



## Original Article

# Femoral Head Diameters and Sex Differentiation in the Northern Zone (Rajshahi) of Bangladesh

Akhtari Afroze<sup>1</sup>, M Durrul Huda<sup>2</sup>

### Abstract

This study was aimed to find out the variations of the femoral head diameters in relation to sex in Bangladeshi people. The study was based on 123 paired human femurs (radiological view) of which 52 were male and 71 were female. It was observed that the mean vertical and transverse diameters of the head of the male femur were significantly greater than that of female ( $P < 0.001$ ). No statistical significant difference was present between the measurement of the right and left side of the same sixth identification points that were derived from the vertical and transverse diameters of the head of the femur were higher in males than in females. The results showed that diameters of the femoral head as well as the identification points that are derived from them are of use in sex identification. The present study is of value to the forensic experts, orthopaedicians and prosthetists as it gives the idea about the dimensions of the femoral head in the present area.

TAJ 2005; 18(2): 84-88

### Introduction

Determination of an individual's sex from the available skeleton is of great importance in forensic medicine<sup>1</sup>. In medico legal cases, determination of stature, sex and age from skeletal remains of deceased person is often referred to the anatomist and other professionals in the field of anthropology<sup>2, 3, 4</sup>. Although male bones are generally longer, thicker and heavier with more prominent points of muscle attachment than female ones it is very difficult to identify sex by examining a individual bone, except the hip bone<sup>2</sup>.

Therefore, most of the long bones, either individually or in combination have been subjected to statistical and morphological analysis for the purpose of determining sex<sup>3,4,5</sup>.

The study of the dimensions of the head of the femur for the purposes of sex identification has been carried out by several anatomists and anthropologists<sup>6-10</sup>. They concluded that dimensions of femoral head are variable and it varies according to sexes, races, heredity, climate and other geographical factors. So far as I know, no such work had yet been done in Bangladesh to differentiate the sex of the femora.

The knowledge of various dimensions of the femoral head in both sexes will not only help the anatomists and forensic experts in sexing the femora but will also be of immense importance in prosthesis of femoral head which may be used by the orthopaedic surgeons in femoral head replacement surgery<sup>11</sup>.

<sup>1</sup> Professor, Department of Anatomy, Rajshahi Medical College, Rajshahi-6000, Bangladesh

<sup>2</sup> Assistant Professor, Department of Radiology, Rajshahi Medical College, Rajshahi-6000, Bangladesh.

So my study is a little attempt to gain knowledge about the metric standards of femoral head in Bangladeshi people in both sexes and to find out its variations according to sexes.

### Materials and methods

The materials used for these investigations were X-ray films of femurs of adult individuals whose ages ranged between 15 and 70 years and those sexes were known. They were selected from consecutive X-rays taken at the Radiology Department of Rajshahi Medical College, Rajshahi, and from various private diagnostic centers of Rajshahi city from January '2005 to May 2005.

Only radiographs that showed no evidence of pathological disorders and whose cortices at the femoral heads were intact were included in the study. A total of 123 radiographs of paired femurs (246 femurs) showing the pelvis and hip joints fulfilled these condition. Out of these 71 radiographs (142 femurs) were of male and 52 radiographs (104 femurs) were from female subjects.

The films were taken at a routine object film distance of 5 cm and focal-film distance of 92 cm in the antero-posterior view and with the big toes touching on their medial aspects. A magnification correction factor of 2.86% was applied to the measurements<sup>12</sup>.

Measurements were done by compus and millimeter scale and the results were expressed in millimeter.

The vertical diameter of femoral head was measured as the straight distance between the most superior to the most inferior point of the femoral head at right angle to the long axis of the neck of femur<sup>11</sup>. The transverse diameter of femoral head was measured from the centre of the line of junction between head and neck of femur to the point of maximum curvature of head, along the same line to the long axis of neck<sup>13</sup>. Statistical

analysis was done to see the significance of the differences between the male and female values of the right and left femoral head diameters.

The male identification point was determined as the maximum value of the range of diameters of the head of the female femur. The female identification point was determined as the minimum value of the range of values for the male<sup>7</sup>.

### Results

The results of measurements of vertical and transverse diameters of the heads of the left and right femurs in males and females are presented in table-I. The vertical and transverse diameters of the head of the male right femur were significantly greater than the corresponding diameters of the head of the female right femur ( $P < 0.001$ ; Table-I) similarly, the vertical and transverse diameters of the head of the male left femur were significantly greater than the corresponding diameters of the head of the female left femur. The mean right and left vertical and transverse diameters of both male and female femoral head are also shown in table-1. There is no significant difference between the values of the right and left side of femoral head. The male identification points that were derived from the vertical diameters were 53 mm for the right femur and 52 mm for the left femur. The corresponding female identification points were 43 mm for the right femur and 42 mm for the left femur (Table-1; bar diagram-1,2,3,4). The transverse diameter of the head of the femur gave the identification points of 46 mm for the male right, 45 mm for the male left, 34 mm for the female right and 33 mm for the female left femur (Table-1; bar diagram-1,2,3,4).

**Table-1:** Measurement of the vertical and transverse diameters of femoral head.

Parameters	Vertical diameter				Transverse diameter			
	Male (n=52)		Female (n=71)		Male (n=52)		Female (n=71)	
	Right	Left	Right	Left	Right	Left	Right	Left
Range of femoral head diameter in mm.	43-60	42-59	39-53	40-52	34-50	33-50	31-46	30-45
Mean diameter of femoral head in mm.	51.6	51.5	45.7	45.6	42.3	42.1	37.6	37.4

S E. in mm.

1.30

1.31

1.19

1.19

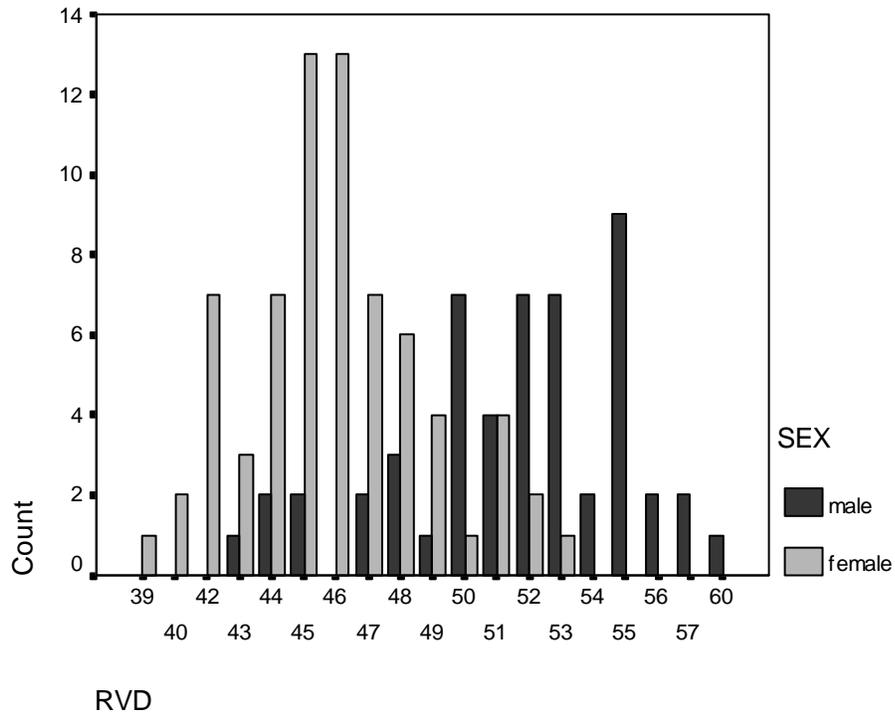
1.34

1.33

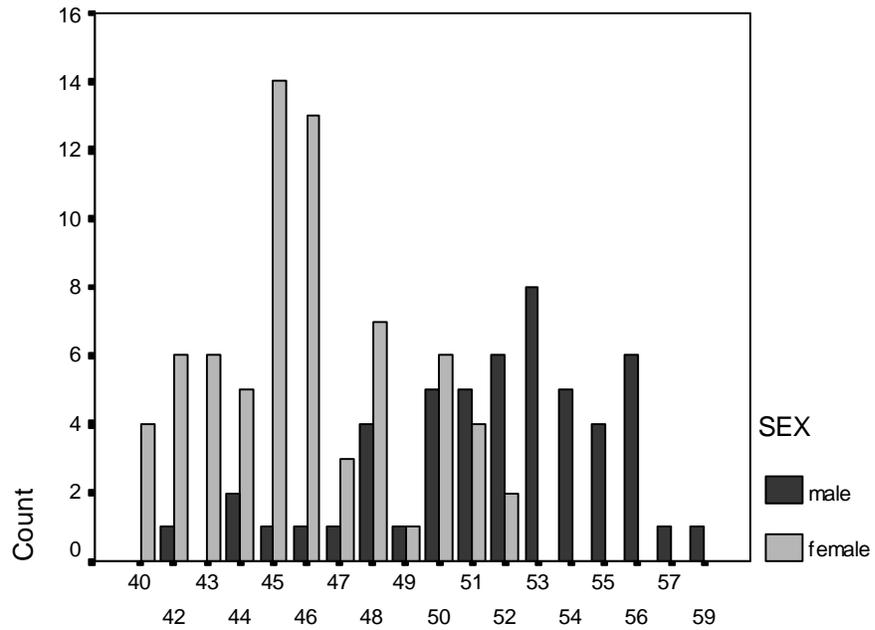
1.21

1.21

**Bar diagram-1:** Showing right vertical femoral head diameter (in mm)

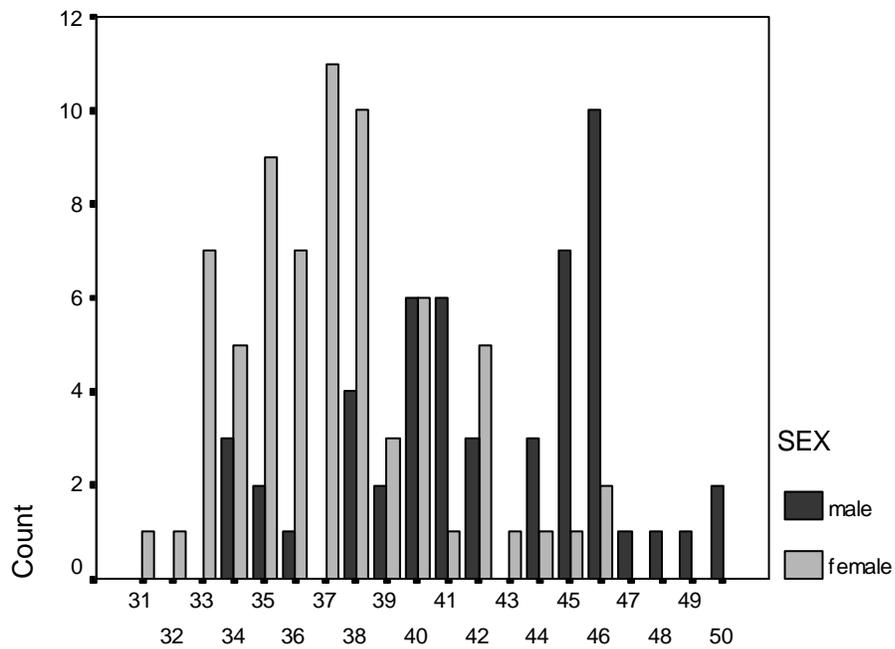


**Bar diagram-2:** Showing left vertical femoral head diameter (in mm)



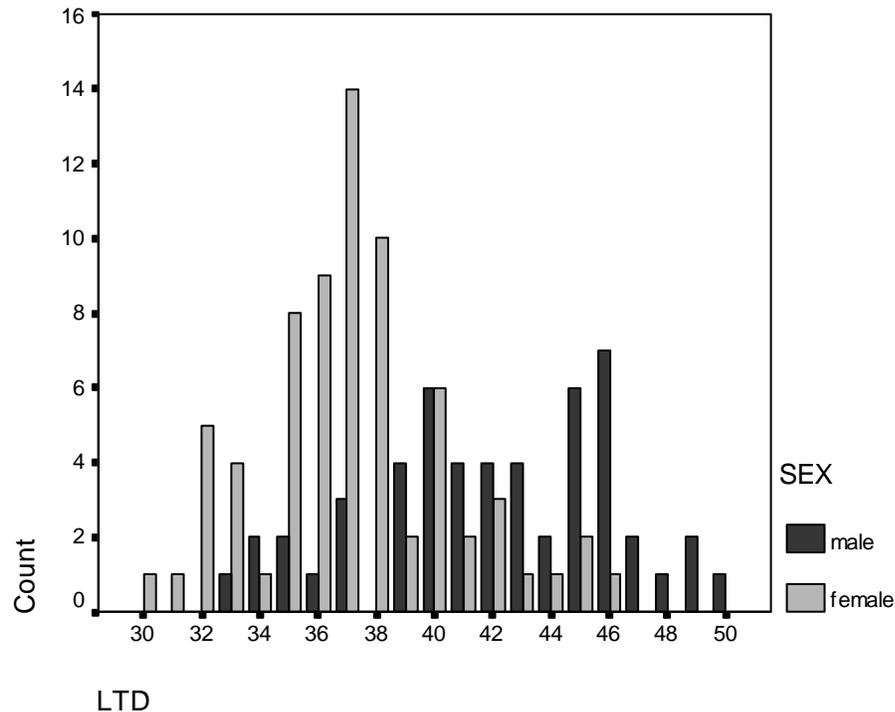
LVD

**Bar diagram-3:** Showing right transverse femoral head diameter (in mm)



RTD

**Bar diagram-4:** Showing left transverse femoral head diameter (in mm)



### Discussion

Anatomists have carried out various measurements to differentiate the sex of the femora. and claimed that the head diameter and width of the lower end discriminated sex better than any other part of the bone<sup>6-10</sup>. They also concluded that a dimension of femoral head varies according to races, heredity, climate and other geographical factors. So, every population have their own metric standards. Knowledge about the average dimensions of the femoral head in both sexes will not only help in early detection of disputed sex by anatomist and by forensic experts but also help to the orthopaedic surgeon and prosthetists in hip replacement surgery and to construct suitable prostheses<sup>11</sup>. To the best of our knowledge not much literature is available on these parameters, especially about Bangladeshi people; therefor the need for the present study to be carried out was felt.

From the present study it was revealed that the male people of the northern area of Bangladesh (Rajshahi) have vertical and transverse femoral head diameters which are significantly greater

( $p < 0.001$ ) than the corresponding diameters of the female. This suggests that femoral head diameters are of value in sex differentiation among the inhabitants of this region. The values that are derived from the present study about the various dimensions of femoral head were smaller than the Nigerians<sup>7</sup> and nearer to that of the Indians<sup>13</sup>. Nigerians are taller than average Indians and so their femoral heads are bigger than that of Indians and Bangladeshi people. The above observations also indicate its value in regional differentiation. In the present study, the identification point for males was greater than that for females and implies that this parameter is useful in sex differentiation. As there was no such work in Bangladesh to find out the femoral head dimensions and sex differentiation, so far as I know, it was not possible to compare the results with the others. However, to establish an accepted standard of this region, further study with larger groups of population is recommended.

## References

1. Krogman WM. Skeleton in forensic medicine. Trans Inst Chic 1946; 16: 154-167.
2. Williams pl., Warwick R., Dyson M and Bannister LH. Grays Anatomy, 38th edition. Edinburgh Churchill Livingstone 1995; 269-273.
3. Stewart TD. Medicolegal aspects of the skeleton. I. age, sex, race and stature. Am J Phys Anthropol 1984; 6:315-321.
4. Nadkarni SD et al. Determination of sex of an individual from the available femur. Journal of Anatomical Society of India 1974; 23(1):32.
5. Jit I. And Singh S. The sexing of adult clavicles. Indian Med Res 1966; 54: 551-571.
6. Asala SA. Sex determination from the head of the femur of South African white and blacks. Forensic Science International 2001; 117:15-22.
7. 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.
8. Purkait R. Sexual dimorphism in femora: an Indian study. Forensic Science Communications 2002; 4:1-6.
9. Javadakar BS. A study of the measurement of the head of the femur with special reference to sex: A preliminary report. J Anat Soc India 1961; 10:25-27.
10. Leelavathy N., Rajangans S., Janakirams S., Thomas IM. Sexing of femora. J Anat Soc India 2000; 49(1):17-20.
11. Chauhan R., Paul S., Dhaon BK. Anatomical parameters of North Indian hip joints-Cadaveric Study. J Anat Soc India 2002; 51(1):39-42.
12. Files GW. Medical radiographic Technic. Springfield, Thomas. 1943.
13. Singh SP. And Singh S. The sexing of adult femora: Demarking points for Varanasi zone. Indian Med Gaz 1972; 11:45-49.

All Correspondence to:  
**Akhtari Afroze**  
Professor, Department of Anatomy  
Rajshahi Medical College, Rajshahi.