

DNA ANALYSIS OF HUMAN SKELETAL REMAINS FROM THE MEDIEVAL NECROPOLES IN BOSNIA AND HERZEGOVINA – A GENETIC STRUCTURE OF OUR ANCESTORS AND PREDICTION OF THEIR MIGRATIONS

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INTRODUCTION

Archaeological sites represent a rich historical and cultural heritage of medieval Bosnia. Among the archaeological sites, the most of them are with stećak tombstone. Stećak is medieval tombstone that appear in the period between the 12th and 16th century AD primarily on the territory of today's Bosnia and Herzegovina (B&H). Even though individual excavations of skeletal remains from archaeological sites have been carried out continuously from the period of medieval Bosnia, there is no data about the genetic structure of ancient B&H populations (Figure 2) [1].

The aim of this study was to obtain usable aDNA (ancient DNA) profiles, then compare and potentially find kinship relations, determine haplogroup based on obtained Y-STR profiles and mtDNA sequence.



Figure 1. Stone sarcophagus (photo by Bujak E.)

MATERIAL AND METHODS

DNA was isolated from teeth and bones samples using an optimized phenol/chloroform DNA extraction procedure, preceding decalcification with EDTA. Quantification of samples was performed with a Quantifiler Duo quantification kit for determining the exact concentration of DNA and potential presence of inhibitors. PowerPlex® Fusion and PowerPlex® Y23 System were used for amplification of 22 autosomal STRs, single Y and amelogenin as well as 23 YSTR loci, according to manufacturer's recommendations [2;3]. Following the analysis, we obtained six useful aDNA profiles.



Figure 2. Stone sarcophagus (photo by Bujak E.)

RESULTS AND DISCUSSION

Comparative analysis of aDNA profiles of ten samples showed that five persons were closely related. By comparing aDNA profiles of archaeological skeletal samples S1 and S2, common allelic variants were detected at all analysed loci, which indicates a kinship relationship (father-son). Based on the statistical analysis of paternity index (PI) and the obtained value of the combined paternity index (CPI), which was 251, the probability of paternity (PP) of 99.603175% was calculated. For samples A4, A5 and A6 the calculated probability of maternity was 99.9999796% and 99.9999396% respectively. Y-analysis revealed that the obtained Y-haplotypes of samples S1, S2, S4, A2, A5 and A6 belong to I2a Y-haplogroup. The detected Y-haplotype of sample S3 was found to belong to the R1 haplogroup. Molecular genetic characterization of medieval Bosnia populations will be compared with genetic data of recent B&H populations, thus assessing the genetic differentiation between recent and medieval B&H populations.

Table 1. Allelic variants of obtained STR profiles from ancient DNA

STR Loci	S1	S2	S3	S4	A1	A2	A3	A4	A5	A6
D3S1358	15 17	14 15	16 18	15 18	16 18	16 18	17 18	15 17	14 15	17 17
D1S1656	12 16	12 16	11 16.3	15 17.3	15 17.3	12 14	12 14	16 18.3	16 18.3	16 18.3
D2S441	11 17	11 11.3	10 11	11 14	11 11	11 12	11 12	13 14	10 14	13 13
D10S1248	10 -	13 -	10 16	-	14 -	14 -	13 14	13 14	13 -	13 14
D13S317	7 -	9 11	8 11	-	-	-	11 13	8 12	8 14	8 14
Penta E	-	7 15	10 11	-	-	7 10	5 12	13 16	13 16	-
D16S539	11 12	12 13	11 12	11 -	11 14	12 12	9 10	12 14	12 12	12 12
D18S51	12 20	12 15	15 17	10 14	15 16	13 17	14 19	18 19	16 18	14 19
D2S1338	17 20	17 19	22 -	25 -	17 20	17 23 25	18 24	17 23	17 20	17 23
CSF1PO	13 15	12 13	10 12	9 14	10 12	-	11 11	11 12	-	11 -
Penta D	13 -	15 -	7 9	9 -	-	-	9 11	9 10	10 11	9 11
TH01	6 10	6 9	9.3 10	9.9 3	6.9 3	6.9 3	6 9	9.3 10	6 10	9.9 3
vWA	14 -	17 18	15 17	18 -	16 19	15 16	14 19	17 18	16 17	17 18
D21S11	-	29 32.2	30 31.2	31.2 32.2	30 -	32.2 33.2	29 31	30 32.2	28 32.2	28 32.2
D7S820	-	10 -	10 11	10 -	-	10 11	11 -	8 9	9 11	8 -
D5S818	10 12	10 12	12 13	-	-	10 12	10 13	12 13	12 13	13 -
TPOX	-	8 -	-	-	-	-	8 11	8 -	8 -	8 -
DYS391	-	11 11	11 11	-	//////	-	//////	//////	-	11
D8S1179	13 14	13 14	11 15	12 15	10 12	11 14	11 14	13 13	11 13	11 13
D12S391	17 18	18 23	18 19	18 19	20 23	18 19	22 23	17 22	18 22	17 26
D19S433	15.2 -	14 15	14 15	15 -	13 14	13 14	13 14	15 15	12 15	-
FGA	18 25	19 23	19 21	-	21 22	23 25	22 24	23 23	23 24	23 -
D22S1045	11 -	15 -	15 -	-	-	-	15 -	11 18	11 15	-
Amelogenin	X Y	X Y	X Y	X Y	X X	X Y	X X	X X	X Y	-

References:

[1]Bujak E. (2015). Arheološka istraživanja srednjovjekovnih nekropola u Kopošićima kod Ilijaša i Divičanima kod Jajca, te popis stećaka na području Hadžića.; [2]Promega PowerPlex® Y23 system – Technical Manual (TMD035). Madison: Promega Corporation; 2012.; [3]Promega PowerPlex®Fusion system – Technical Manual (TMD039). Madison: Promega Corporation;2012.; [4]Haplogroup predictor. Available from: <http://www.hprg.com/haptest5/>