



## ANTHROPOMETRIC MEASUREMENT OF FOOT LENGTH, FOOT BREADTH & THEIR RELATION TO SEX IN JAMMU AND KASHMIR POPULATION.

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**ABSTRACT** **INTRODUCTION:** Determination of sex from foot dimensions is of great value in Anthropology as well as forensic sciences for personal identification and medico legal purposes.

**AIM:** The aim of present study was to find relation between foot dimensions and sex in J&K population.

**METHODOLOGY:** A sample of 200 medical students (100 males and 100 females) between the age group of 18-25 years were taken up for this study. Anthropometric measurement i.e, foot length and foot breadth was measured separately on left and right side of each individual.

**RESULTS:** Foot index was calculated and it was found that the overall left foot index for males is 38.18 and for females is 37.44. This indicates that the value of left foot index is more than 38 is male and foot index less than 38 is female. For right foot, foot index is 38.24 for males and 37.44 for females. Interpretation suggested that foot index for right foot more than 38 indicates male gender and foot index less than 38 suggest female gender.

**KEYWORDS :** Foot Length, Foot Breadth, Foot index.

### INTRODUCTION:

All human beings belong to same species (Homo sapiens) and still no two individuals are exactly alike in their measurable traits. Even genetically identical twins may differ in some respects. Recently **Dayananda R, et al 2014<sup>3</sup>** defined the anthropometry as a series of systematized techniques which express the dimensions of human skeleton quantitatively. It is viewed as a basic tool of biological anthropology and is finding increased use in the medical sciences, especially in the discipline of forensic medicine. Anthropometry has continuously been used in forensic examinations of unknown comingled human remains (**Waghmare Vet al, 2010<sup>10</sup>**).

Sex determination is an important and one of the foremost criteria in establishing the identity of an individual (**Kanchan T & Krishan K, 2011<sup>5</sup>**). Sex determination is relatively easy if the entire skeleton is available but pelvis and skull are more reliable bones for this purpose. However in medico legal cases one does not always have a complete pelvis or skull, hence it is important to be able to assess sex from other parts of skeleton also (**Bhosale RS & Zambare BR, 2013<sup>3</sup>**). In this regard, it has been observed that foot can be useful as it is usually protected by the shoes. In case of mass disasters where there is a chance of evaluating various mutilated parts of the body, DNA technology could be the most accurate procedure for the identification of body parts. However DNA analysis lacks in terms of affordability in India. Hence identification by anthropometry could be a reasonable, convenient and simple solution till the DNA analysis takes off in India (**Saharan RA & Arun M, 2015<sup>7</sup>**).

**Vernon DW & McCourt FJ, 1999<sup>9</sup>** stated that forensic podiatrists apply their experience and sound podiatric knowledge in forensic investigations, to show the association of an individual to the scene of crime and answer any legal question regarding foot or footwear.

In forensic science, determination of sex is quite important for identification of a person. For a given stature, the dimensions of the foot are proven to be relatively smaller in females, as compared to males. Female feet are not only scaled down isometric version of male feet but also differ in number of shape characteristics. A women foot has higher arch, shallow first toe, a shorter length of outside ball of foot, and small instep circumference. This structural variation can be used to identify the sex of a person.

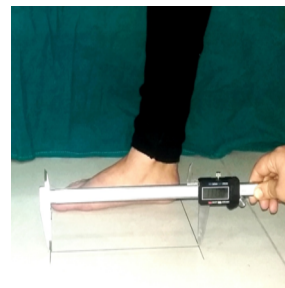
### MATERIAL AND METHODS:

After written and informed consent, a sample of 200 medical students (100 males and 100 females) between the age group of 18-25 years from Government Medical College and Government Dental College, Jammu. The study was conducted in a separate post-graduate room. The objective and methods of the study was explained to the sample population and informed consent was obtained, by taking their signatures. Foot measurements i.e, foot

length and foot breadth were measured.

**Foot length :** is the distance from the most prominent part of heel to the most distal part of longest toe (greater or second toe)(Fig 1).

**Foot breadth:** It is the distance between the most prominent point on the medial aspect of head of first metatarsal and the most prominent point on lateral aspect of head of fifth metatarsal (Fig 2). After taking all these measurements, foot index was calculated.



(Fig.1)



(Fig. 2)

**Foot index**=Foot breadth/Foot length×100

### OBSERVATION AND RESULTS:

**Table : Showing left foot index as per age of male and female subjects**

Age	LeftFootLength		LeftFootBreadth		LeftFootIndex	
	Male	Female	Male	Female	Male	Female
18 - 20 Years	25.65	23.12	9.81	8.57	38.23	37.07
21 - 23 Years	26.12	23.30	9.97	8.76	38.16	37.59

24 - 25 Years	26.00	23.06	9.94	8.66	38.23	37.55
Overall	26.01	23.22	9.93	8.70	38.18	37.44

**Table : Showing right foot index as per age of male and female subjects**

Age	RightFootLength		RightFoot Breadth		RightFootIndex	
	Male	Female	Male	Female	Male	Female
18 - 20 Years	25.60	23.17	9.84	8.60	38.45	37.07
21 - 23 Years	26.22	23.46	10.01	8.84	38.18	37.59
24 - 25 Years	26.13	23.14	9.99	8.70	38.22	37.55
Overall	26.08	23.35	9.97	8.76	38.24	37.44

#### DISCUSSION:

Forensic experts often deal with unidentified deceased or mutilated remains. Many factors have to be studied and considered in order to make an identification. Determination of sex play a very important role in establishing identity. So when sex is known, half of the identity is known. Forensic experts often deal with unidentified deceased or mutilated remains. Sex determination is a vital part of analysis of human remains. In present study attempts have been made to find correlation of foot measurement with sex .It was done by evaluating foot index which is calculated by dividing the foot breadth by foot length and multiplied by 100.

Foot Index=Foot Breadth/Foot Length

The physical anthropometric studies show gender differences. In our study males had average foot length 2cm and foot breadth 1cm greater than females. In all age groups, foot index in males was found to be greater than 38, and in females it was less than 38. Therefore this value i.e 38 can be used as deviation point for determination of sex .So foot index more than 38 is suggestive of male and less than 38 is suggestive of female. Thus the study indicates a positive correlation between individuals foot measurement and gender. This is in consonance with study done by **Danborono B & Elukpo A, 2008**<sup>1</sup> where foot index >34 was suggestive of male population and less than 34 is suggestive of female sex .Other study that predicts gender from foot index was done by **Tobias KE et al, 2014**<sup>8</sup> where males have foot index more than 40 and females have foot index less than 40. Another study done by **Agnihotri A et al, 2006**<sup>1</sup> showed that male population have foot index less than 37 and females have foot index more than 37. Similar study done by **Singla R et al, 2012**<sup>7</sup> shows that foot index for males is less than36 and for females is greater than 36.

By devising a reference point i.e foot index we can predict the sex of an unknown individual from the foot dimensions. So, this study could be helpful in medicolegal cases especially in identification of severed body parts in forensic and criminal identification. Also this study may be helpful in plastic and reconstructive surgeries.

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