

**A COMPARATIVE STUDY OF DIGIT RATIOS OF SICKLE CELL AND NORMAL SUBJECTS IN SOUTHERN NIGERIA**\*<sup>1</sup>Josiah S. Hart and <sup>2</sup>Aaron Boma Philip<sup>1</sup>Department of Anatomy, Faculty of Basic Medical Sciences, College of Health Sciences, University of Port Harcourt, Choba, Port Harcourt, Rivers State, Nigeria.<sup>2</sup>Department of Science Laboratory Technology, Federal Polytechnic Ukana, Akwa Ibom State, Nigeria.**\*Corresponding Author: Dr. Josiah S. Hart**

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**ABSTRACT**

**Background:** This study was carried out to determine the morphological association of sickle cell patients in southern part of Nigeria. **Materials and Methods:** Comparative analysis of two hundred (200) subjects were carefully studied. The subjects comprise one hundred (100) sickle cell subjects 60 female (SS) and 40 males (SS) and 100 normal (60 females and 40 males). The parameters studied was the 2D digital ratio (ring finger) and 4D digit ratios (index finger). **Results and Discussion:** Statistically analysis showed no significant differences between sickle cell patients and normal humans ( $P > 0.05$ ). Adult sex hormones are sexual dimorphic and this is determined during early fetal development. Males tend to have a lower 2D; 4D ratio than females. **Conclusion:** This sex differences in 2D: 4D could be a result of utero concentration of sex steroids, with a low 2D:4D (for male) being positively related to prenatal testosterone (i.e. high levels of testosterone facilitates the growth of the ring finger) while high 2D:4D (for female) is positively related with prenatal oestrogen.

**KEYWORDS:** Index finger, Ring finger, Digit Ratio, Sickle cell, Nigeria.**INTRODUCTION**

The expression of one quantity of digits to another which could either be in proportion, or measurement is known as Digital Ratio. Such impression is made based on numerical methodology. These comprises the index finger, called the second digit or 2D and the ring finger; called the fourth digit or 4D, they are express as 2D: 4D.<sup>[1-3]</sup>

Manning and colleagues have shown that 2D:4D ratio vary between different ethnic groups.<sup>[4-6]</sup> This variation is far larger than as Manning put it "there is more differences between a pole and a fingerlain than a man and a woman". The variation appears to be related to latitude such that more northerly population have higher digit ratios.

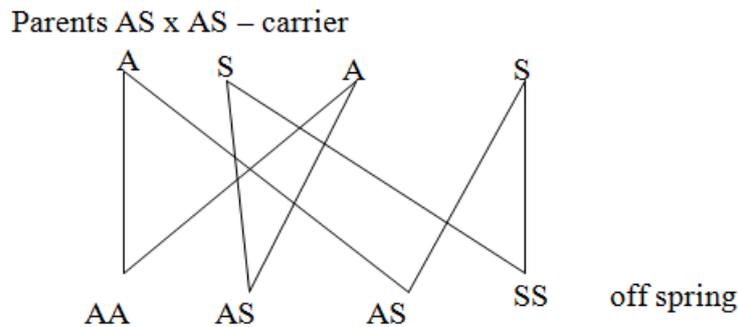
Digit ratio is said to be sexually dimorphic with mean value being lower in males than females in a normal average adult male and female<sup>[4-6]</sup> sexual dimorphism is the somatic differences between species (male and female) that arises as a consequence of sexual maturation. Men generally have shorter index finger than ring finger the ratio of the length of the index finger to the ring finger is smaller for men than for women in men, a smaller ratio (meaning the two digits are more similar in size) is thought to be associated with higher testosterone exposure before birth.

2D is almost the same length as the 4th although it may be slightly longer or shorter in men the index finger is more often shorter than the fourth. There is some evidence that testosterone facilitates the differentiation of the brain prenatally and postnatally.<sup>[7-15]</sup>

Hence finger lengths explain about 5% of the variation in these personality measures. There has been several case study on the relationship between sickle cell patients and normal people but not much on digit ratio (2D:4D).

**Definition of Sickle Cell Disease**

Sickle cell disease is considered as an inherited blood disorder characterized by defective haemoglobin, it is caused by a genetic mutation, an abnormal crescent shaped i.e., red cells, sickle cell anaemia is caused by mutation in the B-globin chain of haemoglobin, replacing glutamic acid with less polar valine at the 6<sup>th</sup> amino acid position.

**Illustration**

The presence of a defective gene (SS) is needed to have sickle cell anaemia, if each parent carries one sickle hemoglobin gene (S) and one normal gene (A) with each pregnancy there is 25% chance of the child inheriting 2 normal genes and not having the disease and 50% chance of being a carrier like the parents (see illustration above).

There are a total of 46 chromosomes in the human body with 23 pairs each. The pair of chromosome contain gene responsible for normal hemoglobin production. A mutation in this gene induces sickle cell disease. This disease is characterized by anemia, fever, acute chest syndrome, stroke, Jaundice or yellowing of the skin, eyes and mouth etc.<sup>[16-20]</sup>

Some researchers have done works on digit ratios in different subjects.<sup>[21-38]</sup>

**Aim of the Study**

This study was aimed at comparing the finger length of sickle cell humans to that of normal human subjects and the mean value of 2D: 4D of sickle cell humans and normal humans.

**Objectives**

1. To know the digit ratio in sickle cell subjects as against normal subjects.
2. To know the male: female variation of 2D:4D in sickle cell subjects.
3. Compare the finger length of sickle cell patients to that of normal subjects.

**Significance of the Study**

The result of this study will indicate whether females tend to have larger digital ratio (2D: 4D) than male. It will also ascertain to what degree vaso-occlusive crisis's of sickle cell disease may affect the finger length of sickle cell humans given that bone is one of the common target organ as well as the gender variation.

**MATERIALS AND METHODS**

**Research Design:** The study was non-experimental.

**Sample Size and Sampling Technique:** A total of two hundred (200) subjects were investigated. These includes 100 sickle cell subjects (60 females and 40 males) and 100 normal subjects (60 females and 40 males).

**Criteria for Subject Selection:** subjects recruited for this study had no known deformities of fingers and digits. The subjects were selected from Cross Rivers State (Calabar) and Akwa Ibom State (Uyo) both in Southern Nigeria.

**Ethical Clearance:** Ethical clearance was obtained from the Research Ethics Committee of the University of Port Harcourt, Nigeria.

**Data Collection:** The length of the index finger (2D) and ring finger (4D) digits of the left and right hands were measured from the tip of the finger to the ventral proximal crease, for subjects that have multiple creases at the base of the digit, the most prominent crease was used. All measurements were made and recorded using a Digital Vernier Caliper with an accuracy of 0.01cm. All measurements were taken with the subjects standing in erect position.

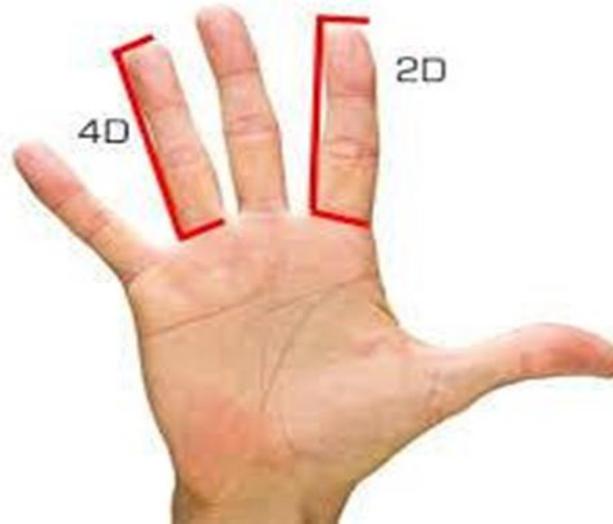


Fig. 1: Second and Fourth Digit (2D:4D) (Adopted from Jack Fisher's official publishing blog).

### Statistical Analysis

Mathematically Equation  $S.E = \frac{(S.D)}{n}$  or  $\frac{(SM=W)}{n}$

Where W=difference between highest and lowest value

n=number of values

sm=standard error of the mean

- Mean (X)

- Standard Deviation (S.D)

- Standard error (S.E)

The student t-test was used to test for significance using the ratio of the standard error and the range.

### RESULTS

The results of the study are shown in the tables 1-3. The result obtained is in accordance with the hypothesis which said. The ratio of the length of the ring and index finger (2D:4D) for normal average humans were sexually dimorphic with mean value being higher in female than male (female > male). All the values in all the parameters used did not have any statistical significant difference when the two groups were compared, as such no significant variation occurred between normal humans and sickle cell humans  $p > 0.05$ .

Table 1: 2D:4D (cm) of both normal and sickle cell humans.

Parameter	Normal males		Sickle cell males	
	Right	Left	Right	Left
Mean	0.96	0.96	0.96	0.96
Standard Deviation	0.00733	0.00680	0.00968	0.00119
Standard Error	0.00116	0.00108	0.00153	0.00119
Sample Size (n)	40	40	40	40
P>0.005				

Table 2: Mean, Standard Deviation, Standard Error of the length of second digit (index finger) (2D) (cm) of both normal and sickle cell.

Parameter	Normal males		Sickle cell males		Normal female		Sickle cell female	
	Right	Left	Right	Left	Right	Left	Right	Left
Mean	6.907	7.109	6.854	7.116	7.207	7.366	7.1897	7.2836
Standard Deviation	0.5623	0.4828	0.4974	0.6111	0.6008	0.5336	0.4735	0.5379
Standard Error	0.0889	0.07634	0.0786	0.0866	0.0776	0.0689	0.0611	0.0707
Sample Size (n)	40	40	40	40	60	60	60	60
P>0.005								

Table 3: Mean, Standard Deviation, Standard Error of length of fourth digit (ring finger) (4D) cm of both normal and sickle cell humans.

Parameter	Normal males		Sickle cell males		Normal female		Sickle cell female	
	Right	Left	Right	Left	Right	Left	Right	Left
Mean	7.114	7.379	7.180	7.370	7.214	7.375	7.194	7.287
Standard Deviation	0.5757	0.4689	0.4950	0.5373	0.6034	0.5594	0.5036	0.5271
Standard Error	0.0910	0.07414	0.0783	0.0850	0.0779	0.0722	0.0650	0.0680
Sample size (n)	40	40	40	40	60	60	60	60

## DISCUSSIONS

A close observation of the digit ratio of subjects with sickle cell anaemia its very obvious that there is no statistical significant difference between both categories under investigation. The study has shown that 2D:4D is sexually dimorphic and this could be a result the difference in sex hormones.

Studies have revealed that sexual dimorphism is determined as early as the 4<sup>th</sup> week of fetal life and remains unchanged at puberty. There are evidence that sex differences in 2D:4D arise from in utero concentration of sex steroids with low 2D:4D for male. The result of this study corroborates the reports of previous authors.<sup>[1-6]</sup>

Some authors in their study have reported that the digit ratio of the right hand 2D:4D showed a stronger association with a range of index traits and that this association positively relates with normal and sickle cell humans. Other reports from previous researchers indicate that 2D:4D digit ratio vary with sex with female having a higher value than the males. However female 2D:4D are almost the same length; although it may be slightly longer or shorter. In men the index finger (4D) is more often shorter than the ring finger (2D).<sup>[8-20]</sup> This present study affirms the reports of the previous authors.

## CONCLUSIONS

The digit ratio of index and ring finger (2D:4D) of sickle cell subjects and normal subjects have proven that there is no statistical significant variation in both categories. The study showed a mean value of digit ratio for normal subjects to be 7.130 both hands and a mean value of 7.128 for sickle cell subjects.

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## Conflict of Interest

We write to state that there is no conflict of interest.

## Source of Funding-Self-funding.

## Author's Contribution

We write to state that both authors have contributed significantly, and that all authors are in agreement with the contents of the manuscript. 'Author A' (Josiah S. Hart) designed the study and protocol, 'reviewed the design, protocol and examined the intellectual content and 'Author B' (Aaron Boma Philip) wrote the first draft of the manuscript, managed the literature search and managed the analyses of the study. All authors read and approved the final manuscript.

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