



Sex Determination from Head Circumference and Maximum Head Diameter in Femur

Dr.S. Ranjan Bajpai

Associate professor Department of Forensic Medicine and Toxicology, SMBT Institute of Medical Sciences and Research Centre, Nasik, Maharashtra, * Corresponding Author

Dr. Amol Maiyyar

Assistant professor Department of Forensic Medicine and Toxicology, SMBT Institute of Medical Sciences and Research Centre, Nasik, Maharashtra.

ABSTRACT

Introduction: Femur is the strongest and longest bone of the body. Sexual identification from the skeletal parts has medico legal importance.

Material and Methods: The present study was conducted on 160 unknown femora were selected for this study, from the department of anatomy and department of Forensic Medicine And Toxicology, SMBT institute of Medical Sciences & Research centre, Nasik, Maharashtra were included in the study. A set of following two anthropometric parameters were studied from left sided femur. Measurements were made using Vernier caliper, flexible measuring tape.

Result : It was found that the head circumference and maximum head diameter were significantly higher in males as compared to female.

Conclusion: We concluded that both parameter are most important for sex determination of dried femora.

KEYWORDS : Femora, Head circumference, Maximum head diameter , Nasik district.

INTRODUCTION :

Femur is a Latin word means thigh. It is named so because it belongs to thigh. Femur is the strongest and longest bone of the body. Femur constitutes more than one-quarter of the height of the individual. Femur head is more than half of a sphere. It articulates with hip bone at acetabulum to form hip joint. In spite of the fact that latest statistical techniques such as multivariate analysis dramatically improve the percentage of accuracy, they are not used now a days¹.

Sexual dimorphism in the femur is due to modification of the female pelvis with respect to its specialized function of reproduction². A simple methods of sex determination from fragmented skeletal remains are available to forensic anthropologists and skeletal biologists. The head of the femur is an example of such bone fragments³. Skull and pelvis are the highly reliable skeletal element for sex identification⁴. Therefore it is important to be able to assess sex from the other parts of the skeleton also⁵.

Pavel Timonov et al studied sexual dimorphism in the femur among contemporary Bulgarian population data is then compared with data similarly from Thai, North American, African, East Asian and Croatian⁶. Medico legal importance of femur neck shaft angle is usually reduced if the disease involves its head and neck. This is called coxa vara.

The purpose of this study is the osteometric assessment of sexual dimorphism in head circumference and maximum head diameter of femur in local population of Nasik.

MATERIAL AND METHODS:

The study was conducted in the department of Forensic Medicine And Toxicology, SMBT institute of Medical Sciences & Research centre, Nasik. The present study was conducted on 160 unknown femora were selected for this study. Bones with femoral prosthesis, cortical bone deterioration, extreme osteophytic activity and diffuse osteoarthritis were excluded.

A set of following two anthropometric parameters were studied from left sided femur. Measurements were made using Vernier caliper, flexible measuring tape.

Following measurements were taken:

Head circumference – measured on the border of the articular surface by measuring tape.

Maximum Head diameter – measured with a Vernier caliper.

The reason for choosing the left sided femur because left lower limb is functionally dominant in majority of humans. Demarcating point was measured by using mean \pm 3SD (calculated range, cover 99.75% of sample) for all the parameters. Ethical approval was granted by the Institutional Ethics Committee (IEC). All the data were entered and analyzed by using statistical packages for social science (SPSS) software version 20.

RESULT:

The following tables shows the results of present study:

Table no: 1 shows that maximum head diameter measurement were significantly higher in males as compared to female. The average maximum diameter of femoral head of males femur was 45.02mm. Average maximum diameter of femoral head of female femur was 39.03mm. The male demarcating point higher in males than the females. Demarcating point method identified 24% males and 62% females.

| Statistical values | Left side | |
|--------------------|---------------|-----------------|
| | Male (N = 95) | Female (N = 65) |
| Range | 43-51 | 37-46 |
| Mean (mm) | 45.02 | 39.03 |
| SD (mm) | 2.07 | 2.32 |
| Demarcating point | >48.50 | <36.24 |
| Percentage (%) | 24% | 62% |
| P value | <0.001 | <0.001 |

Table No:1 showing the maximum head diameter of left side femur and its Statistical values.

Table no: 2 shows that head circumference measurement were significantly higher in males as compared to female. The average head circumference of femoral head of males femur was 135.28 mm. Average head circumference of femoral head of female femur was 120.30 mm. The male demarcating point higher in males than the females. Demarcating point method identified 15% males and 20% females.

| Statistical values | Left side | |
|--------------------|---------------|-----------------|
| | Male (N = 95) | Female (N = 65) |
| Range | 131-152 | 116-155 |
| Mean (mm) | 135.28 | 120.30 |
| SD (mm) | 6.07 | 8.43 |
| Demarcating point | > 147.42 | <117.89 |
| Percentage (%) | 15% | 20% |
| P value | <0.001 | <0.001 |

DISCUSSION:-

The present study conducted in department of Forensic Medicine And Toxicology, SMBT institute of Medical Sciences & Research centre, Nasik. Two measurements of femur shows the presences of sexual dimorphism. Our result shows that maximum head diameter were significantly higher in males as compared to female. Kalpana et al¹ identified only 47% bone with demarcating point of maximum head diameter of femur. This is because of significant overlapping of measurements in the two sexes. Formula derived from this study distal epiphyseal breadth + Head Diameter + Midshaft Transverse Diameter which provided 96 % overall accuracy of Western Maharashtra region.

Hema Nidugala et al⁷ studied in south Indian population Epicondylar breadth (EB) is the best parameter for sex determination which agrees with other published data in different population⁸⁻¹⁰. Asala SA mean head diameter of the male femur was significantly greater than the mean head diameter of the female femur in both population groups (white and black South Africans). These values were correspondingly greater in the white than the black population³. In Chinese population distal epiphyseal breadth is the most dimorphic part¹¹. Osteometric Standards that can be used in determining sex in the identification process, the values of the mean maximum length in male femora in Maharashtra was 450.82 mm (right) and 452.37 mm (left) and that in female 416.49 mm (right) and 420.43 mm (left)¹².

Akhtari Afroze et al¹³ studied on Northern Zone (Rajshahi) of Bangladesh. This study suggests that femoral head diameters are of value in sex differentiation among the inhabitants of this region. Nigerians and nearer to that of the Indians. Nigerians are taller than average Indians and so their femoral heads are bigger than that of Indians and Bangladeshi people¹⁴.

In our study head circumference measurement were significantly higher in males as compared to female. Pavel Timonov et al⁶ results shows that upper end and circumference of the head is most successful in sex determination Bulgarian population. Urvik C. Kukadiya et al¹⁵ on his study entitle " Sex determination from vertical diameter of femoral head in Gujarati population" by using DP method for vertical diameter of femoral head, 2.61 % of male femur was correctly identified as male femur and 19.23 % of female femur was correctly identified as female femur.

CONCLUSION :

Present study has set a benchmark for sex determination from dried femora. From medico legal perspective suggests the estimation of sex from available fragmentary femora specific to the district of Nasik.

REFERENCES:

1. Kalpana.R.Gaikwad, Dr.V.R.Nikam. Sexual Dimorphism in Femur. IOSR Journal of Dental and Medical Sciences (IOSR-JDMS) e-ISSN: 2279-0853, p-ISSN: 2279 0861. Volume 13, Issue 7 Ver. VI (July, 2014), PP 04-09.
2. Purkait R and Chandra H; sexual dimorphism in femora: Central India study; Forensic science communications; 2002; volume 4; issue 3; Page No 1-6.
3. Asala SA. Sex determination from the head of the femur of South African whites and Blacks. Forensic Sci Int. 2001 Mar 1;117(12): 1522.
4. Krogman WM and Iscan MY; Human skeleton in forensic medicine; Ch. 5 sex differences in the long bones; 3rd edition; Springfield USA; Charles C. Thomas; 1978; Page No. 143-150.
5. Pandya A M, Singel T C, Akbari V J3, Dangar K P, Tank K C, Patel M P. Sexual dimorphism of maximum femoral length. National journal of medical research. Vol 1 Issue 2 Oct – Dec 2011 : ISSN 2249 4995.
6. Pavel Timonov, Antoaneta Fasova, Dobrinka Radoinova, Alexandar Alexandrov, and Delian Delev. A study of sexual dimorphism in the femur among contemporary Bulgarian population. Euras J Anthropol 5(1):46–53, 2014.
7. Hema Nidugala, Bhagya Bhaskar, Sucharitha Suresh, Ramakrishna Avadhani. Metric Assessment Of Femur Using Discriminant Function Analysis In South Indian Population. Int J Anat Res 2013, Vol 1(2):29-32. ISSN 2321- 4287.
8. Van Gerven DP. The contribution of size and shape variation to patterns of sexual dimorphism of the human femur. Am J Phys Anthropol 1972; 37: 49-60.
9. Iscan MY, Shihai D. Sexual Dimorphism in the Chinese Femur. Forensic Sci Intern 1995; 74(1-2), 79-87.
10. Humphrey LT. Growth patterns in the modern human skeleton. Am J Phys Anthropol 1998;105: 57–72.
11. Işcan MY, Shihai D. Sexual dimorphism in the Chinese femur. Forensic Sci Int. 1995 Jun 30;74(12):7987.
12. Rajeshwari S. Bhosale1, Dr. B. R. Zambare. Sex determination from femur using length

of femur in Maharashtra. IOSR Journal of Dental and Medical Sciences (JDMS) ISSN: 2279-0853, ISBN: 2279-0861. Volume 3, Issue 4 (Jan. - Feb. 2013), PP 01-03.

13. Akhtari Afroze, M Durrul Huda. Femoral Head Diameters and Sex Differentiation in the Northern Zone (Rajshahi) of Bangladesh. TAJ December 2005; Volume 18 Number 2.
14. Asala SA, Mbajorgu FE. And Papandro BA. A comparative study of femoral head diameters and sex differentiation in Nigerians. Acta Anatomica 1998; 162:232-237.
15. Urvik C. Kukadiya, Tulsibhai C. Singel, Pratik N. Trivedi, Jayesh K. Rathava, Vidya K. Saptara, Dilip V. Gohil, Mital M. Patel. Sex determination from vertical diameter of femoral head in Gujarati population. International Journal of Advanced Research (2014), Volume 2, Issue 6, 859-863