Institute of Experimental Morphology and Anthropology with Museum
Bulgarian Anatomical Society

Acta morphologica et anthropologica, 13
Sofia • 2008

Anthropometrical Characterization and Sexual Differences of the Mandible Bone

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The aim of the present investigation is to make a detailed anthropometrical characterization of the mandible bone in skeleton material of individuals from both genders and to determine the sexual differences. The research includes 128 mandibles of adults divided according to their sex into two groups (each group subsumes 64 bones). The absolute metrical differences between both genders are with priority for males concerning all linear features, and for both angles the priority is for females. The sexual differences are biggest for the branch height and they are slightest for the profile angle. The mandible front width and the profile angle vary within wide limits for each bone.

Key words: mandible bone, anthropometrical characterization, sexual differences, categorization.

Introduction

From the literature review [1, 5, 6] we established that in Bulgaria the purposeful anthropological investigations of the mandible bone in skeleton material are not enough and they are orientated predominantly towards bone asymmetry and teeth measuring. The metrical data for mandible bone are scanty, especially for its profile angle.

The aim of the present work is to make a detailed anthropometrical characterization of the mandible bone in skeleton material of individuals from both genders and to determine the sexual differences.

Material and Methods

The investigation includes 128 mandible bones of adults divided according to their sex into two groups (each group subsumes 64 bones). The methods of M a r t i n - S a l l e r [2] and J. J o r d a n o v [7] are applied. In the present paper the data about 8 basic features of mandible bone are discussed: mandible angle width and front width, projectional length, height in symphysis, height and smallest width of the branch, mandibular and profile angle. The distribution by the categories of A l e k -

s e e v-D e b e t z [4] is applied. It was forced to initiate additional categories for some of the features — "hyper small" (for height in symphysis and branch smallest width) and "hyper large" (for mandible front width and projectional length). The data are statistically processed by variation analysis.

The valuation of sexual differences is made by the absolute metrical differences and their relative share, as well as by their standardization according to the Index of relative inter-group differences of W o l a n s k i [3]. This index is applied to determine the sexual differences and it is called Index of Sexual Differences (ISD). Its values submit the sexual differences to the Relative Index Units (IU).

$$ISD = 2 \times [(\bar{x}_{males} - \bar{x}_{females}) \times 100] / (\bar{x}_{males} + \bar{x}_{females}).$$

The *t*-criterion of Student at $P<0.05$ is used to determine the authenticity of the established sexual differences.

Results and Discussion

Valuation of sexual differences' extend

The absolute metrical differences between both genders are with priority for males concerning all linear features (Table 1). All differences are statistically significant with the exception of this of mandible front width. Biggest difference between both genders is observed about branch height. Concerning both measured angles the priority is for females, as the difference is statistically significant only for the mandibular angle.

The values of ISD are graphically presented in Fig. 1. Values of ISD, which are equal to zero, show absence of sexual differences; the positive values display relative priority for males, and the negative ones — for females. The sexual differences are biggest for the branch height, followed by the height in symphysis. Closely values of ISD have the next features: branch smallest width and mandible projectional length, as well as mandible angle width and mandibular angle. The rest two features (mandible front width and profile angle) have slightest sexual differences. This fact probably shows that these both measurements do not depend on the sexual appurtenance of individual.

T a b l e 1. Biostatical characterization of the absolute mandible measurements and sexual differences

	Males							Females							Sexual differences		
	n	$\bar{x}$	SD	SEM	*V*	min	max	*n*	$\bar{x}$	SD	SEM	*V*	min	max	Absolute difference	t-test	ISD
Mandible angle width	58	100.12	6.18	0.81	6.17	86.0	113.5	56	95.88	5.92	0.79	6.18	85.0	113.0	4.24	3.75*	4.33
Mandible front width	60	45.12	2.49	0.32	5.52	40.0	54.0	64	44.53	2.51	0.31	5.64	40.0	53.0	0.59	1.32	1.32
Mandible length-projectional	64	87.47	4.66	0.58	5.32	79.0	98.0	64	82.36	4.36	0.54	5.29	71.5	91.0	5.11	6.41*	6.02
Mandible height in symphysis	64	32.69	2.83	0.35	8.66	28.0	39.0	64	29.23	3.30	0.41	11.29	20.0	35.0	3.46	6.37*	11.18
Mandible branch height	64	64.23	4.38	0.55	6.83	52.0	73.5	64	56.94	5.02	0.63	8.82	46.5	69.5	7.29	8.75*	12.03
Mandible branch smallest width	64	31.66	2.69	0.34	8.48	24.5	37.5	64	29.49	2.46	0.31	8.32	24.0	34.0	2.17	4.76*	7.08
Mandibular angle	64	120.51	5.83	0.73	4.83	106.0	134.5	64	125.53	6.81	0.85	5.42	109.5	141.5	-5.02	4.48*	-4.08
Profile angle of mandible	64	85.48	5.94	0.74	6.95	68.0	99.0	64	86.19	7.47	0.93	8.67	65.0	106.0	-0.71	0.59	-0.82

— Priority for females
* $P<0.05$

T a b l e 2. Distribution of the investigated mandible bones by categories

Category	Rubrics	Males		Category	Rubrics	Females	
		n	%			*n*	%
Mandible angle width							
Very small	*79-90*	3	5,17	*Very small*	*74-85*	2	3,57
Small	*91-96*	11	18,97	*Small*	*86-90*	8	14,29
Medium	*97-103*	25	43,10	*Medium*	*91-97*	25	44,64
Large	*104-109*	15	25,86	*Large*	*98-102*	13	23,21
Very large	*110-121*	4	6,90	*Very large*	*103-114*	8	14,29
Mandible front width							
Very small	*37,8-42,1*	9	15,00	*Very small*	*36,5-40,7*	3	4,70
Small	*42,2-44,6*	16	26,67	*Small*	*40,8-43,1*	18	28,12
Medium	*44,7-47,3*	26	43,33	*Medium*	*43,2-45,7*	22	34,38
Large	*47,4-49,8*	8	13,33	*Large*	*45,8-48,1*	18	28,12
Very large	*49,9-54,2*	1	1,67	*Very large*	*48,2-52,4*	2	3,12
Hyper large	*54,3-x*	-	-	*Hyper large*	*52,5-x*	1	1,56
Mandible length-projectional							
Very small	*64-70*	-	-	*Very small*	*61-66*	-	-
Small	*71-74*	-	-	*Small*	*67-70*	-	-
Medium	*75-79*	3	4,69	*Medium*	*71-75*	6	9,38
Large	*80-83*	11	17,19	*Large*	*76-79*	9	14,06
Very large	*84-90*	38	59,37	*Very large*	*80-85*	36	56,25
Hyper large	*91-x*	12	18,75	*Hyper large*	*86-x*	13	20,31
Mandible height in symphysis							
Hyper small	*x-23,5*	-	-	*Hyper small*	*x-21,2*	2	3,13
Very small	*23,6-28,6*	2	3,12	*Very small*	*21,3-25,8*	8	12,50
Small	*28,7-31,4*	25	39,06	*Small*	*25,9-28,3*	10	15,62
Medium	*31,5-34,5*	19	29,69	*Medium*	*28,4-31,2*	29	45,31
Large	*34,6-37,3*	12	18,75	*Large*	*31,3-33,7*	14	21,88
Very large	*37,4-42,4*	6	9,38	*Very large*	*33,8-38,3*	1	1,56
Mandible branch height							
Very small	*45-53*	1	1,56	*Very small*	*40-48*	5	7,81
Small	*54-58*	7	10,94	*Small*	*49-52*	8	12,50
Medium	*59-63*	19	29,69	*Medium*	*53-57*	24	37,50
Large	*64-68*	26	40,62	*Large*	*58-61*	18	28,13
Very large	*69-77*	11	17,19	*Very large*	*62-70*	9	14,06
Mandible branch smallest width							
Hyper small	*x-24,7*	2	3,13	*Hyper small*	*x-23,1*	-	-
Very small	*24,8-29,5*	9	14,06	*Very small*	*23,2-27,6*	14	21,88
Small	*29,6-32,1*	32	50,00	*Small*	*27,7-30,0*	27	42,18
Medium	*32,2-35,2*	13	20,31	*Medium*	*30,1-32,9*	14	21,88
Large	*35,3-37,8*	8	12,50	*Large*	*33,0-35,3*	9	14,06
Very large	*37,9-42,6*	-	-	*Very large*	*35,4-39,8*	-	-
Mandibular angle							
Very small	*100-111*	5	7,81	*Very small*	*104-115*	4	6,25
Small	*112-117*	15	23,44	*Small*	*116-121*	16	25,00
Medium	*118-124*	27	42,19	*Medium*	*122-128*	24	37,50
Large	*125-130*	16	25,00	*Large*	*129-134*	14	21,87
Very large	*131-142*	1	1,56	*Very large*	*135-146*	6	9,38

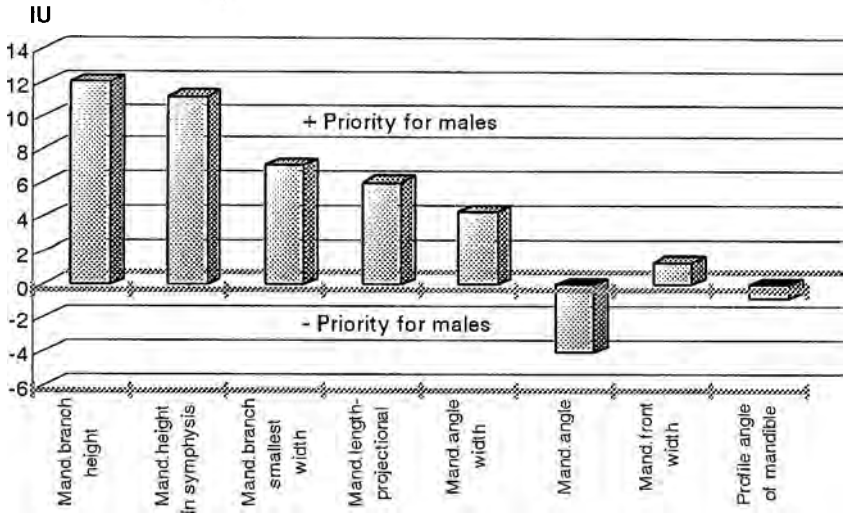

Fig. 1. Sexual differences (ISD data)

Distribution of the investigated mandible bones by categories (Table 2)

Mandible angle width (measurement 66 by Martin–Saller) — concerning both genders the mandibles having "medium angle width" prevail. Lowest is the per cent of the cases, which belong to the category "very small".

Mandible front width (measurement 67 by Martin–Saller) — for both genders the majority of the mandible bones refers to the category "medium". Lowest is the per cent, coming into the category "very large". In female gender there is one case for which the value of this measurement exceed the limits of category "very large" and respectively it was assigned to the category "hyper large".

Mandible length-projectional (measurement 68 by Martin–Saller) — the investigated mandible bones are distinguished for comparatively "large" projectional length. Concerning both genders, the bones with "very large" length prevail. Relatively high is the per cent of the cases that refer to the category "hyper large". For both sexes in the category "very small" and "small" couldn't be referred any of the investigated mandibles.

Mandible height in symphysis (measurement 69 by Martin–Saller) — the investigated mandibles are remarkable for comparatively "small" height in symphysis. In female gender there are cases, which come under the limits of the category "very small". Concerning this feature we have observed the biggest sexual differences in the percentage distribution by categories.

Mandible branch height (measurement 70 by Martin–Saller) — in male gender the majority of cases comes into the category "large", followed by the category "medium". For females the percentage distribution in these two categories is conversely.

Mandible branch smallest width (measurement 71a by Martin-Saller) — for both genders highest is the per cent for the category "small". Concerning the bones of males there are established cases, which come underneath the limits of the category "very small".

Mandibular angle (measurement 79 by Martin–Saller) — in both sexes highest is the percentage frequency of bones, belonging to the category "medium". Concerning the distribution in the rest categories, big distinctions are observed.

Profile angle of mandible (measurement $79_{(1)}$ by Martin–Saller) — for this angle the mean values for both genders are very close. This fact gives us reason to suppose that as the mandible front width, so the profile angle shows a great variability. The percentage distribution for that feature is not discussed in the present work, since Alekseev–Debetz did not give categories about this angle.

Conclusion

1. All linear features have higher absolute values of mandible bones in individuals from the male gender, which is a natural biological regularity. Concerning both measured angles the priority is for females.
2. The sexual differences are biggest for the branch height and slightest for the profile angle.
3. Mandible front width and profile angle vary within wide limits in the separate individuals and these features do not depend on the sexual appurtenance.
4. According to the categories of Alekseev-Debetz, the mandible bones in individuals from the male gender are distinguished for: "medium" width, comparatively "large" projectional length, "small" height in symphysis, "large" height but comparatively "small" width of the branch. The mandibles of females have also "medium" width and comparatively "large" projectional length. In contrast to males, the bones in females have "medium" height in symphysis and "medium" branch height. For both genders highest is the percentage frequency of the mandibles that have "medium" value of the mandibular angle.

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