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Anthropological Characterization of the *Scapula* in Bone Remains from Mediaeval Necropolis in Drastar (9th - 15th century AD)

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In total, 41 males and 23 female scapulae were metrically and scopically investigated in detail. The results obtained show significant differences in size and form of the scapula in both sexes.

Key words: *scapula*, feature, sexual differences.

Introduction

The examination of human postcranial skeleton in bone remains from archaeological excavations, and in particular every bone of the skeleton, present an opening to give notion for sex and age, stature, proportionality and body massiveness of buried individuals and to trace back the physical development of differently ancient human populations.

The *scapula* as a whole is very rarely saved from archaeological excavation, and that's why the data of its detailed morphological description are too little.

The aim of this study is to make a detailed metric and scopic characterization of *scapula*, to establish the sexual differences of separate features and to determine these ones, which are of great significance for the sexual differentiation.

Material and Methods

The anthropological investigation was done on osteological material from archaeological excavations of mediaeval necropolis in the National Archaeological Reserve "Durostorum — Drastar — Silistra" [4]. In total, 41 males and 23 female scapulae, belonging to adult individuals, were investigated. The sex and age were determined by metric and scopic features of cranium and postcranial bones, described by R. Martin — K. Saller [1], V. P. Alekseev [3], B. A. Nikityuk [5], etc.

The anthropological investigation was done by the classical methods of R. Martin — K. Saller [1] and V.P. Alekseev [3]. Eleven metric features were measured, four indices were calculated and four scopic features were described through grades and scales after V. P. Alekseev [3].

The metric data were analyzed using SPSS version 13.0. The sexual differences were evaluated through the U-test of Mann-Whitney. The quantitative assessment of sexual differences was made by the Wolanski's index for inter-group comparisons (ISD) [2]:

$$ISD = \frac{2.(x_1 - x_2).100}{x_1 + x_2},$$

where x_1 is mean of the feature in males and x_2 is mean of the feature in females.

Results and Discussion

Metric characterization

The main biostatistical results of the study are given in Table 1.

Table 1. Biostatistical characterization of measurements and indices of human scapula, for individuals from both sexes (osteological data)

No by Martin	Features	Males						Females						ISD	U-value
		n	mean	min	max	SD	$s\bar{x}$	*n*	mean	min	max	SD	$s\bar{x}$		
1	Anatomical breadth	6	164.58	147	179	13.33	5.44	6	147.75	139	160	7.87	3.21	10.78	0.045*
2	Anatomical length	11	106.59	95	118	7.69	2.32	8	95.81	90	103	4.71	1.66	10.65	0.004*
3	Length of *margo lateralis*	18	140.17	128	155	7.24	1.71	13	126.23	115	140	8.41	2.33	10.47	0.000*
4	Length of *margo superior*	7	85.10	71	106	12.67	4.79	6	75.33	71	84	4.84	1.98	12.18	0.114
5a	Anatomical breadth of *fossa infraspinata*	9	119.06	106	137	8.93	2.98	7	111.00	100	120	8.37	3.16	7.01	0.124
6a	Anatomical breadth of *fossa supraspinata*	8	63.38	46	78	11.25	3.98	5	48.20	44	50	2.49	1.11	27.21	0.004*
7	Length of *spina scapulae*	13	141.42	123	157	10.83	3.00	7	126.93	120	138	7.09	2.68	10.80	0.008*
12	Length of *cavitas glenoidalis*	35	41.83	38	47	2.29	0.39	20	36.20	32	41	2.19	0.49	14.43	0.000*
13	Breadth of *cavitas glenoidalis*	35	29.69	23	35	2.11	0.36	23	25.02	23	30	1.63	0.34	17.07	0.000*
15	Breadth-wise - lengthwise angle	5	94.60	88	102	5.98	2.68	6	91.33	80	96	5.72	2.33	3.52	0.409
17	Axilo-glenoidal angle	5	139.00	130	152	8.00	3.58	6	140.00	131	151	7.77	3.17	-0.72	0.582
2:1	Scapular index	6	66.38	56.74	73.47	6.03	2.46	5	64.50	62.30	68.35	2.32	1.04	2.87	-
3:1	Marginal index	6	86.78	79.78	95.24	6.49	2.65	6	86.71	82.14	91.80	4.46	1.82	0.08	-
6a:5a	Index of spinal cavities b)	6	48.95	38.98	58.26	7.71	3.15	9	43.52	39.29	50.00	4.63	2.07	11.74	-
13:12	Lengthwise – breadth-wise index of *cavitas glenoidalis*	33	71.11	50.00	79.49	5.45	0.95	20	68.84	63.89	78.13	3.69	0.83	3.24	-

The basic metric features of ***scapula*** are **its anatomical breadth (1)** and **anatomical length (2)**. The measurements of both features are significantly greater ($P<0.05$) in male scapulae than in female ones. The difference is 16.83 mm for anatomical breadth and it is 10.78 mm for anatomical length.

The next two features characterize *fossa infraspinata* of the *scapula*. They are: **length of *margo lateralis* (3)** and **anatomical breadth of *fossa infraspinata* (5a)**. The means of both features are greater in male scapulae, but the sexual difference in

the first feature (13.94 mm) is statistically significant ($P<0.05$), whereas the difference for the second one (8.06 mm) is not significant.

The metric characterization of *fossa supraspinata* includes the following two features: **length of *margo superior* (4)** and **anatomical breadth of *fossa supraspinata* (6a)**. The measurements of these features are greater in male scapulae also, but only the second feature is statistically significant ($P<0.05$). The male-female difference is 9.77 mm for the length of *m. superior* and it is 15.18 mm for the anatomical breadth of *f. supraspinata*. The previous shows that this measurement is greater with a quarter in male scapulae than in female ones.

The ***spina scapulae*** is an important element for the anatomical structure of scapula and it is metric characterized through its **projection length (7)**. Its measurement is significantly greater ($P<0.05$) in male scapulae with 14.49 mm than in female ones.

The main features of ***cavitas glenoidalis*** are its length and breadth. The mean of the **length of *c.glenoidalis* (12)** is significantly greater ($P<0.05$) in male scapulae than the mean in female ones. The male-female difference is 5.63 mm. The **breadth of *c.glenoidalis* (13)** shows significant difference ($P<0.05$) between both sexes. It is greater in male scapulae with 4.67 mm.

In this study are read data for two angles: **breadth-wise - lengthwise angle (15)** and **axilo-glenoidal angle (17)**. The first angle is little greater than the right angle in both sexes — with 4.6° in male scapulae and with 1.3° in female ones. The second angle is an obtuse angle with almost equal values in both sexes — about 140°.

Index characterization about form and proportionality of scapula

The form and proportionality are determined computing following four indices:

The **scapular index (2:1)** is greater in the scapulae of male individuals at 1.88 %, than its value in these of females. The difference shows that male scapulae are relatively longer and narrower compared to female ones.

The **marginal index (3:1)** has very close values in scapula of males and females. This result shows that the scapulae in both sexes are with relatively almost equal length of *margo lateralis* towards anatomical breadth.

The **index of spinal cavities b) (6a:5a)** is greater in male scapulae at 5.43 %. That difference determines relatively larger breadth of *fossa supraspinata* in male scapulae compared to that in female ones.

The **lengthwise — breadth-wise index of *cavitas glenoidalis* (13:12)** is greater in male scapulae again at 2.27 %. This male-female difference shows that *cavitas glenoidalis* in males is relatively shorter and wider compared with the same one in females.

Comparative assessment of sexual differences by the data of ISD

The values of **index of sexual difference (ISD)** show that all measured features have priority for the male scapulae (with slightly exception for feature 17) (see Table 1). Highest value of ISD has the anatomical breadth of *fossa supraspinata*. Next by strength are the sexual differences for features characterizing *cavitas glenoidalis* — its breadth and length. Comparatively strong differences for both sexes display also the features that characterize the *scapula* as a whole, as well as its *fossa infraspinata*, *margo superior* and *spina scapulae*. Slightly sexual differences are found in the measured angles. Primary meaning for the assessment of sexual differences has the index of spinal cavities b) too. About other indices, the values of ISD show slight male-female differences.

Scopic characterization

The **form of *margo superior scapulae*** is reported in 11 male and 8 female scapulae. *Margo superior* is practically horizontal in 5 male and in 4 female scapulae. *Margo*

superior is inclined below 35° in other 5 male scapulae and in 3 female ones also. The incline of *margo superior* is above 35° in 1 male and 1 female scapula.

The **form of *incisura scapulae*** is determined in 23 male and in 11 female bones. The absence of *incisura scapulae* is registered in 2 males and 1 female scapula. A shallow incisura is recorded in 7 male and in 6 female bones. A deep *incisura scapulae* is observed in 13 male and in 4 female scapulae. An *incisura scapulae*, whose end almost shape a complete circle is met in 1 male bone only and it is not found among female scapulae. The form of *incisura scapulae* that is apertura is missing in both sexes.

The **form of *spina scapulae*** is determined in 27 male and in 16 female scapulae. The *spina scapulae* is thin, with small extension on the level of *incisura scapulae* in 14 male scapulae and in 13 female ones. The *spina scapulae* is thin in its basis and then get thick in 9 male and in 3 female scapulae. The *spina scapulae* is uniformly thin along its whole length in 2 male scapulae only, and the *spina* is sharply curved down after its basis in 2 bones, as well. The last two forms of *spina scapulae* are not recorded in female scapulae.

The **form of *cavitas glenoidalis*** is presented by a pear-shaped cavity in all 35 male and 22 female scapulae. An ovoid-shaped cavity is not observed.

Conclusions

All measured lengths and breadths of scapula are greater in males than in females.

According to the data of indices about form and proportionality, the male scapulae are relatively longer and narrower, with wider *fossa supraspinata* and with shorter and wider *cavitas glenoidalis*, compared to the female scapulae.

From scopic features the sexual differences are well pronounced in the form of *incisura scapulae*. It is predominantly deep in male scapulae, but it is mainly shallow in female ones.

The comparative assessment of sexual differences for all investigated metric features shows that male and female scapulae are differentiated at greatest about anatomical breadth of *fossa supraspinata* and about length and breadth of *cavitas glenoidalis*, which probably reflect the different development of the musculature in scapular region in both sexes.

The established sexual differences in the investigated anthropological features of scapula could be used to formulate the algorithms that determine or specify additionally the sexual affiliation of bone remains, when there are scarce or missing data for the sexual differentiation.

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