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SHORT COMMUNICATION

FORENSIC VALUE OF TEN SHORT TANDEM REPEAT LOCI IN TURKEY COMPARED TO OTHER ETHNIC GROUPS

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ABSTRACT

Allele frequencies of the 10 short tandem repeats (STRs) loci (D16S539, D2S1338, D3S1358, vWA, D18S51, D21S11, D8S1179, D19S433, FGA, THO1) included in the AmpFlSTR SGM Plus kit, were obtained from biological samples from 100 unrelated individual residing in different part of Turkey. The χ2 test showed that all these loci agreed with Hardy-Weinberg equilibrium, The results were compared with the previously published data from Turkish and other ethnic groups. Suggest that these loci with their high heterozygosity and combined power of discrimination (PD) values are useful for forensic identifications.

Keywords: Forensic science; AmpFlSTR SGM Plus; Short tandem repeats (STRs); Population genetics; Turkey

Subjects. Samples were obtained from 100 unrelated Turkish individuals living in Turkey (12 females, 88 males). Individuals were selected from seven geographical region of Turkey. From the Marmara Region (11 individuals), Aegean Region (17 individuals), Central Anatolian Region (24 individuals), Eastern Anatolian Region (16 individuals), Black Sea Region (16 individuals), Mediterranean Region (seven individuals) and Southeastern Region (nine individuals) (Figure 1).

DNA Extraction and Typing. Genomic DNA was isolated from blood, tissue, saliva, hair and semen samples using the phenol-chloroform isoamyl alcohol method [1] [Amp*Fl*STR SGM *Plus*™ Polymerase Chain Reaction (PCR) Amplification Kit user manual, 2001]. Multiplex PCR, using 1-2 ng target DNA, was performed with the GeneAmp PCR system 9700 using the Amp*Fl*STR SGM *Plus*™ kit (Applied Biosystems Division/Perkin-Elmer, Foster City, CA, USA) according to the manufacturer's instructions. The loci D16S539, D2S1338, D3S1358, vWA, D18S51, D21S11, D8S1179, D19S433, FGA, THO1 were co-amplified and analyzed on ABI PRISM 3100 Genetic analyzer. The results were analyzed using Gene Scan analysis version 3.1.2 software and genotypes were determined by comparison to allelic ladder using Genotyper DNA fragment analysis version 2.0 software (Applied Biosystems/Perkin Elmer).

Analysis of Data. Evaluation of the Hardy-Weinberg equilibrium expectations was carried out using the Fisher's exact *t*-test. Further calculation

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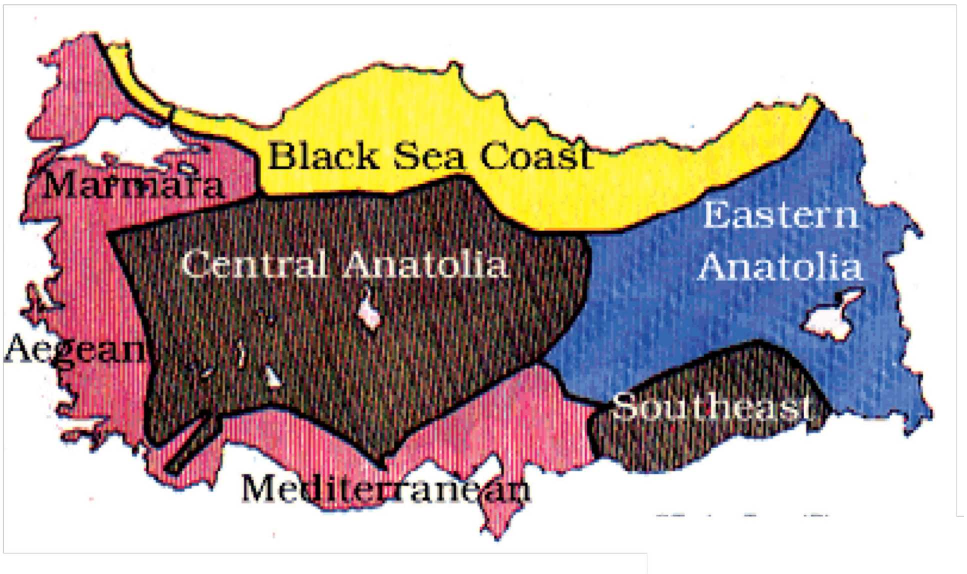

Fig. 1. Map of Turkey showing its all geographical regions.

of statistical parameters of forensic interest and population differentiation tests were conducted using the Arlequin 2.0 software package [2].

Results and discussion: Allele frequencies for 10 short tandem repeat (STR) loci and parameters of genetic and forensic interest are presented in Table 1. In the Turkish population, the D3S1358 locus allele 16 (0.556), vWA locus allele 17 (0.486), D16S539 locus allele 11 (0.555), D2S1338 locus allele 17 (0.412), D8S1179 locus allele 13 (0.483), D21S11 locus allele 30 (0.407), D18S51 locus allele 14 (0.349), D19S433 locus allele 14 (0.385), THO1 locus allele 6 (0.604), FGA locus allele 22 (0.460), are the most common alleles. The frequencies ranged from 0.005 to 0.604. The Fisher's exact *t*-test results indicated that the loci were in Hardy-Weinberg equilibrium. The most discriminating loci, according to their power of exclusion (PE) values, were D2S1338 and D18S51, whereas THO1 and D3S1358 turned out to be the least discriminating loci. The heterozygosity of the 10 STR loci screened in this study ranged from 0.77 to 0.89, indicating that these loci could be used in determination of identity because of the high heterozygosity. The 10 loci have a power of discrimination (PD) 0.99999999999988 and the combined power of exclusion (PE) is 0.999994 in Turkey. The probability of identity across all 10 loci was estimated as 1 in 8.33 trillion. Thus, the PD value estimated for the Turkish population was highly significant.

On comparison of the observed allele frequencies with previously published data from Turkey [3-9], we found no statistically significant difference for all STRs ($p > 0.05$). Allele 22 of vWA and allele 9 of the D19S433 locus were detected in Turkish individuals, and are absent in Chinese, North and West African and Czech populations [10-13]. The observed combined PD and PE values were also compared with the published populations [10-13]. The combined PE value (0.999994) for Turks was higher than for Chinese (0.999949), Czech (0.999971) and North African (0.999522) populations, but lower than for West Africans (0.99999946). The combined PD value in the Turkish population also seems to be a little higher than in the Chinese (0.999999999997) and the Czech (0.99999999999939), and a little lower than in North African (0.99999999999999959) and West African (0.9999999999999999952) populations.

Table 1. Observed allele frequencies for AmpFISTR SGM Plus loci in a sample of 100 individuals from Turkey

Allele	D16S539	D2S1338	D3S1358	vWA	D18S51	D21S11	D8S1179	D19S433	FGA	THO1
6										0.604
7										0.098
8	0.015						0.009			0.020
9	0.056						0.005	0.011		0.222
9.3										0.046
10	0.028				0.006		0.044			0.009
10.2					0.008					
11	0.555				0.020		0.015	0.008		
12	0.228				0.191		0.071	0.085		
13	0.110		0.007	0.009	0.124		0.483	0.200		
13.2					0.005			0.015		
14	0.007		0.030	0.026	0.349		0.220	0.385		
14.2								0.042		
15			0.228	0.072	0.064		0.124	0.126		
15.2								0.059		
16		0.009	0.556	0.122	0.088		0.025	0.031		
16.2								0.022		
17		0.412	0.228	0.486	0.048			0.005		
17.2								0.006		
18		0.055	0.058	0.218	0.036				0.006	
19		0.125	0.014	0.043	0.027				0.019	
20		0.081		0.016	0.011				0.030	
21		0.019			0.015				0.124	
22		0.038		0.006	0.005				0.460	
23		0.205							0.218	
24		0.027							0.075	
25		0.013							0.046	
26		0.006							0.012	
27						0.013			0.006	
28		0.005				0.128				
29						0.211				
30						0.406				
30.2						0.025				
31						0.018				
31.2						0.083				
32						0.005				
32.2						0.038				
33						0.006				
33.2						0.056				
34.2						0.009				
H	0.82	0.85	0.77	0.85	0.89	0.78	0.80	0.82	0.80	0.80
PD	0.9314	0.9647	0.9066	0.9336	0.9610	0.9612	0.9444	0.9392	0.9552	0.9656
PE	0.6698	0.7687	0.5847	0.6669	0.7578	0.7361	0.6952	0.6970	0.7199	0.6387
MP	0.0686	0.0353	0.0934	0.0664	0.0390	0.0388	0.0556	0.0608	0.0448	0.0844
PIC	0.9990	0.9998	0.9979	0.9991	0.9998	0.9997	0.9993	0.9994	0.9996	0.9985
P	0.8244	0.3033	0.9512	0.9064	0.5108	0.6878	0.8306	0.3858	0.8790	0.7152

H: Heterozygosity; PD: power of discrimination; PE: power of exclusion; MP: matching probability; PIC: polymorphism information content; P: Hardy-Weinberg equilibrium exact test based on 3100 shufflings

In conclusion, our results show that 10 STR loci (D16S539, D2S1338, D3S1358, vWA, D18S51, D21S11, D8S1179, D19S433, FGA, THO1) are useful markers for personal identification and forensic case work in the Turkish population.

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