

Prevalence of Morton's Toe Amongst People of the Kalabari Tribe, Rivers State, Nigeria

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Abstract

Background: Anatomical variations have been genetically linked and the phenomenon Morton's toe is no exception. Its prevalence has been a notable phenomenon in the medical field. This study investigated the prevalence of Morton's toe amongst the Kalabari tribe of Rivers State, Nigeria. **Materials & Methods:** A total of 446 participants were sampled for this study. **Results & Discussions:** The observed longer second toe pattern was described as present (both feet, right foot or left foot), while a shorter second toe was described as absent. Morton's toe was more prevalent (65.9%) in the studied population than absent (34.1%); with males (34.7%) having slightly higher proportion of Morton's toe than females (31.2%), a little difference of 3.5% which was not so significant. The pattern of inheritance of Morton's toe was without sex predisposition, with larger population exhibiting Morton's toe. The male participants had a present to absent ratio of 3:1 indicating that for every three males who had Morton's toe, one male around did not. The female participants had a present to absent ratio of 2:1 indicating that for every two females who had Morton's toe, one female around did not have it. **Conclusion:** In the general population, the ratio for present to absent is 2:1, implying that for every two persons with Morton's toe in the population, there is one person who does not have it. The study also observed bilateral symmetry (i.e., some individuals presented with Morton's toe on both feet), while others had it on either the left or right foot.

Keywords: Prevalence, Morton's Toe, Kalabari, Rivers State.

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INTRODUCTION

The human foot plays a key role in supporting the weight of the body, in keeping a stable upright

posture and in providing locomotion. It must be flexible enough to absorb the ground reaction forces and stiff enough for weight-bearing (Moore & Dailey, 2014).

The features and shape of the human foot have aroused interest since ancient times. Several types of soles are described according to their shape and toe length. One of the most common is the Greek foot, which can be seen in many statues from ancient Greece: Venus de Milo and also in the Michelangelo's David. (Noutsou & Vounotrypidis, 2015). This type of foot is characterized with longer second toe compared to the first one. The condition is named Morton's toe after the orthopedic surgeon Dudley J. Morton (1884–1960) in the early 20th century.

Morton's toe is a congenital condition with brachymetatarsia. It is usually asymptomatic, but in some occasions the hypermobility or instability of the first metatarsal bone can result in gait changes, in calluses formation and hammertoes. Some people simply have it, while others don't, and it's fairly prevalent (Adekoya *et al.*, 2020).

Inappropriate footwear, injuries, or overuse do not contribute to Morton's toe, this is because it has hereditary Morphogenetic features, which vary in expression among populations. There are also observable

characteristics that people inherit from their parents in an autosomal dominant or recessive fashion (Aigbogun *et al.*, 2019).

This research is aimed at determining the prevalence of Morton's toe among the Kalabari tribe of Southern Nigeria. This study is limited to accessing the toe for the presence or absence of Morton's toe. The findings of this study would be useful in educating the masses on the phenomenon of 'Morton's toe', creating the awareness that it is not a disability of any sort neither is it a deformity that would reduce the quality of life but rather just a variation in nature and does not call for any drastic measures to be taken.

MATERIALS AND METHODS

Study Area

The study was done on the Kalabari tribe of Rivers State. The Kalabari are a sub-group of the Ijaw people living in the eastern Niger Delta region of Nigeria. With a population of about 350,000(National Population Commission), the Kalabari area spans over a remarkable part of the south side of River State.



Fig. 1: Map of Kalabari kingdom (Kalabari Virtual Town Hall Meeting, 2016).

Study Design: This study was a cross-sectional study design involving indigenes of the Kalabari tribe of Rivers State, Nigeria.

Sample Size

Based on the Metropolitan Nigeria Area Population, Kalabari has a population of approximately 350,000 (National Population Commission). Taro Yamane's formula for sample size was used to calculate the sample size for this study;

n: sample size

N: the population of the study (350000)

e: the margin error in the calculation (0.5)

$$n = N / (1 + Ne^2) = 350000 / (1 + 350000 * 0.5^2)$$

$$350000/1+500$$

n = 394 However, the number of participants for the study was 446 individuals.

Sampling Techniques

A multi- staged sampling technique comprising the block (cluster) sampling used in picking participants from the traditionally arranged compounds and the simple random sampling technique used to select participants from selected families based on a ballot system. This was done based on consent of the participants, those who disapproved were left out with no consequences. All eligible participants were then given serial numbers which was used to begin data collection.

Instruments and Methods of Data Collection

Data for the study was collected using a self-created, closed-ended questionnaire that was adapted for use based on previous research on similar studies. It explored socio-demographic factors such as age, educational level and marital status. It also examined the presence or absence of Morton's toe which was by both physical observation and measurement. Each participant was allocated a number (E.g. 5). The length of both the big and second toes were then measured and recorded twice and the mean value calculated and used (done to reduce error).

Data was collected using the following methods and materials:

1. Questionnaire
2. Physical observation
3. Digital Vernier caliper – to accurately measure the length of the toes

Data Management

The data obtained from the structured questionnaire were uploaded from the recorded notes to the Microsoft Excel tool for proper arrangement based on the outlined categories. The upload was cross checked to avoid error and false results. The uploaded data was then analyzed using descriptive and inferential tools of the Statistical Package for Social Sciences (SPSS) version 29.

Ethical Consideration

Ethical approval was sought and obtained from the Research and Ethical Committee of the Faculty of

Basic Medical Sciences, Rivers State University, with REC number RSU/FBMS/REC/23/016 before the commencement of the study. A consent form was given to all participants, which they signed after reading the information provided about the nature of the study. The content of the consent form was clearly read out to participants who could not read in a language best understood by them. Participants were free to opt out of the study without penalty if they decided not to engage or felt uncomfortable with the study.

RESULTS

Socio-Demographic Characteristics of Participants

The most frequent socio-demographic characteristics were age category 31-45yrs with 145(32.5%), female gender with 229(51.3%), secondary education with 164(36.8%). A relatively high percentage of participants with Morton's toe completed their secondary school education, this might be an indication that they were not segregated for it, as the feet were usually exposed due to the usage of sandals as the accepted footwear in secondary schools. This could mean that people with Morton's toe within the tribe were socially accepted rather than discriminated. However, this statement was not researched on exclusively and therefore may not necessarily be the reason for a high percentage of participants with a longer second toe completing secondary education. A total number of 429(96.2%) participants of the sampled population had some level of education indicating a good level of literacy within the population.

Table 1: Socio-demographic characteristics of participants

Socio-demographic characteristics	Frequency (n)	Percent (%)
Age category		
16 – 30	118	26.5
31 – 45	145	32.5
46 – 60	95	21.3
61 – 75	66	14.8
76 – 90	22	4.9
Total	446	100
Gender		
Male	217	48.7
Female	229	51.3
Total	446	100
Education		
No formal education	17	3.8
Primary	116	26.0
Secondary	164	36.8
Tertiary	149	33.4

Table 2: Distribution of Morton's toe

Morton's toe	Frequency(n)	Percent (%)
Present	294	65.9
Absent	152	34.1
Total	446	100

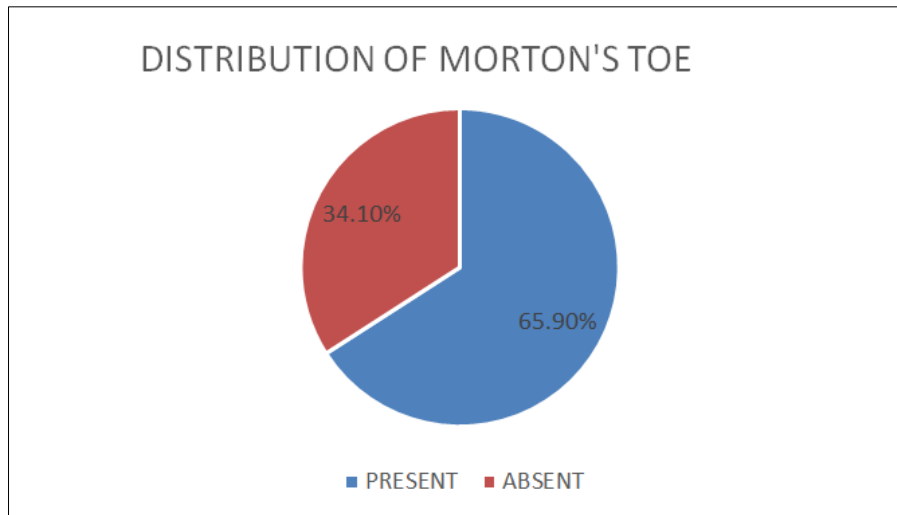


Fig. 2: Distribution of Morton's toe

Table 2 and Fig 2 respectively show the distribution of the Morton's toe characteristic amongst the sampled male and female participants.

Table 3: Comparison of Morton's toe distribution with socio-demographic characteristic

Comparison of Morton's toe distribution with sex: demographic charts					
GENDER	MORTON'S TOE				
	PRESENT			ABSENT	TOTAL
	RIGHT	LEFT	BOTH		
MALE	24(11.1%)	12(5.5%)	119(54.8%)	62(28.6%)	217(100%)
FEMALE	20(8.7%)	20(8.7%)	99(43.3%)	90(39.3%)	229(100%)
TOTAL	44	32	218	152	446

DISCUSSION

The information obtained from the structured questionnaire was entered and analyzed using the Statistical Package for Social Sciences (SPSS) version 29. Descriptive statistics were carried out on sociodemographic data. The frequencies generated were presented using tables and charts. The chi-square and Fisher's exact test were used to examine the relationship between variables. A p-value of less than 0.05 was considered significant.

Data were collected from 446 participants; 217 (48.7%) males and 229 (51.3%) females [Table 3]. The percentage of males who had a longer second toe was more compared to that of the females, these finding support the idea that sexual dimorphism in skeletal development in early fetal life is associated with differences between the exposure to androgens in males and females, (Rivas *et al.*, 2014). Sex-associated difference in the distribution of Morton's toe is presented in Table 3. The result from Figure 2 indicates that the distribution of Morton's toe was more in the studied population. One hundred and fifty-five (34.7%) males had Morton's toe as against 62 (13.9%) males who did not, while 139 females (31.2%) had as against 90 (20.2%) who did not. The male participants had a present to absent ratio of 3:1 indicating that for every three males who had Morton's toe, one male around did not. The female participants had a present to absent ratio of 2:1

indicating that for every two females who had Morton's toe, one female around did not have it. In the general population, the ratio for present to absent is 2:1, implying that for every two persons with Morton's toe in the population, there is one person who does not have it.

The study observed bilateral symmetry (i.e., some individuals presented with Morton's toe on both feet), while others had it on either the left or right foot. The frequency of Morton's toe (65.9%) was more when compared to its absence (34.1%), which did not conform with the study of (Paul *et al.*, 2023) on Idoma tribe (Benue State, Nigeria), which reported 71.7% longer big toe (absence) in the sampled population. A higher percentage of males (34.7%) presented with longer second toe than females (31.2%), a little difference of 3.5% which was not so significant. Longer second toe might have expressed some level of dominance over longer big toe, but this is not a clear indication of the dominance of the longer second toe. Although various researchers have expressed doubts that Morton's toe, like several other traits such as ear lobe attachment and nose shape, which is believed to be transmitted in a Mendelian fashion, is rather based on more complex genetic models. Kaplan claimed that the relative length of the hallux and second toe is simply inherited with long hallux being recessive (Aigbogun *et al.*, 2019). In Ebeye *et al.*, (2014), the study concluded that the morphogenetic traits investigated varies in the population but do not vary with

gender, this conclusion was not in conformance with this study as the prevalence of Morton's toe amongst the male population was more than that of the female suggesting the males might have a slight edge in manifesting some morphogenetic traits than the females as was reported by Rivas *et al.*, (2014). According to Munir *et al.*, (2015), the higher prevalence of the morphogenetic characters observed; free earlobe, attached earlobe, bent little finger, straight little finger, Hitchhiker's thumb and straight thumb was observed among females. The Chi-Square test showed an association of bent little finger and Hitchhiker's thumb with gender. This conclusion was in conformance with Rivas *et al.*, (2014) and this study, which further suggest that morphogenetic traits are possibly influenced by sexual dimorphism. Paul *et al.*, (2023) said Morton's toe was most frequent in the male gender resulting in sexual dimorphism. The result of this study corroborates the reports of the following persons (Ebeye *et al.*, 2014; Eboh *et al.*, 2017; Aigbogun *et al.*, 2019; Adekoya *et al.*, 2020), and who had in the past reported similar results in their respective study populations and is also in conformance with this study.

CONCLUSION

This study has investigated the Prevalence of Morton's toe amongst people of the Kalabari tribe, Rivers State, Nigeria. The study found that the proportion of participants with Morton's toe was 65.9% while 34.1% did not have. It should be noted that the large frequency of a trait in a population does not make it dominant. The pattern of inheritance of Morton's toe was without sex predisposition, with larger population exhibiting longer second toe.

Recommendation: We recommend that the findings of the study be used as a reference for other studies on indigenous tribes.

Contributions to Knowledge

This study has investigated the Prevalence and Inheritance Pattern of Morton's toe amongst people of the Kalabari tribe, Rivers State, Nigeria. The study found that the proportion of participants with Morton's toe was 65.9% while 34.1% did not have.

The pattern of inheritance of Morton's toe was without sex predisposition, with larger population exhibiting longer second toe.

The male participants had a present to absent ratio of 3:1 indicating that for every three males who had Morton's toe, one male around did not. The female

participants had a present to absent ratio of 2:1 indicating that for every two females who had Morton's toe, one female around did not have it. In the general population, the ratio for present to absent is 2:1, implying that for every two persons with Morton's toe in the population, there is one person who does not have it.

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