

FOR THE RECORD

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Genetic Study of 15 Important STR Loci Among Four Major Ethnic Groups of Bihar, India*

POPULATIONS: Brahmin ($N = 59$), Bhumihar Brahmin ($N = 65$), Rajput ($N = 58$), Kayasth ($N = 53$).

KEYWORDS: forensic science, Powerplex™ 16 STR Loci, Hardy-Weinberg Equilibrium, Brahmin, Bhumihar Brahmin, Rajput, Kayasth

Access of the Data Via Electronic Mail From Communicating Author

Genotype studies at highly polymorphic 15 STR loci were carried out in four major ethnic groups of Bihar, the second most populous state in the northeastern part of the Indian subcontinent. The communities included in the present analysis hold a special attraction for human genetic studies because they practice a high degree of endogamy at the community level and exogamy at the sub-population level (1). All the samples used in the study were collected from Bihar only. These population groups belong to upper strata of the Hindu Religion and to date no STR study has reported on them.

DNA Extraction and Quantitation—The genomic DNA of 235 unrelated individuals was extracted from peripheral blood leukocytes using the standard phenol-chloroform extract method (2), followed by ethanol precipitation. Quantitation of extracted DNA was carried out using the Quantiblot Kit (PE Biosystem).

Amplification and Analysis—PCR amplification was performed using the PowerPlex™ 16 System PCR amplification Kit, (Promega) and the amplified products were detected using the ABI Prism™ 377 DNA sequencer and reference-sequenced ladder (Promega).

To check the genetic stability in the studied populations, the allele frequency data were analyzed for Hardy-Weinberg probability tests: homozygosity test, likelihood ratio test, and exact test (4) using DNA TYPE program.

Result—See Tables 1–15.

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Quality Control—Laboratory Internal Control Standards and Kit Controls.

Discussion—All loci were found to be highly polymorphic in the sample populations, with the loci Penta D in Bhumihar Brahmin (77%), Penta E in Rajput (81.3%), FGA in Rajput (82.5%), and D21S11 in Bhumihar. Brahmin (82.2%) have the highest heterozygosities and TPOX in Kayasth (57.1%), D5S818 and D3S1358 in Rajput (63.6% and 66.3%, respectively) display the lowest observed heterozygosities. The present data can be used as reference in human identification and genetic diversity studies.

TABLE 1—Observed allele frequencies of locus- vWA in four communities of Bihar.

Alleles	Brahmin $N = 59$	Bhumihar Brahmin $N = 65$	Rajput $N = 58$	Kayasth $N = 53$
13	0.009	0.000	0.027	0.000
14	0.188	0.123	0.161	0.157
15	0.143	0.107	0.027	0.078
16	0.196	0.172	0.241	0.255
17	0.286	0.287	0.277	0.255
18	0.098	0.123	0.178	0.137
19	0.063	0.164	0.089	0.118
20	0.017	0.024	0.000	0.000
H	0.714	0.672	0.803	0.803
HP	0.383	0.009	0.798	0.595
ET	0.126	0.394	0.769	0.757
LR	0.207	0.460	0.856	0.753

H: Observed heterozygosity; HP: Probability of Homozygosity; ET: Exact Test; LR: Likelihood ratio.

TABLE 2—Observed allele frequencies of locus-D8S1179 in four communities of Bihar.

Alleles	Brahmin N = 59	Bhumihar Brahmin N = 65	Rajput N = 58	Kayasth N = 53
8	0.000	0.008	0.038	0.030
9	0.009	0.000	0.048	0.010
10	0.188	0.202	0.192	0.170
11	0.116	0.081	0.038	0.070
12	0.125	0.137	0.096	0.090
13	0.196	0.137	0.202	0.150
14	0.205	0.242	0.232	0.260
15	0.116	0.137	0.048	0.160
16	0.036	0.048	0.096	0.040
17	0.009	0.008	0.010	0.020
18	0.000	0.000	0.000	0.000
19	0.000	0.000	0.000	0.000
H	0.785	0.838	0.826	0.820
HP	0.757	0.621	0.179	0.783
ET	0.342	0.319	0.031	0.527
LR	0.549	0.396	0.032	0.554

H: Observed heterozygosity; HP: Probability of Homozygosity; ET: Exact Test; LR: Likelihood Ratio.

TABLE 3—Observed allele frequencies of locus-TPOX in four communities of Bihar.

Alleles	Brahmin N = 59	Bhumihar Brahmin N = 65	Rajput N = 58	Kayasth N = 53
7	0.000	0.000	0.000	0.010
8	0.464	0.395	0.482	0.306
9	0.155	0.097	0.118	0.163
10	0.064	0.105	0.073	0.072
11	0.281	0.371	0.264	0.378
12	0.036	0.024	0.054	0.061
13	0.000	0.008	0.009	0.010
14	0.000	0.000	0.000	0.000
H	0.636	0.725	0.618	0.306
HP	0.412	0.745	0.781	0.460
ET	0.370	0.769	0.580	0.161
LR	0.433	0.592	0.725	0.153

H: Observed heterozygosity; HP: Probability of Homozygosity; ET: Exact Test; LR: Likelihood ratio.

TABLE 4—Observed allele frequencies of locus-FGA in four communities of Bihar.

Alleles	Brahmin N = 59	Bhumihar Brahmin N = 65	Rajput N = 58	Kayasth N = 53
18	0.009	0.017	0.000	0.010
19	0.071	0.034	0.091	0.051
20	0.071	0.155	0.091	0.133
20.2	0.018	0.000	0.011	0.092
21	0.134	0.181	0.091	0.010
21.2	0.009	0.034	0.023	0.112
22	0.143	0.121	0.148	0.122
22.2	0.018	0.000	0.011	0.000
23	0.170	0.130	0.194	0.051
23.2	0.000	0.009	0.057	0.153
24	0.160	0.164	0.148	0.010
24.2	0.000	0.000	0.011	0.175
25	0.125	0.103	0.068	0.010
25.2	0.009	0.009	0.011	0.010
26	0.045	0.017	0.045	0.010
27	0.009	0.026	0.000	0.020
27.2	0.000	0.000	0.000	0.000
28	0.009	0.000	0.000	0.031
H	0.767	0.793	0.886	0.857
HP	0.979	0.815	0.993	0.999
ET	0.376	0.073	0.702	0.534
LR	0.482	0.111	0.662	0.638

H: Observed heterozygosity; HP: Probability of Homozygosity; ET: Exact Test; LR: Likelihood ratio.

TABLE 5—Observed allele frequencies of locus- D5S818 in four communities of Bihar.

Alleles	Brahmin N = 59	Bhumihar Brahmin N = 65	Rajput N = 58	Kayasth N = 53
7	0.000	0.000	0.019	0.000
8	0.000	0.000	0.000	0.000
9	0.073	0.024	0.019	0.028
10	0.100	0.109	0.120	0.132
11	0.300	0.242	0.277	0.349
12	0.427	0.422	0.361	0.321
13	0.100	0.195	0.185	0.170
14	0.000	0.008	0.019	0.000
H	0.727	0.640	0.537	0.641
HP	0.547	0.293	0.010	0.546
ET	0.506	0.132	0.363	0.466
LR	0.677	0.151	0.221	0.613

H: Observed heterozygosity; HP: Probability of Homozygosity; ET: Exact Test; LR: Likelihood ratio.

TABLE 6—Observed allele frequencies of locus-D13S317 in four communities of Bihar.

Alleles	Brahmin N = 59	Bhumihar Brahmin N = 65	Rajput N = 58	Kayasth N = 53
7	0.026	0.008	0.017	0.000
8	0.155	0.138	0.216	0.226
9	0.103	0.062	0.078	0.113
10	0.078	0.115	0.060	0.104
11	0.284	0.269	0.241	0.227
12	0.276	0.316	0.284	0.198
13	0.061	0.069	0.095	0.094
14	0.017	0.023	0.009	0.038
H	0.672	0.846	0.844	0.867
HP	0.100	0.856	0.845	0.616
ET	0.432	0.799	0.840	0.838
LR	0.422	0.796	0.741	0.780

H: Observed heterozygosity; HP: Probability of Homozygosity; ET: Exact Test; LR: Likelihood ratio.

TABLE 7—Observed allele frequencies of locus-D7S820 in four communities of Bihar.

Alleles	Brahmin N = 59	Bhumihar Brahmin N = 65	Rajput N = 58	Kayasth N = 53
6	0.000	0.000	0.000	0.000
7	0.028	0.008	0.035	0.019
8	0.142	0.235	0.202	0.264
9	0.142	0.070	0.070	0.047
10	0.189	0.289	0.246	0.208
11	0.273	0.180	0.228	0.330
12	0.198	0.195	0.193	0.104
13	0.028	0.023	0.017	0.019
14	0.000	0.000	0.009	0.009
H	0.679	0.734	0.719	0.811
HP	0.105	0.830	0.755	0.852
ET	0.728	0.641	0.608	0.607
LR	0.790	0.760	0.572	0.582

H: Observed heterozygosity; HP: Probability of Homozygosity; ET: Exact Test; LR: Likelihood ratio.

TABLE 8—Observed allele frequencies of locus-D16S53 in four communities of Bihar.

Alleles	Brahmin N = 59	Bhumihar Brahmin N = 65	Rajput N = 58	Kayasth N = 53
8	0.078	0.069	0.098	0.066
9	0.129	0.138	0.170	0.123
10	0.129	0.085	0.152	0.085
11	0.414	0.231	0.223	0.396
12	0.138	0.300	0.214	0.170
13	0.112	0.131	0.134	0.151
14	0.000	0.046	0.009	0.009
15	0.000	0.000	0.000	0.000
H	0.793	0.738	0.785	0.754
HP	0.239	0.113	0.137	0.206
ET	0.418	0.169	0.104	0.163
LR	0.413	0.181	0.131	0.153

H: Observed heterozygosity; HP: Probability of Homozygosity; ET: Exact Test; LR: Likelihood ratio.

TABLE 9—Observed allele frequencies of locus-CSFIPO in four communities of Bihar.

Alleles	Brahmin N = 59	Bhumihar Brahmin N = 65	Rajput N = 58	Kayasth N = 53
7	0.026	0.000	0.000	0.000
8	0.000	0.000	0.009	0.000
9	0.018	0.016	0.052	0.019
10	0.219	0.266	0.172	0.211
11	0.316	0.290	0.284	0.375
12	0.316	0.356	0.345	0.337
13	0.096	0.056	0.069	0.058
14	0.009	0.016	0.060	0.000
15	0.000	0.000	0.009	0.000
H	0.719	0.677	0.793	0.653
HP	0.814	0.866	0.236	0.910
ET	0.633	0.840	0.017	0.738
LR	0.601	0.787	0.034	0.900

H: Observed heterozygosity; HP: Probability of Homozygosity; ET: Exact Test; LR: Likelihood ratio.

TABLE 10—Observed allele frequencies of locus-Penta-D in four communities of Bihar.

Alleles	Brahmin N = 59	Bhumihar Brahmin N = 65	Rajput N = 58	Kayasth N = 53
7	0.000	0.016	0.049	0.000
8	0.000	0.016	0.000	0.038
9	0.302	0.156	0.245	0.202
10	0.216	0.211	0.196	0.163
11	0.233	0.273	0.177	0.212
12	0.121	0.141	0.137	0.183
13	0.069	0.086	0.118	0.106
14	0.025	0.094	0.039	0.087
15	0.034	0.007	0.039	0.009
H	0.706	0.828	0.725	0.826
HP	0.297	0.814	0.724	0.298
ET	0.674	0.509	0.687	0.189
LR	0.884	0.609	0.735	0.235

H: Observed Heterozygosity; HP: Probability of Homozygosity; ET: Exact Test; LR: Likelihood ratio.

TABLE 11—Observed allele frequencies of locus-D3S1358 in four communities of Bihar.

Alleles	Brahmin N = 59	Bhumihar Brahmin N = 65	Rajput N = 58	Kayasth N = 53
12	0.000	0.000	0.025	0.000
13	0.000	0.000	0.025	0.000
14	0.037	0.059	0.063	0.068
15	0.278	0.314	0.250	0.240
16	0.324	0.305	0.225	0.394
17	0.287	0.195	0.200	0.250
18	0.056	0.102	0.187	0.048
19	0.018	0.017	0.025	0.000
20	0.000	0.008	0.000	0.000
H	0.740	0.711	0.550	0.653
HP	0.238	0.920	0.009	0.655
ET	0.069	0.690	0.814	0.627
LR	0.145	0.866	0.701	0.708

H: Observed Heterozygosity; HP: Probability of Homozygosity; ET: Exact Test; LR: Likelihood ratio.

TABLE 12—Observed allele frequencies of locus-THO1 in four communities of Bihar.

Alleles	Brahmin N = 59	Bhumihar Brahmin N = 65	Rajput N = 58	Kayasth N = 53
6	0.342	0.323	0.400	0.192
7	0.158	0.153	0.100	0.260
8	0.140	0.097	0.083	0.087
9	0.289	0.234	0.242	0.317
9.3	0.062	0.177	0.142	0.135
10	0.009	0.016	0.033	0.009
H	0.771	0.709	0.716	0.846
HP	0.240	0.552	0.328	0.589
ET	0.201	0.488	0.288	0.670
LR	0.174	0.592	0.401	0.550

H: Observed Heterozygosity; HP: Probability of Homozygosity;
ET: Exact Test; LR: Likelihood ratio.

TABLE 13—Observed allele frequencies of locus-D21S11 in four communities of Bihar.

Alleles	Brahmin N = 59	Bhumihar Brahmin N = 65	Rajput N = 58	Kayasth N = 53
25	0.000	0.000	0.000	0.000
27	0.018	0.000	0.018	0.010
28	0.202	0.081	0.132	0.115
29	0.228	0.202	0.281	0.251
30	0.167	0.153	0.175	0.144
30.2	0.035	0.032	0.009	0.038
31	0.009	0.056	0.044	0.029
31.2	0.087	0.121	0.079	0.000
32	0.009	0.008	0.009	0.163
32.2	0.175	0.234	0.192	0.000
33	0.000	0.008	0.000	0.163
33.2	0.070	0.097	0.061	0.077
34.2	0.000	0.008	0.000	0.010
H	0.824	0.903	0.736	0.826
HP	0.750	0.588	0.458	0.931
ET	0.379	0.170	0.650	0.484
LR	0.324	0.083	0.629	0.531

H: Observed Heterozygosity; HP: Probability of Homozygosity;
ET: Exact Test; LR: Likelihood ratio.

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TABLE 14—Observed allele frequencies of locus-D18S51 in four communities of Bihar.

Alleles	Brahmin N = 59	Bhumihar Brahmin N = 65	Rajput N = 58	Kayasth N = 53
10	0.009	0.000	0.018	0.010
11	0.026	0.016	0.026	0.000
12	0.096	0.119	0.088	0.058
13	0.088	0.119	0.123	0.105
14	0.246	0.317	0.211	0.346
15	0.211	0.095	0.114	0.125
16	0.114	0.111	0.140	0.115
17	0.140	0.127	0.105	0.096
18	0.035	0.008	0.053	0.048
19	0.017	0.040	0.044	0.048
20	0.009	0.024	0.060	0.029
21	0.000	0.008	0.009	0.010
22	0.009	0.008	0.009	0.010
23	0.000	0.008	0.000	0.000
24	0.000	0.000	0.000	0.000
25	0.000	0.000	0.000	0.000
H	0.789	0.746	0.719	0.846
HP	0.903	0.761	0.933	0.674
ET	0.176	0.299	0.827	0.065
LR	0.238	0.278	0.992	0.043

H: Observed Heterozygosity; HP: Probability of Homozygosity;
ET: Exact Test; LR: Likelihood ratio.

TABLE 15—Observed allele frequencies of locus-Penta-E in four communities of Bihar.

Alleles	Brahmin N = 59	Bhumihar Brahmin N = 65	Rajput N = 58	Kayasth N = 53
5	0.042	0.016	0.082	0.019
6	0.000	0.000	0.018	0.000
7	0.068	0.063	0.064	0.067
8	0.008	0.024	0.018	0.010
9	0.000	0.008	0.054	0.000
10	0.042	0.111	0.054	0.048
11	0.068	0.143	0.091	0.087
12	0.145	0.095	0.109	0.154
13	0.102	0.095	0.030	0.115
14	0.102	0.048	0.073	0.038
15	0.093	0.135	0.109	0.134
16	0.085	0.071	0.091	0.134
17	0.144	0.087	0.054	0.087
18	0.051	0.048	0.054	0.029
19	0.017	0.032	0.054	0.010
20	0.008	0.024	0.036	0.029
21	0.025	0.000	0.009	0.029
22	0.000	0.000	0.000	0.010
23	0.000	0.000	0.000	0.000
24	0.000	0.000	0.000	0.000
25	0.000	0.000	0.000	0.000
H	0.762	0.793	0.872	0.826
HP	0.770	0.676	0.969	0.989
ET	0.659	0.759	0.499	0.148
LR	0.839	0.814	0.682	0.306

H: Observed Heterozygosity; HP: Probability of Homozygosity;
ET: Exact Test; LR: Likelihood ratio.

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