# Sexual dimorphism in supero – inferior diameter of the femoral neck among the contemporary Bulgarian population

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This study aims to demonstrate the accuracy of sex determination through use of the supero- inferior diameter of the femoral neck among the contemporary Bulgarian population and comparison of the yielded results with the data described by some international authors. An aggregate of 48 femora, 28 male and 20 female were studied. The Paired-Samples T-test proves the lack of significant difference between the two consecutive measurements (p=0,137) and between the left and right measurements (p=0,137). The Independent Samples Test reveals a significant difference between the variable of the two sexes ( p<0,001). As a result, this landmark may successfully be used as a sex discriminant.

*Key words:* forensic anthropology, sexual dimorphism, femoral neck, supero-inferior diameter

## Introduction

Each forensic anthropology examination of human skeletal remains is based on determining "the great four": sex, age, stature and race. When the whole skeleton, including pelvis and skull, is available, the accuracy rate of sex determination reaches up to 95 %. In case of a single bone available, except for a femur, sex determination is seriously impeded (5,8).

The significant sexual dimorphism of the femur is based on several facts:

1. Men are relatively physically stronger than women and they use their muscles more actively.

2. Men's axial skeleton is heavier than women's and this weight is normally distributed in the upper end of the two femora.

3. Due to its reproductive function the female pelvis differs in shape from male's, which is expected to result in a change in the upper part of the femora, forming the pelvic bones.

Studies on sex determination through use of various anthropometric landmarks of the femur have been carried out by a number of international researchers (1,3,4,5,7,8). Those authors do not quote equal values of a single index in the examination of differ-

ent population groups. This results from the influence of the differences in race, dietary regime, heredity, social and geographic factors.

This study aims to demonstrate the accuracy of sex determination through use of the supero- inferior diameter of the femoral neck among the contemporary Bulgarian population and comparison of the yielded results with the data described by some international authors.

## Materials and methods

An aggregate of 48 femora, 28 male and 20 female were studied. They had been subject of forensic examination, and the sex of one part of said femora was known, while that of the others was determined through pelvic bones analysis. The bones included in this study fulfill the following criteria: – show no anomalies, deformations or abrasions, 2- have sustained no fractures previously, 3- have reached skeletal maturity. They belong to Bulgarians born after 1910; the average age of the known male bones is $56,8\pm13,44$ years, and of the female ones $64.3\pm13,97$ years (Mean±SD).

The mean studied is the supero – inferior diameter of the femoral neck (M 15). Two consecutive measurements were carried out in order to reduce errors in measurement. The Paired-Samples T-test was applied twice for the purpose of detecting the significant differences in the results from the two repeated measurements, as well as from the measurements performed on the left and right femoral necks of 19 pairs of bones. The means resulting from the two consecutive measurements of each bone undergo the Kolmogorov-Smirnov Test designated to indicate their distribution, and an Independent Samples Test designated to indicate any difference between the two sexes, and a Discriminant Function Analysis for the purpose of creation of a discriminant function for classification of the bones into male and female.

## Results

The Paired-Samples T-test proves the lack of significant difference between the two consecutive measurements (p=0,137) and between the left and right measurements (p=0,137).

Therefore, the sample includes left or right femora of the respective pairs.

The means of the variable in our study of the male and female sex are shown in Figure 1. The mean of the male sex is bigger than that of the female.

Figure 2 shows the means resulting from this study and the means resulting from the previous studies covering contemporary Caucasians conducted by Alunni-Perret et al.)1) и Stojanowski and Seidemann (6), which prove the difference in the populations.

| Sex | N | % | Mean | SD |
|---|---|---|---|---|
| M | 28 | 58 | **33,36** | 3,56 |
| F | 20 | 42 | **28,22** | 1,77 |

Fig.1

| Sex | Mean | SD | Mean | SD | Mean | SD |
|---|---|---|---|---|---|---|
| M | 33,36 | 3,56 | 33,91 | 2,9 | 35,09 | 2,49 |
| F | 28,22 | 1,77 | 28,92 | 1,9 | 30,85 | 2,2 |

Fig.2

| Sex | M | F | | |
|---|---|---|---|---|
| N | 28 | 20 | | |
| mean±SD | *33,36 ± 3,56* | *28,22 ± 1,77* | *t = 5,946* | *p <0,001* |

Fig.3

| Functions and variables | Raw coefficient | Standart coefficient | Structure coefficient | Sectioning point |
|---|---|---|---|---|
| M15 | 0,376 | *1* | *1* | *- 0,16* |
| *Constant* | *- 11,733* | | | |
| *Females < 30,79 < Males* | | | | |

Fig.4

| Percent correctly classified | | |
|---|---|---|
| Male | Female | Total |
| 95% | 75% | 89,60% |

Fig.5

The Kolmogorov-Smirnov Test shows that the supero- inferior diameter of the femoral neck among the contemporary Bulgarian population is accurately distributed. (p=0,067).

The Independent Samples Test reveals a significant difference between the variable of the two sexes ( p<0,001). As a result, this landmark may successfully be used as a sex discriminant. (Figure 3).

The acquired data is subjected to Discriminant Function Analysis and the studied index is involved as an independent variable. (Figure 4).

Based on this analysis the following function is created F= 0,376.M15 – 11,733 If F>-1,93 we assume that the bone is male and vice versa. As a result of this discriminant function the accuracy of sex determination of contemporary Bulgarian population is shown in Figure 5.


## Conclusion

The mean of the anthropometric landmark examined is considerably bigger in men than in women, which is confirmed in the other foreign studies (1,2,6). Due to this characteristic, the supero-inferior femoral neck diameter may successfully be used for sex discriminant. The achieved result of accurate sex determination of 86,9 % matches the results achieved by foreign authors using the same landmark (1,6). On the other hand, differences are found in results comparison. Such population variations result from different social, genetic and climatic conditions. This necessitates the creation of contemporary standards for the different populations.

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