

## FOR THE RECORD

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# Population Frequencies for CSF1PO, TPOX, TH01, F13A01, FES/FPS and VWA in Seven Amerindian Populations from Colombia

**POPULATION:** The Amerindian population of Colombia represents around 1.7% of the population (1,2). They belong to different linguistic families (Chibcha, Tukano, Arawak, Guahibo, Choco, Maku, Karib, and Quechua among others). The Amerindian tribes of Colombia are located in the Amazonian/Orinoquian region, the Northeast, Southwest and Pacific regions of Colombia. Few studies have been carried out for STR variability among Amerindian tribes (3–5). On the other hand, several studies have been performed for STR variability in Caucasian and Afro-Colombian populations (1,2,6–10).

We have carried out a study in 7 Amerindian populations named Cubeo ( $n = 49$ ), Curripaco ( $n = 32$ ), Desano ( $n = 28$ ), Tucano ( $n = 26$ ), Embera ( $n = 31$ ), Puinabe ( $n = 77$ ), and Nukak ( $n = 29$ ) for 6 STR loci (CSF1PO, TPOX, TH01, F13A01, FES/FPS and VWA) to determine allele frequencies and other parameters of forensic importance.

**KEYWORDS:** forensic science, DNA, short tandem repeats, population genetics, Amerindian, Colombia

The F13A01, FES/FPS, VWA, CSF1PO, TPOX and TH01 STR loci were amplified from DNA isolated from whole blood using two triplex systems (GenePrint, Promega Corporation). The amplification conditions were identical to those proposed by the manufacturer. All amplifications were carried out in a MJ Research PTC100VG thermocycler.

The amplification products were resolved in a 4% Acrylamide-Bis-Acrylamide denaturing gel and silver nitrate stained. Allelic designations were based on the recommendations by the DNA Commission of the International Society for Forensic Genetics (ISFG) (11) with the aid of allelic ladders provided in each kit. Quality control and proficiency testing for these systems have been carried out for the GEP-ISFG working group and CTS (Collaborative Testing Services).

The statistical evaluation was carried out with the aid of GDA and PowerStats software packages (12,13). The analysis included the possible divergence from Hardy-Weinberg equilibrium, observed and expected heterozygosity, power of exclusion (PE), polymorphic information content (PIC), discrimination power (DP) and an analysis for association between loci. Minimum allele frequencies for PCR-based loci, based on statistical and population genetics theory (14), were determined. Thus, a greater confidence of the DNA profile frequency estimates can be attained with current size databases.

Statistical significant differences were detected in allele frequencies when compared the Amerindian populations with the Caucasian-Mestizo and Black populations of Colombia (data not shown). In addition, a limited number of alleles were detected for all loci analyzed; despite of this finding, the heterozygosity level was comparable to those observed in Caucasian-Mestizo and Afro-Colombian populations.

All seven populations do not deviate from Hardy-Weinberg expectations with the exception for VWA in the Desano tribe

TABLE 1—Allele frequencies and forensic parameters for CSF1PO in seven Amerindian tribes from Colombia.

CSF1PO	Cubeo $n = 49$	Desano $n = 28$	Tucano $n = 26$	Embera $n = 31$	Curripaco $n = 32$	Nukak $n = 29$	Puinabe $n = 77$
8				0.0326			
9	0.0102		0.040	0.0161	0.0156		0.0065
10	0.1531	0.0893	0.1600	0.2903	0.2031	0.3793	0.1688
11	0.1633	0.1071	0.2000	0.1452	0.2344	0.2931	0.1948
12	0.6327	0.6250	0.6000	0.4194	0.3594	0.2069	0.5714
13	0.0306	0.1786		0.0968	0.1719	0.1207	0.0584
14	0.0102						
MAF	0.0485	0.0803	0.0872	0.0824	0.0804	0.0932	0.0316
He	0.5918	0.5714	0.6000	0.7742	0.7813	0.8621	0.5844
PE	0.3226	0.3319	0.3303	0.4694	0.5103	0.4580	0.3622
PIC	0.5061	0.5165	0.5222	0.6616	0.7017	0.6605	0.5553
PD	0.7505	0.7398	0.7456	0.8366	0.8574	0.8133	0.7870
HW	0.5970	0.3575	0.1975	0.6440	0.3985	0.2715	0.1210

MAF: Minimum allele frequency; He: Observed heterocigosity; PE: Power of exclusion; PIC: Polymorphic information content; PM: Matching probability; PD: Power of discrimination; HW: Hardy-Weinberg equilibrium 2000 shuffles, Chi squared test.

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TABLE 2—Allele frequencies and forensic parameters for TPOX in seven Amerindian tribes from Colombia.

TPOX	Cubeo n = 49	Desano n = 28	Tucano n = 26	Embera n = 31	Curripaco n = 32	Nukak n = 29	Puinabe n = 77
8	0.3673	0.3036	0.3000	0.5806	0.2969	0.7931	0.2987
9	0.0102		0.0200	0.0161	0.0469		0.0065
10	0.0306				0.0156		
11	0.3571	0.3929	0.4200	0.1774	0.2969	0.2069	0.4026
12	0.2347	0.3036	0.2600	0.2258	0.3437		0.2922
MAF	0.0479	0.0870	0.0933	0.0776	0.0804	0.0684	0.0331
He	0.5918	0.7143	0.7200	0.6774	0.7813	0.3448	0.6623
PE	0.3226	0.3319	0.3828	0.3229	0.4367	0.1372	0.3724
PIC	0.5061	0.5165	0.5976	0.5211	0.6445	0.2743	0.5914
PD	0.7505	0.7398	0.7808	0.7367	0.8320	0.4946	0.7920
HW	0.5010	0.1400	0.2885	0.6230	0.7980	1.000	0.0410

MAF: Minimum allele frequency; He: Observed heterocigosity; PE: Power of exclusion; PIC: Polymorphic information content; PM: Matching probability; PD: Power of discrimination; HW: Hardy-Weinberg equilibrium 2000 shuffles, Chi squared test.

TABLE 3—Allele frequencies and forensic parameters for TH01 in seven Amerindian tribes from Colombia.

TH01	Cubeo n = 49	Desano n = 28	Tucano n = 26	Embera n = 31	Curripaco n = 32	Nukak n = 29	Puinabe n = 77
6	0.3673	0.3929	0.4615	0.4355	0.4687	0.3966	0.5065
7	0.4694	0.5000	0.4038	0.5000	0.3594	0.5690	0.3636
9.3	0.1633	0.1071	0.1346	0.0645	0.1719	0.0345	0.1299
MAF	0.0468	0.0772	0.0918	0.0697	0.0707	0.0712	0.0328
He	0.5306	0.5000	0.6923	0.4839	0.5625	0.4138	0.6494
Ho	0.6244	0.5948	0.6176	0.5653	0.6314	0.5269	0.5893
PE	0.3282	0.2936	0.3138	0.2593	0.3320	0.2247	0.3071
PIC	0.5397	0.4977	0.5227	0.4577	0.5442	0.4149	0.5134
PD	0.7772	0.7653	0.6923	0.7014	0.7813	0.6920	0.7374
HW	0.2145	0.5365	0.4175	0.0805	0.4270	0.5295	0.1155

MAF: Minimum allele frequency; He: Observed heterocigosity; PE: Power of exclusion; PIC: Polymorphic information content; PM: Matching probability; PD: Power of discrimination; HW: Hardy-Weinberg equilibrium 2000 shuffles, Chi squared test.

TABLE 4—Allele frequencies and forensic parameters for F13A01 in seven Amerindian tribes from Colombia.

F13A01	Cubeo n = 49	Desano n = 28	Tucano n = 26	Embera n = 31	Curripaco n = 32	Nukak n = 29	Puinabe n = 77
3.2	0.5106	0.5714	0.3846	0.3548	0.4375	0.4310	0.4481
4	0.2766	0.1786	0.3037	0.2097	0.2187	0.2931	0.1948
5	0.0581	0.1964	0.3115	0.2518	0.2031	0.2586	0.1169
6	0.0106		0.0192	0.0161	0.0781	0.0172	0.0974
7	0.1170	0.0536	0.0769	0.1613	0.0625		0.1429
MAF	0.0474	0.0787	0.0986	0.0862	0.0773	0.0866	0.0339
He	0.5532	0.5357	0.8077	0.8387	0.4688	0.7586	0.7013
PE	0.3905	0.3545	0.4517	0.4950	0.2828	0.3779	0.4955
PIC	0.5874	0.5494	0.6530	0.6911	0.4537	0.5926	0.6805
PD	0.8330	0.7883	0.8373	0.8554	0.6856	0.7872	0.8767
HW	0.3790	0.8255	0.7425	0.4470	0.5675	0.3615	0.7220

MAF: Minimum allele frequency; He: Observed heterocigosity; PE: Power of exclusion; PIC: Polymorphic information content; PM: Matching probability; PD: Power of discrimination; HW: Hardy-Weinberg equilibrium 2000 shuffles, Chi squared test.

(0.0455  $X^2$  test) and TPOX in the Puinabe (0.0410  $X^2$  test), both near to the expected. However, both the likelihood ratio test and the exact test did not show deviations from HW equilibrium. In addition, the analysis based on the number of different genotypes observed in the sample population shows that the observed num-

TABLE 5—Allele frequencies and forensic parameters for FESFPS in seven Amerindian tribes from Colombia.

FESFPS	Cubeo n = 49	Desano n = 28	Tucano n = 26	Embera n = 31	Curripaco n = 32	Nukak n = 29	Puinabe n = 77
8				0.0167			
10	0.0106	0.0536	0.0577	0.1500	0.1719		0.0455
11	0.7021	0.6786	0.5769	0.6000	0.6875	0.5690	0.8377
12	0.2340	0.1786	0.1346	0.1167	0.0781	0.1379	0.0909
13	0.0426	0.0714	0.1923	0.1167	0.0312	0.2931	0.0260
14	0.0106	0.0179	0.0385		0.0312		
MAF	0.0440	0.0742	0.0844	0.0757	0.0671	0.0784	0.0267
He	0.4255	0.4286	0.5385	0.6333	0.4688	0.5862	0.3117
PE	0.2251	0.2887	0.3779	0.3674	0.2828	0.2994	0.1535
PIC	0.3940	0.4618	0.5655	0.5224	0.4537	0.5001	0.2718
PD	0.6302	0.6658	0.7633	0.7867	0.6856	0.7301	0.4888
HW	0.0955	0.1470	0.1565	0.7875	0.1170	0.9590	0.9400

MAF: Minimum allele frequency; He: Observed heterocigosity; PE: Power of exclusion; PIC: Polymorphic information content; PM: Matching probability; PD: Power of discrimination; HW: Hardy-Weinberg equilibrium 2000 shuffles, Chi squared test.

TABLE 6—Allele frequencies and forensic parameters for VWA in seven Amerindian tribes from Colombia.

VWA	Cubeo n = 49	Desano n = 28	Tucano n = 26	Embera n = 31	Curripaco n = 32	Nukak n = 29	Puinabe n = 77
14	0.0102		0.0192	0.0161	0.0156	0.0862	0.0065
15	0.0918	0.1071	0.1154		0.0469		0.0130
16	0.4796	0.2500	0.4038	0.05645	0.4219	0.4828	0.4610
17	0.2857	0.4821	0.3269	0.1613	0.3594	0.3448	0.3896
18	0.0816	0.1071	0.0769	0.2419	0.0625	0.0862	0.1169
19	0.0408	0.0536	0.0385	0.0161	0.0937		0.0130
20	0.0102		0.0192				
MAF	0.0535	0.0803	0.0961	0.0735	0.0759	0.0814	0.0321
He	0.7551	0.5714	0.7692	0.5806	0.6875	0.6552	0.6104
PE	0.4324	0.4436	0.4731	0.3414	0.4278	0.3662	0.3431
PIC	0.6231	0.6345	0.6619	0.5389	0.6223	0.5672	0.5468
PD	0.8080	0.8444	0.8639	0.7742	0.8438	0.7919	0.7809
HW	0.4185	0.0455	0.9955	0.7755	0.8000	0.9815	0.3505

MAF: Minimum allele frequency; He: Observed heterocigosity; PE: Power of exclusion; PIC: Polymorphic information content; PM: Matching probability; PD: Power of discrimination; HW: Hardy-Weinberg equilibrium 2000 shuffles, Chi squared test.

bers of distinct heterozygote and homozygote genotypes (15) are in accordance with their respective HWE predictions.

There were four possible associations found out of the 75 comparisons performed representing a 5% (near to the expected). They corresponded to F13A01/VWA in the Desano tribe (0.0075), TPOX/FESFPS (0.0155) in the Tucano tribe, TPOX/FESFPS (0.0295) in the Cubeo tribe and TPOX/TH01 (0.0045) in the Embera tribe. The data suggest that there is little evidence of deviation from independence in the populations studied.

The complete dataset is available to any researcher via electronic mail from the corresponding author at [jjyunisl@unal.edu.co](mailto:jjyunisl@unal.edu.co)

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