The comparison of free androgen index and serum free testosterone levels in women with hirsutism or polycystic ovary syndrome. *Journal of Clinical and Experimental Investigation,* 2(2):152-156.

Gupta, C.M., Tukane, M.A. and Bhanu, B.V. (1984).Absence of triradius "d" on palm of leprosy patients.*Indian Journal of Leprosy,* 56(4): 852-854.

Gupta, C.M. and Tutakne, M.A. (1986).An evaluation of palmer flexion creases and dermatoglyphics in leprosy.*Indian Journal of Leprosy,* 58: 263-275.

Graham, J.H., Raz, S., Hagit, H.O. and Nevo, E. (2010).Fluctuating asymmetry methods, theory and application.*Symmetry,* 2: 466-547.

Grant, P. (2010). Spearmint herbal tea has significant anti-androgen effects in polycystic ovarian syndrome. A randomized controlled trial.*PhytotherapyResearch,* 22(2):186-188.

Greenfield, B. (2012). Why women gain weight as they age and what to do about it. *Fox NewsLifestyle*,1-3.

Gyenis, G., Hidegh, A. and Petho, B. (1990).Dermatoglyphics in Hungarian schizophrenic patients.*DermatoglyphicReseach,KliverAcademicPublishers,Dordrecht.*146-155.

Gyenis, G. (2000). A short history and some results of the dermatologlyphic studies in Hungary.*ActaBiologicalSzegediensis,* 44 (1-4): 135 – 138.

Haedersdal, M. and Getzsche, P.C. (2006).Laser and photoepilation for unwanted hair growth.

CochraneDatabaseSystematicReviews,(4): 5-10.

Hajheydari, Z., Jamshidi, M. and Masoudzadeh, A. (2007). Association between hirsutism and mental health,*Neurosciences,*12:242-244.

Hampson, E. and Sankar, J.S. (2012). Re-examining the Manning hypothesis: androgen receptor polymorphism and the 2D:4D ratio. *EvolutionandHuman Behaviour,*33:557-561

Harold, C. and Rebecca, W. K. (1940).Purkinje's observation on finger prints and other skin features.*TheJournalofCriminalLawandCriminology,*31(3):343356

Harrich, N., Esteban, E., Chafik, A. and Moral, P. (2002).Dermatologic characterization of barbars from Morocco.Qualitative and quantitative digital and palmer data.*AmericanjournalofHumanBiology,*29 (4): 442 – 456.

Hartz, A.J., Barboriak, P.N., Wong, A., Katayama, K.P. and Rimm, A.A. (1979).The association of obesity with infertility and other related menstrual abnormalities in women.*InternationalJournalofObesity,* 3:57-73.

Hassan, Q., Mustafa, G., Yousufani, Ishaaq., M. and Abaasi, M.H. (2011). Comparative study of dermatoglyphics among the students of Ziauddin University.*Medforum,* 22(12):16-25.

Henry, E.R (1934).Classificationandusesoffingerprints.*7th ed.; H.M. Stationary office: London, pg* 20-22

Herschel, W.J. (1916). The origin of finger-printing, *Oxford university press: London.* pg 5-9

Higashimoto, I., Yoshiura, K.I., Hirakawa, N., Higashimoto, K., Soejima H,etal. (2006). Primary palmar hyperhidrosis locus maps to14q11.2-q13.*AmericanJournal of MedicalGenetics,*140: 567-572.

Himelein, M.J. and Thatcher, S.S. (2006). Polycystic ovary syndrome and mental health: A review.*ObstetricalandGynecologicalSurvey,*61: 723-732.

Hlaing, H.K. (2012). Personal identification and verification using palm print biometric. *International Journal of Latest Technology in Engineering Management and Applied Sciences,* 1(10): 1-3.

Honekopp, J., Manning, J.T. and Muller, C. (2006). Digit ratio (2D:4D) and physical fitness in males and females: evidence for effects of prenatal androgens on sexually selected traits.*HormonesBehavior,* 49: 545-549.

Honekopp, J. and Watson, S. (2011). Meta-analysis of the relationship between digitratio 2D:4D and aggression.*PersonalityandIndividualDifferences,*51,381-386.

Howe, L.D., Hallal, P.C., Matijasevich, A., Wells, J.C., Santos, I.S., Barros, A. *etal* (2014). The association of birth order with later body mass index and blood pressure: a comparison between prospective cohort studies from the United Kingdom and Brazil.*InternationalJournalofObesity,*38, 973-979.

Hunter, M.H. and Carek, P.J. (2003).Evaluation and treatment of women with hirsutism.*AmericanFamilyPhysician,* 67: 2565 – 2572,

Ibegbu, A.O., Danjuma, Z.C., Hamman, W.O.,Umana, U.E., Ikyembe, D.T., and Musa, S.A. (2012). Anthropometric study of the index (2nd) and ring (4^{th}) digits in Ebira ethnic group of Nigeria.*Asian Journal of Medical Sciences,* 4(2):79-84.

Igbigbi P.S. and Msamati, B.C. (1999) Palmar and digital dermatoglyphic patterns in Malawian subjects.*EastAfricanMedicalJournal,* 76: 668 – 671.

Igbigbi, P.S. and Msamati, B.C. (2001).Palmar and digital dermatoglyphic characteristics of Zimbabwean subjects.*EastAfricanMedicalJournal,*78 (10): 536 – 539.

Igbigbi, P.S., Ominde, B.S and Oyibojoba, O.A. (2018).Dermatoglyphic pattern of schizophrenia patients in a Nigerian population.*International of Anatomy Research,*6 (2.1): 5114-5121.

Jackson, A.S., Stanforth, P.R. and Gagnon, J. (2002). The effect of sex, age and race on estimating percentage body fat from body mass index: the heritage family study. *InternationalJournalofObesityandRelatedMetabolicDisorders,*26(6): 789-796.

Jain, A.K., Ross, A., and Prabhakar, S. (2004). An introduction to biometric recognition, IEEE trans. Circuit system.*Video Technology,* 14 (1): 4-20.

Jaja, B.N., Olabiyi, O., Noronha, C.C., and Okanlawon, A. (2008).Assymetry and pattern polarization of digital dermal ridges amongst the Ogoni people of Nigeria.*Scientific Research and Essay,* 3 (1):51-56

Jalali, F. and Hajian – Tilaki, K.O. (2002). A comparative study of dermatoglyphic patterns in patients with myocardial infarction and control group.*ActaMedicaIranica,* 40(3):187- 191

Jin, K., Soo, C., Young, M., Seung, H., Kyu, H., Sun, M. and Shin, Y. (2011). Assessment of hirsutism among Korean women: results of a randomly selected Sample of women seeking pre-employment physical check-up. *Human Reproduction,* 26(1):214-220.

John, P., Hector, J., Jack, S. and John, K. (2003).Prevention and management of positional skull deformities in infants.*Pediatrics,* 112(1):199-202.

Kaufman, K.D (1996). Androgen metabolism as it affects hair growth in adrogenic alopecia. *DermatologicClinics,*14:697-711.

Kaufman, K.D. (2002). Androgens and alopecia.*MolecularandCellular Endocrinology,*198: 89-95.

Kahn, H.S., Graff, M., Stein, A.D., Zybert, P.A., McKeague, I.W. and Lumey, L.H. (2008). A finger print characteristics associated with the early prenatal environment.*AmericanJournalofHumanBiology,*20:59-65

Kim, J.J., Chae, S.J. and Choi, Y.M. (2011).Assessment of hirsutism among Korean women.*HumanReproduction,* 26(1):214–220.

Kingston, C. and Kirk, P.L. (1965). Historical development and evaluation of the 12 point rule in finger print identification.*InternationalCriminalPoliceReview,* 20(186), 62 -69.

Kishore, K.A., and Veer, C.S. (2012). General assumption of psychological behavior based on finger print pattern. *Journal of Biology and Life Science,* 3(1): 59-65.

Knickmeyer, R.C., Woolson, S., Hamer, R.M., Konneker, T. and Gilmore, J. (2011). 2D:4D ratios in the first 2 years of life: stability and relation to testosterone exposure and sensitivity.*HormonesandBehavior,*60(3):256-263.

Kohli, S., and Bhalla, V. (2000).Bilateral asymmetry of hand dermatoglyphics in deafmute and hare-lip and cleft palate patients.*ManinIndia,*80:185-193.

Komotz, Y. and Yoshida, O. (1976).Finger patterns and ridge counts of patients with Klinefelter's syndrome (47xxy) among the Japanese.*HumanHeredity,* 26(4):290297.

Kondo, T., Zakany, J., Innis, W.J. and Duboule, D. (1997).Of fingers, toes, and penises.*Nature,* 390, 29

Kong, A., Zhang, D., and Lu, G. (2006). A study of identical twins palm print for personal verification. *Pattern Recognition,* 39 (11): 2149-2156.

Krishnakumar, M., Atheeshwar, S., Chandrasekar, M.D (2014).Myopia and digit ratio in medical college students.*PLoSOne,* 9(2): e89800

Lakshmi, P., and Thenmozhi, R. (2014).A short review on dermatoglyphics.*International Journal ofPharmaceutical Sciences and Research,* 6(4):200-2002.

Lal, N. and Surekh, R.K. (2012).A study of dermatoglyphic pattern in epileptic patients.*JournalofAnatomicalSocietyofIndia,*61(1):26-29.

Lambourne, G. (1984).TheFingerprintStory,Harrap: London.pg 24.

Lapidoth, M., Dierickx, C., Lanigan, S., Paasch, U., and Campo-Voegeli, A.(2010). Best practice options for hair removal in patients with unwanted facial hair using combination therapy with laser: guideline drawn up by an expert working group. *Dermatology,*221: 34-42.

Lau, R., Ng, C., and Wong, R. (2014).Single port video-assisted thoracic surgery vasoview sympathectomy for palmar hyperhidrosis.*Chest,*145: 44A.

Lecouflet, M., Leux, C., Fenot, M., Philippe Célerier., and Hervé Maillard (2014). Duration of efficacy increases with the repetition of botulinum toxin A injections in primary palmar hyperhidrosis: a study of 28 patients.*JournaloftheAmerican AcademyofDermatology,*70: 1083-1087.

Leung, A.K., Chan, P.Y., and Choi, C.K.(1999). Hyperhidrosis.*InternationalJournalof Dermatology,* 38: 561- 567.

Leung, A.K. (2011). Common Problems in Ambulatory Pediatrics: Symptoms and Signs. (1stedn)*NovaSciencePublishers,*NewYork,9-19.

Leung, A.K. and Barankin, B (2014).Palmer hyperhidrosis.*JournalofNeonatologyand ClinicalPediatrics,*1:1.

Li, H., Li, J. and Lu, D. (2000). Study of genetics of interdigital areas dermatoglyphics.*AnthropologyJournal,* 19(3): 244-250.

Loehlin, J.C., Medland, S.E. and Martin, N.G. (2012). Is CAG sequence length in the androgen receptor gene correlated with finger-length ratio? *Personalityand Individualdifferences,*52(2): 224-227

Loriaux, L. (2012). An approach to patient withhirsutism.*JournalofClinical EndocrinologyandMetabolism,*97(9):2957-2968.

Luxen, M.F. and Buunk, B. (2005). Second to fourth digit ratio related to verbal and numerical intelligence and the big five. *PersonalityandIndividualDifferences,* 39(5): 959-966

Maceo, A., Carter, M. and Stromback B. (2013) Palm prints. In: Siegel JA and Saukko PJ (eds.)*EncyclopediaofForensicSciences,SecondEdition, 4* :29-36.

Manning, J.T., Scutt, D. and Lewis-Jones, D.I. (1998).The ratio of 2nd to 4th digit length; a predictor of sperm numbers and concentration of testestorone, luteinizing hormone and oestrogen.*HumanReproduction,*13, 3000-3004.

Manning, John T. (2000). Digit ratio: A pointer to fertility.*BehaviorandHealth*,65-68.

Manning, J.T., Barley, l., Walton, J., et al. (2000). The 2nd: 4th digit ratio, sexual dimorphism,population differences, and reproductive success. Evidence for sexual antagonistic gene?*Evolution andHumanBehaviour.*21(3):163-183

Manning, J.T., Baron-Cohen, S., Wheelwright, S. and Sanders, G. (2001).The 2nd to 4th digit ratio and autism.*DevelopmentalMedicineandChildNeurology,*43: 160-164.

Manning, J.T. and Tarloy, R.P. (2001). Second to fourth digit ratio and male ability in sport: Implications for sexual selection in humans. *Evolution and Human Behaviour,* 22(1):61-69.

Manning, J.T. (2002). The ratio of 2nd to 4th digit length and performance in skilling.*JournalofSportsMedicineandPhysicalFitness,*42:446-450.

Manning, J.T., Barley, L., Lewis-Jones, I., Walton, J., Trivers, R.L., and Thornhill, R. (2002). The 2nd to 4th digit ratio, sexual dimorphism, population differences and reproductive success: evidence for sexually antagonistic genes. *Evolution andHumanBehaviour*,21: 163-183.

Manning, J.T., Bundred, P.E., Newton, D.J. and Flanigan, B.F (2003).The second to fourth digit ratio and variation in the androgen receptor gene.*Evolutionand HumanBehavior,* 24: 399-405

Manning, J.T., Stewart, A., Bundred, P.E., Trivers, R.L. and Stewart, B. (2004).Sex and ethnic differences in 2nd to 4th digit ratio of children.*EarlyHumanDevelopment,* 80 (2): 161-168

Manning, J.T., Fink, B., Neave, N. and Caswell, N. (2005). Photocopies yield lower digit ratios (2D:4D) than direct finger measurements. *ArchivesofSexualBehaviour,* 34(3):329-333

Manning, John, T., Churchill, Andrew, J.G., and Peters, M. (2007). The effects of sex, ethnicity, and sexual orientationon self-measured digit ratio (2D:4D). *Archivesof SexualBehavior,*36(2):223-233

Manning, J.T., Kilduff, L.P., Trivers, R. and Kilduff, T. (2013). Digit ratio (2D:4D) in Klinefelter syndrome.*Andrology,*1 (1): 94-99

Maria, E.L., Terri, G.B., and Roger, A.P (2010). Digit ratios do not serve as anatomical evidence of prenatal androgen exposure in clinical phenotypes of polcystic ovary syndrome.*HumanReproduction,*1:1-41.

Marko, T.A. (1992). Genetics and developmental stability: an integrative conjecture on etiology and Nerobiology of Schizophrenia.*PsychologicalMedicine,* 22:295-305.

Markosyan, R. and Angelina Arzumanyan (2017).Age of menarche and related factors.*Endocrinology* and*MetabolicSyndrome,*6:5.

Martel, M.M. (2009). Conscientiousness as a mediator of the association between masculinized finger length ratios and attention deficit/ hyperactivity disorder (ADHD).*JournalofChildPsychologyPsychiatry,50* (7): 790-798

Martin, K.A., Chang, R.J., Ehrmann. D.A., et al (2008). Evaluation and treatment of hirsutism in premenopausal women: an endocrine society clinical practice guideline.*Journalof ClinicalEndocrinologyMetabolism,*93(4):1105-1120,

Mathew, L., Hedge, A.M. and Rai, K. (2005).Dermatoglyphic perculiarities in children with oral clefts.*JournalofIndianSocietyofPedodonticsandpreventiveDentistry,* 23(4): 179-182.

Matthew, S., Alan, D.M., Vanessa, H., Andrew, G.R., and Lain, E.B. (2016). Body mass index relates weight to height differently in women and older adults: serial crosssectional surveys in England (1992-2011). *JournalofPublicHealth,*38(3): 607613.

Mauthausen K., and Gusen, Y.R. (1959).Estimation of actual individual height during the exhumation of the remains of the former concentration camps.*Journal of forensic science,* 3:533-537

Mayhew, T.M., Gilam, L., McDonald, R. and Ebling, F.J. (2007). Human 2D (index) and 4D (ring) digit lengths: their variation and relationships during the menstrual cycle. *Journal of Anatomy,* 211(5): 630-638.

Mayo Clinic (2011).Polycystic ovarian syndrome.http://www. Mayoclinic.org/diseasecondition/pcos/basics/definition.

McAnulty, R.D. and Michele, B. M. (2006).Sex and sexuality.*GreenwoodPublishing Group,*1:165-167

McFadden, D. and Shubel, E. (2002).Relative lengths of fingers and toes in human males and females.*HormonesandBehaviour,*42, 492-500

McIntyre, M.H., Ellison, P.T., Lieberman, D. E., Demerath, E. and Towne, B. (2005).The development of sex differences in digital formula from infancy in the Fels longitudinal study.ProceedingsofRoyalSocietyofLondon.*SeriesBBiological Sciences,* 272: 1473-1479

McIntyre, M.H., Cohn, B.A. and Ellison, P.T. (2006).Sex dimorphism in digital formulae of children.*AmericanJournalofPhysicalAnthropology,*129: 143-150.

McIntyre, M.H., Barrett, E.S., McDermott, R., Johnson, D.P. and Cowden, J. (2007). Fingerlength ratio (2D:4D) and sex differences in aggression during a simulated war game.*PersonalityandIndividualDifferences,* 42:755-764.

McKnight, E. (1964). The prevalence of hirsutism in young women.*Lancet,*1:410-413.

MdSelNd E. Encuesta Nacional de Salud (ENS). (2003). *Ministerio de Salud: Santiago de Chile,* 2(1): 3-5

Meera, J., Ramarkrishma, A., Bindhu, N., Rani, N. and Meril, A.S. (2015). Cross sectional study of second- and fourth-digit ratio with physical attributes in south indian population.*InternationalJournalofAnatomyandResearch,*3(2): 1133-1137.

Menezes B., and Khany, M.(1998). Estimation of stature from length off sternum in South Indian males.*Forensic Science International,* 125: 141-148.

Miglinets, V. (1991). Relationship between Dermatoglyphic variability and finger length in genetic disorders: Down's syndrome.*Genetica,* 27(3):541-547.

Milicic, J., Petkovic, Z.B. and Bozikov, J. (2003). Dermatoglyphics of digito-palmar complex in autistic disorder: family analysis. *CroationMedicalJournal,* 44: 469476.

Miller, J.R., and Giroux, J. (1966).Dermatoglyphics in pediatric practice.*Journalof Pediatric,*69:302-312.

Milne, B.J., Belsky, J., Poulton, R., Thomson, W.M and Caspi, A. (2003).Fluctuating asymmetry and physical health among young adults.*EvolutionandHuman Behaviour,* 24 (1): 53-63

Mithal, A., Ammini, A.C., Godbole, M.M., Khurana, M.L., Raj, D., Karmarkar, M.G., and Ahuja, M.M. (1988).Late-onset adrenal hyperplasia in North Indian hirsute women.*Hormone Research,*30:1-4

Moore, K. and Persaud, T.N. (2009).The developing human clinical oriented embryology in the Integumentary system.*8thedn.Philadelphia,Pennsylvania:Saunder*

Mulvihill, J.J. and Smith D.W. (1969).The genesis of dermatoglyphics.*Journalof Paediatrics,*75: 579-589.

Mukherjee, A.(1988).Fingerdermatoglyphics among the Naikas ofGurajat.*Anthropologie*,(1):16

Mukherjee, D.P. (1990). Birth order effects on dermatoglyphics on fingers, palms, toes and soles.*AmericanJournalofHumanBiology,* 2 (6): 711-718.

Nair, R. (1986). Dermatoglyphic diversity in congenital heart diseases.*IndianJournalof MedicalResearch,* 83:56-67.

Neave, N., Fink, B. and Manning, J.T. (2003).Second to fourth digit ratio, testosterone, and perceivedmale dominance.ProceedingsoftheRoyalSocietyof LondonSeriesB,*BiologicalSciences,*2167-2172

NEC Solutions America customer honored by California's center for digital government (2004).*NECPressRelease.*

Nehemiah, G. (1684). The description and use of pore in the skin of the hands and feet.*PhilosophicalTransactionsoftheRoyalSocietyofLondon,*14:566-567

Neiswanger, K., Cooper, M.E., Weinberg, S.M., Flodman, P., Keglovits, A.B., Liu, Y, Hu, D.N., Melnick, M., Spence, M.A. and Marazita, M.L., (2002). Cleft lip with or without cleft palate or dermatoglyphics assymetry: evaluation of a Chines population.*OrthodonticsandCraniofacialResearch,*5:140-146.

Nikha, B., Pankaj, B., Vineeta, T. and Mohammed, S.S (2015).Dermatoglyphic analysis of fingertip and palmer print patterns of obese children.*InternationalJournalof MedicalScienceandPublicHealth,*4:7.

Noorbala, M.T. and Kefaie, P. (2010).The prevalence of hirsustism in adolescent girls in Yadz, central Iran.*IranianRedCrescentMedicalJournal,*12(2):111-117.

Odokuma, E.I. and Igbigbi, P.S. (2005).Digital dermatoglyphics in students of Delta State University, Nigeria.*JournalofExperimentalandClinicalAnatomy,* 4(1) 30 – 32.

Okten, A., Kalyoucu, M. and Yaris, N. (2002).The ratio of second and fourth digit lengths and congenital adrenal hyperplasia due to 21-hydroxylase deficiency.*Early HumanandDevelopment,*70: 47-54.

Oladipo, G.S. and Ogunnowo, B. (2004). Dermaaatoglyphic patterns in diabetes mellitus in a south eastern Nigerian population. *AfricanJournalofAppliedZoologyand EnviromentalBiology,* 6: 6 – 8.

Oladipo, G.S., Olabiyi, O., Oremosu A.A., Noronha, C.C., Okanlanwon, A.O. and Paul, C.U. (2007). Sickle cell anemia in Nigeria: Dermatoglyphic analysis of 90 cases. *AfricanJournalofBiochemistryResearch,* 1 (4): 54 – 59.

Oner, G. and Muderris, II.(2013). Efficacy of omega-3 in the treatment of polycystic ovary syndrome.*JournalObstetricandGynaecology,* 33(3):289-291.

Oyeyemi, B.F., Iyiola, O.A., Oyeyemi, A.W., Oricha, K.A., Anifowoshe, A.T., and Alamukli, N.A (2014).Sexual dimorphism in ratio of second and fourth digits and its relationship with metabolic syndroame indices and cardiovascular risk factors.*JournalofResearchinMedicalSciences,* 19(3):234-239

Paez, F., Apiquian, R., Fresan, A., Puig, A., Orozco, B., and Fuente, J.R. (2001). Dermatoglyphic study of positive and negative symptoms in schizophrenia.*Salud Mental,*24: 28-32.

Pallotta R, Carlone G, Petrucci A. and Chiarelli, F. (1989).Dermatoglyphics in von recklinghausen neurofibromatosis.*American Journal Medical Genetics,*34(2):233-6.

Panidis, D., Tziomalos, K., and Papadakis, E. (2013).The clinical significance and primary determinants of hirsuitism in patients with polycystic ovary syndrome. *European JournalofEndocrinology,* 168(6):871-877.

Paul, C., Gillan, R. and Jeremy, V. (2002). Hirsutism: evaluation and treatment.*Journalof ObstetricsandGynaecologyCanada,*110.

Paul, S.N., Kato, B.S., Hunkin, J.L., Vivekanandan, S., and Spector, T.D. (2006). The big finger: the second to fourth digit ratio is a predictor of sporting ability in women. *BritishJournalofSportsandMedicine,*40: 981-983.

Pate, C (2013).The story plot of living the embarrassment of hirsutism.*Archivesof Psychiatric Nursing,*27: 156-157.

Pazos, F., Escobar-Morreale, H.F., Balsa, J., Sancho, J.M., and Varela, C. (1999). Prospective randomized study comparing the long – acting gonadotropin- releasing hormone agonist triptorelin, flutamide, and cyproterone acetate, used in combination to oral contraceptive, in the treatment of hirsutism. *Fertility and Sterility,*71-122-128

Peichel, C.L., Prabhakaran, B., Vogt, T.F (1997). The mouse ulnaless mutation deregulates posterior hoxd gene expression and alters appendicular patterning. *Development,*124: 3481-3492

Penrose, L.S. (1954). The digital triradius 't' on the hands of parents and Sibs of Mongal imbeciles.*AnnalsofHumanGenetics,*19:10.

Penrose, L.S., and Loesch, D. (1970).Topological classification of palmar dermatoglyphs.*JournalofMentalDeficiencyResearch,* 14:111-128.

Peters, M., Tan, U., Kang, Y., Teixeira, L. and Mandal, M. (2002). Sex-specific-finger length patterns linked to behavioral variables: consistency across various human population.*PerceptualandMotorSkills,*94, 171-181.

Peter, K. (2004). Automated fingerprint identification systems.*1stedition,*12-16

Pokrywka, L., Rachon, D., Suchecka-Rachon, K. and Bitel, L. (2005).The second to fourth digit ratio in elite and non-elite female athletes.*AmericanJournalofHuman Biology*,17:796-800.

Puri, N. (2012).A study on the clinical and hormonal profile of patients with hirsutism.*Nasza DermatologiaOnline*,3(2): 88-91.

Pursnani, M.L., Elhence, G.P. and Tibrewala, L. (1989).Palmar, dermatoglyphicsin essential hypertension.*IndianHeartJournal*,41: 119-122.

Radmanesh, M. (2009). Paradoxical hypertrichosis and terminal hair change after intense pulsed light hair removal therapy. *JournalofDermatologicalTreatment*, 20(1):52-54.

Rahman, Q., and Wilson,G.D. (2003). Sexual orientation and the 2ndto 4th finger length ratio: Evidence for organizing effects of sex hormones or developmental instability? *Psychoneuroendocrinology*, 28 (3):288-303.

Rajangam, S., Janakiram, S. and Thomas, L. (1995).Dermatoglyphics in Down's syndrome.*JournalIndianMedicalAssociation*,93(1):10-3.

Rajneesh, S and Rajput, R. (2013).Hirsutismandhomeopathy.*Homoeo cure & Research centre*.3rd edition, 1-7.

Rakik, K. (1988). Specification of cerebral cortical area.*Science*,241:170-176.

Rastogi, P. and Pillai, K.R. (2010). A study of finger prints in relation of gender and blood groups.*JournalofindianAcademyofForensic Medicine*,32:11-13.

Ravendranath, R., Thomas, I..M. (1995). Finger ridge count and finger print pattern in maturity onset diabetes mellitus.*IndianJournalofMedical Science*,49:153-156.

Ravendranath, R., Shubah, R., Nagesh, H.V., Johnson, J. and Rajangam, S. (2006). Dermatoglyphics in rheumatoid arthritis.*IndianJournalofMedicalScience*, 57: 437 –444.

Reed, T., Reichmann, A., Palmer, C. (1977). Dermatoglyphic differences between 45x and other chromosomal abnormalities of Turner's syndrome. *Human Genetics*, 36(1):13-23.

Reddy, B.C., and Reddy, K.N. (2006).A Study of palmar dermatoglyphics among Sugalis, a tribal population of Andhra Pradesh.*Anthropologist*, 8(1): 21-24.

Regoly-Merci, A., Barta, L. and Penax. (1982).Dermatoglyphic differences in obesity, *HumanBiology Budapest*, 11: 95-102.

Ro, K.M, Cantor, R.M, Lange, K.L. and Samuel, S. (2002). Palmar hyerhidrosis: evidence of genetic transmission.*JournalofVascularSurgery*,35: 382-386.

Robert, D. (1972). The chemical composition of palmar sweat.*Fingerprint and identification Magazine*,53(10): 7-9

Robert, T., Manning, J., and Jacobson, A. (2005). A longitudinal study of digit ratio (2D:4D) and other finger ratios in Jamaican children.*Hormones and Behaviour,* 49 (2006): 150-156.

Ronalds, G., Philips, D.I., Godfrey, K.M. and Manning, J.T. (2002). The ratio of the second to fourth digit length: a marker of impaired fetal growth: What does 2D:4D indicate?*EarlyHumanandDevelopment*,68: 21-26.

Rott, H., Schwanitz, G. and Riether, M. (1975).Dermatoglyphics in Noonan's syndrome.*Acta GeneticaeMedicaeetGemellologiae*, 24(1-2):63-67.

Sant, S.M., Vare, A.M. and Fakhruddin, S. (1980).Dermatoglyphic traits in diabetes mellitus.*JournalofAnatomicalSocietyofIndia*, 29:43.

Satyanand, T., Mohit, S., Sachin, K., Amit, K., Gunjan, S. and Neha, N. (2010). Hirsutism- A Symptom rather than a disease: A review. *International Journal of Pharmaceuticaland BiologicalSciences,* 1(3):0975-6299.

Sahar, D., Jalil, K., Mausoud, K., Ali, R., Behjat, S., and Seyed, H.N. (2015). Assessing factors related to waist circumference and obesity: application of a latent variable model. *J Journalof Environmental and Public Health*.1(10): 8-9.

Sarah, B.H (1958). Genetics of dermal ridges: The relation between total ridge count and variability of counts from finger to finger. *AnnalsofHumanGenetics,*22(4): 323339.

Saravanakumar, J. and Prathibha, K.M. (2016). 2D:4D ratio and its implication in medicine. *JournalofClinicalandDiagnosticResearch*,1-20.

Schaumann, B. and Alter, M. (1976). Dermatoglyphicsinmedicaldisorders,*SpringerVerlag, New York*, 26-29

Seltzer, M.H., Plato, C.C. and Fox, K.M. (1990).Dermatoglyphics in identification of women with or at risk of breast cancer.*AmericanJournalofMedicalGenetics,* 37: 482 – 488.

Shaila, K.D. (2003). Elementary, Watson: scan a palm, find a clue.*TheNewYorkTimes,* pg 11.

Shamsuddin, S., Masomi, M. and Magad – Hossini, M. (1997).Relations between the lines on the fingers of hands and the incidence of disease in the human.*Journal ofKerminMedicalScienceUniversity.* 4(3):136-142

Shao, Z. (1992). Dermatoglyphics and choosing athletes.*AnthropologyJournal*, 11(4):369–373.

Shi, W., Rong, G., Bain, Z., and Zhang, D. (2001).Automatic palm print verification. *InternationalJournal ofImageandGraphics*,1 (1):135-152

Shiram, D.R., and Vikas, T.H. (2012). Biometric palm prints feature matching for personal identification. *International Journal of Modern Education and Computer Science*,11:61- 69

Shu, W., and Zhang, D. (1998).Automated personal identification by palm print.*Optical Engineering,* 37(8):2659-2362

Simsek, S., Taskiran, H. and Karakaya, N. (1998).Dermatoglyphic analysis in children with CP.Neurobiology,NU. 6(3):373-380.

Somani, N. and Turvy, D. (2014). Hirsutism: an evidence-based treatment update. *AmericanJournalofClinicalDermatology,* 15(3):247-266.

Sudhakar, H., Manjunatha, R., Madhusudhana, M. and Heragu, R. (2015).Relationship between second to fourth digit ratios and benign prostatic hyperplasia in aging men.*JournalofClinicalandDiagnosticResearch,*9(5): 1-3.

Tang, H., Wu, B., Xu, Z., Xue, L., Li, B.etal. (2014) A new surgical procedure for palmar hyerhidrosis: is it possible to perform endoscopic sympathectomy under deep sedation without intubation? *European Journal Cardiothoracic Surgery,* 22 (1): 1-2

Tirabassi, G.,Giovannini, L., Paggi, F.etal. (2013). Possible efficacy of Lavender andea tree oils in the treatment of young women affected by mild idiopathic hirsuitism.*JournalofEndocrinologyInvestigation,*36(1):50-54.

Townsend, K.A. and Marlowe, K.F. (2004).Relative safety and efficacy of finasteride for treatment of hirsutism.*AnnalsofPharmacotherapy,* 38(6):1070-1073,

Trimpe, T (2009).http://sciencespot.net,21-26.

Trivers, R.L., Manning, J.T. and Jacobson.A (2006). A longitudinal study of digit ratio 2D:4D and other finger ratios in Jamaicans Children. *HormonesandBehavior,* 49:150-156.

Trivers, R.L., Manning, J.T. and Jacobson.A (2013). A longitudinal study of digit ratio 2D:4D and its relationship with adult running speed in Jamaicans. *HumanBiology,* 85:623-626.

Trueb, R.M. (2002). Causes and management of hypertrichosis.*AmericanJournalof ClinicalDermatology,*3(9):617-627

Udoaka, A.I. and Udoaka, E.G. (2009). Dermatoglyphics studies among Ijaw students. *ContinentalJournalBiomedicalSciences,*3: 1-5.

Ujaddughe.M.O. (2015).Assessment of dermatoglyphic patterns and sex distribution in Esan ethnic group of Edo State, Nigeria.*International Journal of Applied and Innovative Research,* 4(1): 9-14.

Umana, U. E.,Ahunna, C.O., Timbuak, J.A., Ibegbu, A.O., Musa, S.A. and Hamman, W.O. (2013). Dermatoglyphics and cheiloscopic patterns in cancer patients; A study in Ahmadu Bello University Teaching Hospital (ABUTH), Zaria, Nigeria. *Current ResearchJournalofBiologicalSciences,*5(5): 220-225.

United states Department of Justice –FBI (1984). The science of finger prints classification and uses. US government posting offices.http://bookstore.gpo.gov/products/sku/027-001-33-35.

Vazquez-Lopez, M.S. and Relgosa, R.P. (2005). Palmar hyperhidrosis in a 13-year old boy: treatment with botulinum toxin A.*ClinicalPediatrics,*44: 549-551.

Verma, S.L., Chary, T.V., Singh, S. and Ashorom, Z. (1995). Dermatoglyphic patterns in Schizophrenic patients.*ActaPsychiatry-11,* 91(3):213-215.

Vishvanathan, G., Singh, H. and Ramanugam, F. (2002).Dermatoglyphic analysis of fingertip print pattern of blind children from Bangalore.*Journal Ecotoxicology Environmental Monitoring*, 12:49-52.

Waseem, R.M. and Vijay, S. (2016). Analysis of dermatoglyphic atd among varsity runners.*InternationalJournalofCurrentResearch,*8(5): 30906-30908.

Weinre, H. (1995). Finger print pattern in Alzheimer's disease.*ArchivesofNeurology,* 42(1):50- 54.

Weisberg, Y.J., DeYoung, C.G., and Hirsh, J.B. (2011). Gender differences in personality across ten aspects of the big five.*FrontiersinPsychology,*2:178.

Wertheim, K. and Maceo, A. (2002).The critical stage of friction ridge and pattern formation.*JournalofForensicIdentification,* 52(1): 35–85.

Williams, T.J., Pepitone, M. E., Christensen, S.E., Cooke, B.M., Huberman, A.D. and Breedlove, N.J. (2000).Finger length ratio and sexual orientation.*Nature,*404: 455-456.

Williams, J.H., Greenhalgh, K.D. and Manning, J.T. (2003). Second to fourth finger ratio and precursors of developmental psychopathology in preschool children. *Early Human Development*, 72:57-65.

Williamson, K., Gunn, A.J., Johnson, N. and Milsom, S.R. (2001).The impact of ethnicity on the presentation of polycystic ovarian syndrome. *AustralianandNewZealand JournalofObstetricandGynaecology,*41: 202-206.

Wolman, S.R., Campbell, M., Marchi, M.L., Deutsch, S.I. and Genshon, T.D. (1990).Dermatoglyphics study in autistic children and control. Journal of AmericanAcademyofChildandAdolescentPsychiatry,29: 878-884.

Wolosker, N., Schvartsman,C., Krutman, M., Taiz Pereira Dozono., and Campbell (2014). Efficacy andquality of life outcomes of oxybutynin for treating palmar hyperhidrosis in children younger than 14 years old.*Pediatric Dermatology,*31: 48-53.

Woolf, C.M. and Gianas, A.D. (1976). Congenital cleft lip and fluctuating dermatoglyphic asymmetry.*AmericanJournalofHumanGenetics*,28: 400-403.

Wuttke, W.,Gorkow, C., and Seidlova-Wuttke, D. (2006). Effects of black cohosh (Cimicifugaracemosa) on bone turnover, vaginal mucosa, and various blood parameters in postmenopausal women: a double-blind, placebo-controlled, and conjugated estrogens-controlled study.*Menopause,* 13(2):185-196.

You, J., Li, W., Zhang, D (2002).Hierarchical palmprint identification via multiple feature extraction.*PatternRecognition,*35(4):847-859

Yunyu, Z.,Yanjun, Z., Lizhen and Wenlei, H. (2002). Application and development of palm print research.*TechnologyandHealthCare,* 10: 383-390.

Zainab A.M. (2017). How can hand finger prints be inherited, and can we use them in early detection of bronchial asthma and blood pressure. *International Journal of Healthcare andBiomedical Research,* 5(3): 166-167.

Zargar, A.H., Wani, A.I., Masoodi, S.R., Laway, B.A., Bashir, M.I. and Salahuddin, M. (2002).Epidemiologic and etiologic aspects of hirsutism in Kashmiri women in the Indian subcontinent.*FertiityandSterility,*77: 674-678

Zhang, D. and Shu, W.(1999). Two novel characteristics in palmprint verification: Datum point invariance and line feature matching. *PatternRecognition,*32(4): 691-702

Zhang, D. (2004). Palm print authentication.*KluwerAcademicPublishers,* pg. 19

Zheng, Z., Cohn, and Martin, J. (2011).Developmental basis of sexually dimorphic ratios.*ProceedingsoftheNationalAcademyofSciences,*108(39):16289- 16294.

APPENDIX I

HEALTH RESEARCH ETHICS COMMITTEE

AHMADU BELLO UNIVERSITY TEACHING HOSPITAL SHIKA, ZARIA, NIGERIA.

E- mail: abuthshika@yahoo.com website: www.abuth.org

Chief Medical Director: Prof. Lawal Khalid, MBBS, FMCS, FWACS, FRCS(ED) mni
Chairman, Medical Advisory Committee: Prof Adamu Ahmed: MBBS, (ABU) LLB (ABU), BL, FWACS, FICS, FACS.
Director of Administration: Alh. Abdulraheem Sallau, BA(Pub. Admin) PGDPA, MPA, (ABU) AHAN, ACIPM.
Ag. Chairperson: Prof Aisha I. Mamman MBBS, FMCPath

NHREC No. 10/12/2015
D-U-N-S No. 954524802

DATE: *14th September, 2017*

ABUTH/HREC/CL/05

ABUTH HREC FULL ETHICAL CLEARANCE CERTIFICATE

Finger and Palm Print Patterns, 2D:4D Ratio and Hirsutism in the Igala Ethnic Group of Nigeria

ABUTH Ethics Committee assigned number: - ABUTHZ/HREC/AO8 /2017

Name of the principal Investigator: - **Ukanu Paul Idoko**

Address of the Principal Investigator: - Dept. of Human Anatomy. ABUTH Zaria
Date of receipt of valid application: - 14th August, 2017

Date of meeting when final determination On ethical approval was made: - 12 September, 2017

This is to inform you that the research described in the submitted protocol, the consent forms and other participant information materials have been reviewed and ***given full approval by the Health Research Ethics Committee.***

Please note: this approval dates from **14th September, 2017 - 14th September, 2018**

No participant recruitment into this research may be conducted outside these dates.

All informed consent forms in this study must carry the ABUTH HREC number assigned to this research and the duration of ABUTH HREC approval of the study.

This HREC expects that you submit your application as well as an annual report for ethical clearance renewal 3 months prior to expiration of study dates. This is to enable you obtain renewal of your approval and avoid interruption of your research.

If there is delay in starting the research, please inform the ABUTH HREC so that starting dates can be adjusted accordingly.

No changes are permitted in the research without prior approval by ABUTH HREC, except in circumstances outlined in national code for Health Research Ethics: **http://www.nhrec.net**.

ABUTH HREC reserves the right to conduct compliance assessment visits to your research site without prior notification.

28/9/17

Prof. Aisha. I. Mamman *MBBS, FMCPath*
Chairperson, ABUTH HREC

APPENDIX II

DEPARTMENT OF HUMAN ANATOMY

FACULTY OF MEDICINE

AHMADU BELLO UNIVERSITY, ZARIA

Dear Respondent,

I, am Ukanu Paul Idoko, an MSc student in the Department of Human Anatomy of the above named institution, I am carrying out a research on "Dermatoglyphic pattern, 2D:4D, Hirsutism and Palmar hyperhidrosis among selected dialects of Igala Ethnic group in Kogi State, Nigeria."

Participation is voluntary, it involves collection of certain information about your personal and family characteristics and also taking your finger and palmer prints.

The information collected from you will be used strictly to achieve the objectives of this study and for scientific publication. I assure you that this study has been reviewed and approved by my supervisors and the University Committee on Research Ethics.

Thank you for your understanding.

Yours sincerely,

Ukanu, Paul Idoko

APPENDIX III

CONSENT TO PARTICIPATE IN RESEARCH

Dermatoglyphic pattern, 2D:4D, Hirsutism and Palmar hyperhidrosis among selected dialects of Igala Ethnic group in Kogi State, Nigeria.

INTRODUCTION

You are kindly being asked to participate in a research study conducted by Ukanu Paul Idokofor a Master of Science degree under the supervision of Dr. B. Danborno, and Dr. J.A Timbuak, from the Department of Human Anatomy, Faculty of medicine, Ahmadu Bello University, Zaria.

If you have any questions or concerns about the research, please feel free to contact: Ukanu Paul Idoko, Faculty of medicine, Tel: 08166813714; Dr. B. Danborno, Faculty of medicine, Tel: 08091703860, or Dr. J.A Timbuak, Faculty of medicine, Tel: 08036986537

PURPOSE OF THE STUDY

The purpose of this preliminary study is primarily to assess dermatoglyphic pattern, 2D:4D, hirsutism and palmar hyperhidrosis among selected dialects of Igala Ethnic group in Kogi State, Nigeria.

This study is in partial requirement for the award of M.Sc degree in Human Anatomy Department in Ahmadu Bello University, Zaria.

WHY ARE YOU BEEN ASKED TO PARTICIPATE?

You are being invited because you are a 13 -19year old secondary school student.

WHAT WILL HAPPEN DURING THIS STUDY?

Information pertaining to growth, demographics (i.e. age, tribe, etc.), and degree of hirsutismwill be assessed using a questionnaire. Your finger and palmer print pattern will also be taken.

POTENTIAL RISKS AND DISCOMFORT

This study does not pose any form of physical, emotional or psychological risks to you.

POTENTIAL BENEFITS TO PARTICIPANTS

The result of this study, when published will help in assessing the distribution of finger and palmer prints among the different Igala dialects and how hirsuite are at risk of having some conditions like acne, irregular menses, and hypertrichosis. This research work can also be used in establishing a dermatoglyphics data base for the different Igala dialects and proper treatment procedures would be recommended to the hirsuite women.

WILL THERE BE ANY COST FOR PARTICIPATING?

Aside from your time, there are no costs in taking part in the study.

REMUNERATION FOR PARTICIPATION

Participation will not attract any financial benefit.

CONFIDENTIALITY

Every effort will be made to ensure confidentiality of any identifying information provided by participants in this study. You will not be identified in any reports orpublications resulting from the study.

PARTICIPATION AND WITHDRAWAL

You can choose whether to be in this study or not. If you volunteer to be in this study, you may withdraw at any time without consequences of any kind. You may exercise the option of removing your data from the study. You may also refuse to answer anyquestions you don't want to answer and still remain in the study. The investigator may withdraw you from this research if circumstances arise that warrants doing so.

RIGHTS OF RESEARCH PARTICIPANTS

You may withdraw your consent at any time and discontinue participation without penalty. You are not waiving any legal claims, rights or remedies because of your participation in this research study. This study has been reviewed and received ethics clearance through Ahmadu Bello University Research Ethics Board. If you have any questions regarding your rights as a research participant, you can obtain further

information about the research or voice your concerns to:

Dr. B. Danborno,
Department of Anatomy,
Faculty of Medicine,
Ahmadu Bello University.
Tel: 08091703860
E-mail: sbdanborno@yahoo.com

SIGNATURE OF RESEARCH PARTICIPANT/LEGAL REPRESENTATIVE

I have read the information provided for the study "dermatoglyphic pattern, 2D:4D, hirsutism and palmar hyperhidrosis among selected dialects of Igala Ethnic group in Kogi State, Nigeria." as described herein. I have been given a copy of this form.

_____

Name of Participant

_____ _____

Signature of Participant Date

SIGNATURE OF WITNESS

_____

Name of Witness

_____ _____

Signature of Witness Date

APPENDIX IV

QUESTIONNAIRE FOR THE STUDY OF DERMATOGLYPHIC PATTERN, 2D:4D, HIRSUTISM AND PALMAR HYPERHIROSIS AMONG SELECTED DIALECTS OF IGALA ETHNIC GROUP IN KOGI STATE, NIGERIA

S/NO……

DEMOGRAPHY OF PARTICIPANT

1. State of origin …….....
2. Dialect …….....
3. Tribe……
4. Place of birth ……..
5. Date of Birth (Day/Month/Year)……..
6. Sex……..
7. Height…….....
8. Weight……
9. B M I.…….
10. Birth Order……..

ETHNIC BACKGROUND

10.Father's Ethnic Group…….....

11.Grand Father's Ethnic Group……...

12.Grand Mother's Ethnic Group…….

13.Mother's Ethnic Group…….....

14.Grand Mother's Ethnic Group…….

15.Grand Mother's Ethnic Group…….

HAND ANTHROPOMETRY

1. Length of digits (mm)

HAND	**F I N G E RS**				
	I	**II**	**III**	**IV**	**V**
RIGHT					
LEFT					

PRINTS RECORDING

FINGERPRINTS

Right fingers (R)

THUMB (T)	**INDEX (I)**	**MIDDLE (M)**	**RING (R)**	**LITTLE (L)**
Ridge Count (T)	**Ridge count (I)**	**Ridge count (M)**	**Ridge Count (R)**	**Ridge (L) count**

Left fingers (L)

THUMB (T)	**INDEX (I)**	**MIDDLE (M)**	**RING (R)** **LITTLE (L)**	**THUMB (T)** **INDEX (I)**
Ridge Count (T)	Ridge count (I)	Ridge count (M)	Ridge Count (R)	Ridge (L) count

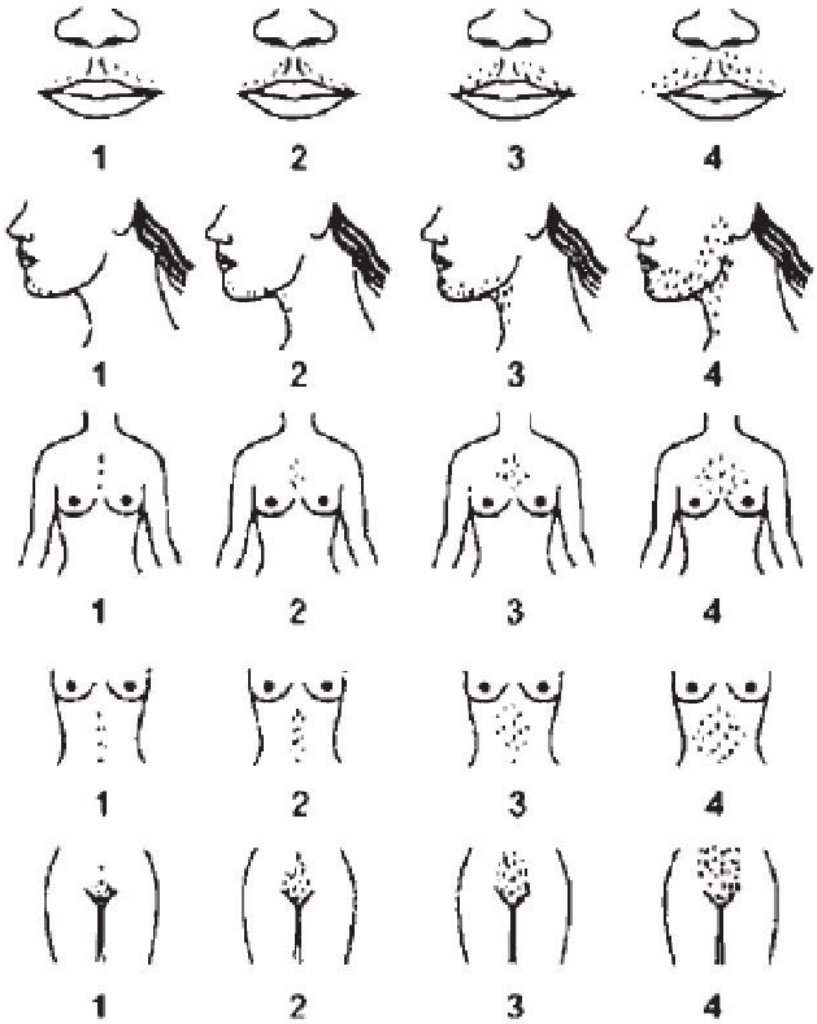
RIGHT PALM PRINT

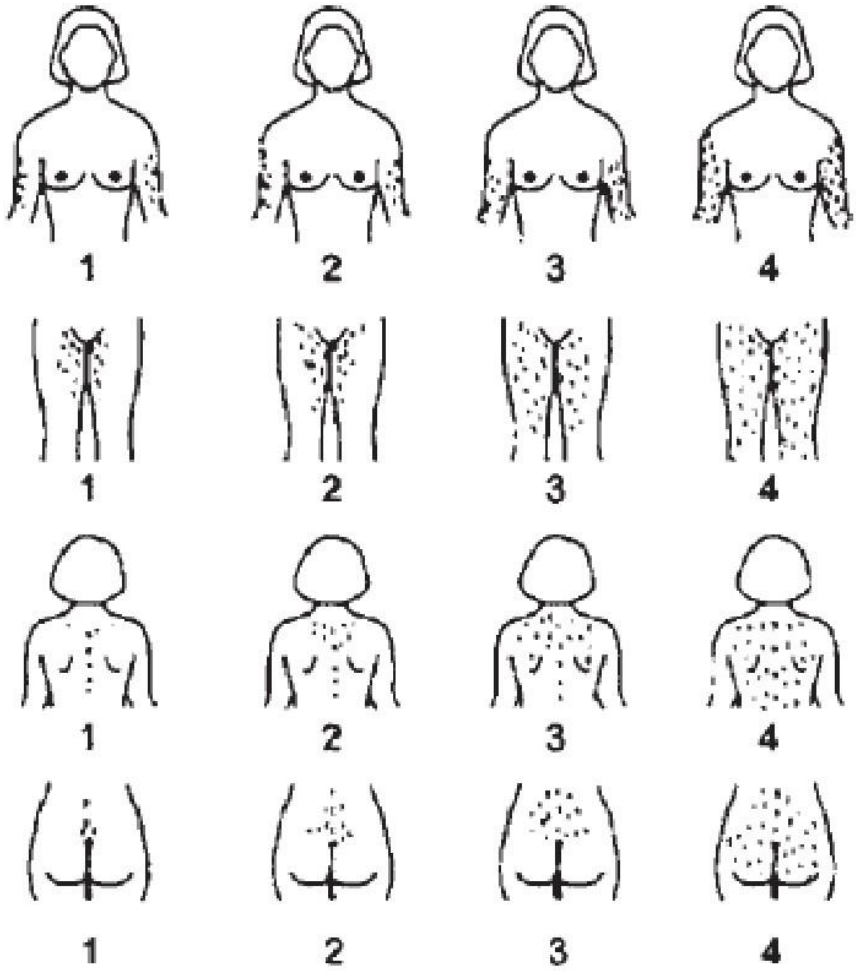
Sex	Palm Crease type	Triradii angle atd	Triradii angle dat	Triradii angle adt

LEFT PALM PRINT

Sex	Palm Crease type	Triridii angle atd	Triradii angle dat	Triradii angle adt

Carefully look at the followings images and circle the image that is representative of your own body





Schematic representation of the mFG score. Nine body areas (upper lip, chin, chest, arm, upper abdomen, lower abdomen, upper back, lower back and thighs) are scored from 1 (minimal terminal hairs present) to 4 (equivalent to a hairy man). If no terminal hairs are observed in the body area being examined the score is zero (left blank). Clinically, terminal hairs can be distinguished from vellus hairs primarily by their length (i.e. .0.5 cm) and the fact that they are usually pigmented. Reproduced with permission from R.Azziz (Yildiz*etal.,* 2010).