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Characterisation of three Amerindian populations from Hidalgo State (Mexico) by 15 STR-PCR polymorphisms

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Abstract The purpose of this study is to report allele frequency data of three ethnic Amerindian population samples: the Otomi (Hña-hñu) from eastern Sierra Madre and Ixmiquilpan valley and the Huasteco from La Huasteca. These groups were characterised by 15 STR-PCR polymorphisms (HumTH01, HumvWA, D18S51, HumTPOX, D19S433, D16S539, D13S317, D8S1179, D7S820, D5S818, HumFGA, CSF1PO, D2S1338, D3S1358 and D21S11). No significant deviations in observed allelic frequencies from Hardy-Weinberg equilibrium were found for all the studied systems. From the forensic point of view, the heterozygosity value, power of discrimination and the a priori chance of exclusion were calculated.

Keywords Population genetics · Amerindian · STR polymorphisms · Otomi · Huasteco

Introduction

DNA polymorphisms using short tandem repeat (STR) loci have been studied in some Amerindian populations [1, 2]. Some authors have emphasised the forensic interest in studying the genetic profile of native populations [3, 4]. The aim of this study is to broaden the knowledge on the population genetics of Amerindian.

The Huasteco population lives in La Huasteca, an area located in central eastern Sierra Madre, in Hidalgo State (northeast Mexico). They call themselves Teenek or Huasteco and their language is possibly of Mayan origin. The ethnographical interpretation is that they are a group of Mayan people who remained isolated by the cultural and demographic pressure of Nahuatl migrations [Oficina para el Desarrollo de los Pueblos Indígenas del Gobierno Mexicano <http://indigenas.presidencia.gob.mx/programa/versionpdf/HuastecosSLP.pdf>]. The native population numbers around 60,200 individuals [INEGI (Instituto Nacional de Estadística y Geografía Informática) – 2000. XII Censo de Población y vivienda. <http://www.inegi.gob.mx>]. We studied a sample of 135 people from 4 different towns in the area, located close to each other: Xochiatipan, Yahualica, Atlapexco and Huetjutla.

The two Otomi Amerindian population groups are from Hidalgo, one group lives in the villages of Tenango de Doria and San Bartolo Tutotepec (La Sierra Madre Oriental), and a sample of 91 individuals was studied. The other group lives in El Cardonal (Ixmiqulpan valley), and the studied sample was 83 people. Both groups speak different dialects of the Hña hñu language, which belongs to the linguistic group of the Otopame. According to the “Instituto Nacional de Estadística Geográfica e Informática” of Mexico, 11,498 people speak this language in eastern Sierra Madre and 8,862 in Ixmiquilpan valley.

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Material and methods

Population sample

DNA was extracted [5] from hair root samples from healthy unrelated individuals by the Chelex method.

Amplification conditions

PCR amplifications were carried out in a 12 µl volume containing 0.5 ng DNA template, and quantified by the QuantiBlot method, following the recommendations for the AmpF/STR Identifier kit (Applied Biosystems, Foster City, CA). Genotypes from DNA amplified products were analysed in capillary gel electrophoresis using an ABI Prism 310 Genetic Analyser [6].

Allele and genotype frequencies were determined and unbiased estimates of expected heterozygosity were computed. A standard χ^2 goodness-of-fit was calculated to assess compliance with Hardy-Weinberg expectations

[7] using the Popgene program. From the forensic point of view, the power of discrimination [8], heterozygosity value and the a priori chance exclusion value were calculated using the Powerstats program from Promega (Madison WI).

Results

The allele frequency distributions for the 15 DNA systems studied in the 3 population samples are shown in Tables 1, 2 and 3. No significant deviations from Hardy-Weinberg expectations were found for all STR loci.

The expected heterozygosity and the power of discrimination calculated from the gene frequencies obtained in these populations (Table 4) reveal that the combination of 15 systems has a high forensic efficiency.

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Table 1 Allele frequencies of the 15 STRs in the Otomi Amerindian population living in eastern Sierra Madre ($n=91$)

Allele	D5S818	D13S317	D7S820	D16S539	HumTH01	HumvWA	D8S1179	HumTPOX	HumFGA	HumCSF1PO	D21S11	D18S51	D2S1338	D19S433	D3S1358
6					0.355										
7	0.092				0.414										
8		0.054	0.070		0.021			0.472							
9	0.049	0.355	0.021	0.098	0.032		0.005	0.011							
9.3					0.177										
10	0.065	0.113	0.269	0.196			0.097	0.049							
11	0.560	0.124	0.333	0.293			0.021	0.379		0.201					
11.2															
12	0.174	0.156	0.252	0.353			0.134	0.088		0.299		0.099		0.016	0.016
12.2														0.048	0.021
13	0.060	0.150	0.048	0.054		0.021	0.333			0.418		0.126		0.210	0.554
13.2														0.161	0.226
14		0.048	0.005	0.005		0.021	0.285			0.076		0.187		0.161	0.145
14.2														0.065	0.038
15						0.048	0.113			0.005		0.176		0.032	
15.2														0.177	
16						0.403	0.011					0.082		0.081	
16.2														0.048	
17						0.242						0.165	0.065		
18						0.188						0.088	0.048		
19						0.075			0.043			0.038	0.290		
20									0.064			0.011	0.194		
21									0.075			0.005	0.032		
22									0.140				0.161		
23									0.102				0.161		
23.2									0.038						
24									0.107				0.032		
25									0.215				0.016		
25.2									0.005						
26									0.140		0.005				
27									0.064		0.054				
28									0.005		0.145				
29											0.011				
29.2											0.210				
30.2											0.091				
31											0.193				
31.2											0.005				
32											0.183				
33.2											0.059				
34.2											0.043				

Table 2 Allele frequencies of the 15 STRs in the Otomi Amerindian population living in Ixmiquilpan valley ($n=83$)

Allele	D5S818	D13S317	D7S820	D16S539	HumTH01	HumvWA	D8S1179	HumTPOX	HumFGA	HumCSF1PO	D21S11	D18S51	D2S1338	D19S433	D3S1358
6					0.368										
7	0.090				0.426										
8		0.055	0.056		0.010		0.473								
9	0.051	0.302	0.028	0.146	0.005		0.011			0.005					
9.3					0.189										
10	0.045	0.121	0.264	0.298			0.093	0.016							
11	0.506	0.137	0.421	0.236			0.049	0.382		0.202					
11.2															
12	0.163	0.170	0.185	0.292			0.093	0.118		0.234		0.109	0.006	0.024	0.006
12.2														0.083	0.033
13	0.146	0.126	0.039	0.028			0.384			0.521		0.149		0.131	0.600
13.2														0.149	0.178
14		0.082	0.006			0.012	0.287			0.037		0.259		0.238	0.156
14.2														0.077	0.017
15		0.005				0.030	0.077					0.109		0.167	0.011
15.2														0.066	
16						0.361						0.103	0.006	0.042	
16.2														0.024	
17						0.343	0.005					0.149	0.109		
18						0.187						0.069	0.086		
19						0.054			0.085			0.017	0.213		
20						0.012			0.450			0.017	0.178		
21									0.148				0.017		
22									0.159			0.017	0.103		
23									0.085				0.195		
23.2									0.006						
24									0.125				0.075		
25									0.204				0.012		
26									0.119						
27									0.023		0.050				
28											0.189				
29.2											0.322				
30											0.006				
30.2											0.067				
31											0.206				
31.2											0.006				
32											0.144				
33.2											0.011				

Table 3 Allele frequencies of the 15 STRs in the Huasteco Amerindian population ($n=135$)

Allele	D5S818	D13S317	D7S820	D16S539	HumTH01	HumvWA	D8S1179	HumTPOX	HumFGA	HumCSF1PO	D21S11	D18S51	D2S1338	D19S433	D3S1358
6					0.417										
7	0.093				0.436										
8		0.027	0.031		0.004			0.543		0.004					
9	0.078	0.364	0.031	0.0.80	0.004					0.031					
9.3					0.139										
10	0.041	0.178	0.250	0.256			0.056	0.016						0.004	
11	0.578	0.178	0.316	0.304			0.049	0.221		0.244				0.012	
11.2														0.008	
12	0.190	0.114	0.301	0.292			0.154	0.221		0.229		0.071		0.023	0.008
12.2														0.023	0.039
13	0.019	0.106	0.047	0.068			0.301			0.411		0.121	0.037	0.092	0.504
13.2														0.185	0.341
14		0.034	0.023			0.004	0.335			0.058		0.233		0.281	0.097
14.2														0.046	0.012
15						0.023	0.079			0.019		0.163		0.092	
15.2														0.181	
16						0.557	0.011			0.004		0.092		0.023	
16.2														0.015	
17						0.277	0.015					0.158	0.090	0.008	
17.2														0.008	
18						0.102			0.012			0.063	0.090		
19						0.038			0.123			0.042	0.392		
20									0.036			0.017	0.097		
21									0.083			0.021	0.011		
22									0.087			0.013	0.071		
23									0.056			0.004	0.235		
23.2									0.004						
24									0.131			0.004	0.011		
25									0.294						
25.2											0.008				
27									0.059		0.034				
28									0.068		0.207				
29									0.020		0.004				
29.2											0.308				
30											0.004				
30.2											0.109				
31											0.117				
32											0.132				
32.2															
33.2											0.079				

Table 4 Statistical parameters of forensic interest for the three Amerindian populations studied

Locus	Population	p	h	PD	CE
HumTH01	Ot. S	0.7114	0.677	0.820	0.394
	Ot. V	0.6176	0.617	0.807	0.312
	H	0.3769	0.575	0.775	0.262
HumvWA	Ot. S	0.0527	0.763	0.876	0.533
	Ot. V	0.9825	0.744	0.868	0.499
	H	0.9951	0.617	0.785	0.311
D18S51	Ot. S	0.6669	0.890	0.953	0.775
	Ot. V	0.6233	0.805	0.952	0.608
	H	0.4101	0.818	0.953	0.633
D16S539	Ot. S	0.4680	0.750	0.878	0.510
	Ot. V	0.7877	0.753	0.882	0.515
	H	0.5363	0.706	0.895	0.438
D13S317	Ot. S	0.6234	0.785	0.927	0.571
	Ot. V	0.4154	0.826	0.938	0.648
	H	0.0650	0.774	0.919	0.552
D8S1179	Ot. S	0.6139	0.720	0.909	0.461
	Ot. V	0.6169	0.714	0.875	0.451
	H	0.5808	0.791	0.904	0.583
D7S820	Ot. S	0.5830	0.742	0.888	0.496
	Ot. V	0.1731	0.674	0.871	0.389
	H	0.4268	0.806	0.870	0.611
D5S818	Ot. S	0.4462	0.674	0.818	0.389
	Ot. V	0.0947	0.730	0.850	0.477
	H	0.7572	0.644	0.809	0.348
D3S1358	Ot. S	0.8616	0.645	0.796	0.349
	Ot. V	0.6219	0.633	0.780	0.333
	H	0.2335	0.651	0.757	0.357
HumCSF1PO	Ot. S	0.0689	0.641	0.853	0.343
	Ot. V	0.7336	0.606	0.804	0.299
	H	0.2038	0.700	0.861	0.428
HumFGA	Ot. S	0.5947	0.892	0.963	0.780
	Ot. V	0.2627	0.862	0.950	0.719
	H	0.6379	0.874	0.953	0.743
D21S11	Ot. S	0.1782	0.880	0.944	0.756
	Ot. V	0.9513	0.778	0.923	0.558
	H	0.2998	0.701	0.938	0.431
HumTPOX	Ot. S	0.2428	0.681	0.755	0.400
	Ot. V	0.8163	0.581	0.791	0.268
	H	0.7761	0.585	0.786	0.273
D2S1338	Ot. S	0.4966	0.759	0.906	0.525
	Ot. V	0.7991	0.818	0.950	0.633
	H	0.8471	0.719	0.899	0.457
D19S433	Ot. S	0.0642	0.857	0.926	0.709
	Ot. V	0.0891	0.762	0.530	0.954
	H	0.9263	0.794	0.952	0.588

Table 4 (continued)

Locus	Population	p	h	PD	CE
Combined	Ot. S			>0.999	0.999
	Ot. V			>0.999	0.999
	H			>0.999	0.999

h Heterozygosity value.

PD Power of discrimination.

CE Chance of exclusion.

P Hardy-Weinberg equilibrium.

Ot S Otomi Amerindian population living in eastern Sierra Madre.

Ot V Otomi Amerindian population living in Ixmiquilpan Valley.

H Huasteco population.

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