

## FOR THE RECORD

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# Allele Frequency Data for Powerplex 16 Loci in Four Major Populations of Orissa, India\*

**POPULATION:** Allele distribution studies were carried out in the four predominant communities of Orissa, namely Oriya Brahmins ( $N = 57$ ), Khandayat ( $N = 62$ ), Karan ( $N = 62$ ), and Gope ( $N = 60$ ), which lies in the southeastern part of the Indian subcontinent. They speak a common dialect "Oriya" and practice very high degree of endogamy. These populations, ranging in size from 5–15 lakhs, form the upper crust of the Hindu hierarchical caste system. (1)

**KEYWORDS:** forensic science, population genetics, DNA typing, polymorphism, short tandem repeat, D3S1358, THO1, D21S11, D18S51, Penta E, D5S818, D13S317, D7S820, D16S539, CSF1PO, Penta D, vWA, D8S1179, TPOX, FGA, Oriya population

Genomic DNA was obtained from blood samples by using standard phenol/chloroform procedure (2). Quantitation of DNA was carried out using the Quantiblot kit (PE Applied Biosystems) and subsequent PCR amplification was performed using the Powerplex™ 16 System (Promega Corp.) The products were detected on a 5% denaturing polyacrylamide sequencing gels using the ABI Prism™ 377 DNA Sequencer (PE Applied Biosystems) and genotype classification was made by comparison with allelic ladders provided with the Powerplex™ 16 System.

Statistical analyses included tests for possible divergence from Hardy-Weinberg expectations and other parameters of forensic importance like unbiased estimate of the expected homozygote frequencies (3), likelihood ratio test (4), and the exact test (5) based on 2000 shuffling experiments. Evaluations were performed using DNATYPE program written by Chakraborty and Zhong.

The distribution of observed allele frequencies and tests for independence at the 15 STR loci in the Orissa population are shown in Tables 1-15. All loci meet Hardy-Weinberg expectations (HWE) except Karan at loci D13S317 ( $p < 0.05$ ) and significant deviation at loci vWA ( $p = 0.003$ ), Khandayat at D3S1358 ( $p = 0.03$ ) and D13S317 ( $p = 0.01$ ) and Gope at vWA ( $p = 0.01$ ). Frequencies obtained were compared with other previously published data on Indian populations (6), US Caucasians, African Americans and Hispanics with no significant difference (7) (data not shown). The data generated from this study will contribute to the expansion of Indian

DNA database suitable for population studies and forensic applications.

The complete dataset is available upon request from V. K. Kashyap, Ph.D., via e-mail: vk2k@hotmail.com.

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TABLE 1—Observed allele frequencies and descriptive statistics of D3S1358 in the four major populations of Orissa.

Allele	Oriya Brahmin N:57	Khandayat N:62	Karan N:62	Gope N:60
12	0.000	0.000	0.008	0.016
14	0.052	0.024	0.098	0.066
15	0.333	0.362	0.401	0.416
16	0.219	0.241	0.237	0.258
17	0.228	0.250	0.163	0.183
18	0.122	0.104	0.073	0.041
19	0.043	0.016	0.016	0.008
20	0.000	0.000	0.000	0.008
H:	0.842	0.854	0.803	0.733
PH:	0.162	0.097	0.369	0.904
PE:	0.192	0.092	0.326	0.335
LR:	0.190	0.037	0.176	0.536

TABLE 2—Observed allele frequencies and descriptive statistics of THO1 in the four major populations of Orissa.

Allele	Oriya Brahmin N:57	Khandayat N:62	Karan N:62	Gope N:60
6	0.280	0.185	0.338	0.175
7	0.175	0.120	0.201	0.158
8	0.184	0.145	0.112	0.175
9	0.192	0.395	0.250	0.350
9.3	0.114	0.120	0.096	0.125
10	0.052	0.032	0.000	0.016
H:	0.912	0.790	0.758	0.750
PH:	0.104	0.149	0.216	0.784
PE:	0.248	0.306	0.243	0.819
LR:	0.171	0.201	0.299	0.832

N: Sample size; H: Obs. Heterozyosity; PH: Homozyosity test; PE: Exact test; LR: Maximum likelihood ratio test based on 2000 shufflings.

TABLE 3—Observed allele frequencies and descriptive statistics of D21S11 in the four major populations of Orissa.

Allele	Oriya Brahmin N:57	Khandayat N:62	Karan N:62	Gope N:60
25	0.000	0.008	0.000	0.000
27	0.008	0.040	0.000	0.008
28	0.122	0.048	0.104	0.091
29	0.271	0.314	0.161	0.208
30	0.192	0.201	0.201	0.200
30.2	0.052	0.048	0.048	0.050
31	0.070	0.040	0.032	0.058
31.2	0.070	0.080	0.104	0.108
32	0.008	0.008	0.016	0.008
32.2	0.122	0.137	0.217	0.250
33.2	0.070	0.072	0.096	0.000
34.2	0.008	0.000	0.016	0.016
H:	0.842	0.758	0.854	0.750
PH:	0.962	0.686	0.556	0.610
PE:	0.767	0.158	0.427	0.167
LR:	0.788	0.219	0.426	0.176

N: Sample size; H: Obs. Heterozyosity; PH: Homozyosity test; PE: Exact test; LR: Maximum likelihood ratio test based on 2000 shufflings.

TABLE 4—Observed allele frequencies and descriptive statistics of D18S51 in the four major populations of Orissa.

Allele	Oriya Brahmin N:57	Khandayat N:62	Karan N:62	Gope N:60
10	0.000	0.000	0.000	0.008
11	0.026	0.000	0.032	0.041
12	0.140	0.064	0.032	0.091
13	0.166	0.153	0.139	0.175
14	0.184	0.370	0.270	0.291
15	0.192	0.161	0.188	0.108
16	0.175	0.096	0.180	0.116
17	0.061	0.072	0.049	0.075
18	0.008	0.040	0.049	0.041
19	0.008	0.024	0.024	0.016
20	0.000	0.000	0.000	0.008
21	0.000	0.000	0.016	0.025
22	0.017	0.008	0.016	0.000
23	0.000	0.008	0.000	0.000
25	0.017	0.000	0.000	0.000
H:	0.824	0.725	0.819	0.883
PH:	0.444	0.694	0.823	0.998
PE:	0.652	0.706	0.294	0.972
LR:	0.228	0.900	0.479	0.979

N: Sample size; H: Obs. Heterozyosity; PH: Homozyosity test; PE: Exact test; LR: Maximum likelihood ratio test based on 2000 shufflings.

TABLE 5—Observed allele frequencies and descriptive statistics of Penta E in the four major populations of Orissa.

Allele	Oriya Brahmin N:57	Khandayat N:62	Karan N:62	Gope N:60
5	0.096	0.040	0.066	0.050
6	0.000	0.000	0.000	0.008
7	0.114	0.024	0.058	0.066
9	0.008	0.000	0.008	0.016
10	0.052	0.032	0.016	0.016
11	0.175	0.169	0.166	0.150
12	0.149	0.185	0.125	0.150
13	0.078	0.088	0.058	0.050
14	0.096	0.024	0.091	0.091
15	0.035	0.104	0.091	0.066
16	0.043	0.064	0.116	0.075
17	0.043	0.056	0.083	0.083
18	0.070	0.120	0.050	0.100
19	0.026	0.048	0.025	0.041
20	0.008	0.032	0.033	0.016
22	0.000	0.000	0.000	0.008
23	0.000	0.000	0.000	0.008
24	0.000	0.000	0.008	0.000
25	0.000	0.008	0.000	0.000
H:	0.947	0.967	0.900	0.916
PH:	0.963	0.815	0.979	0.998
PE:	0.830	0.571	0.821	0.741
LR:	0.810	0.386	0.840	0.692

N: Sample size; H: Obs. Heterozyosity; PH: Homozyosity test; PE: Exact test; LR: Maximum likelihood ratio test based on 2000 shufflings.

TABLE 6—Observed allele frequencies and descriptive statistics of D5S818 in the four major populations of Orissa.

Allele	Oriya Brahmin N:57	Khandayat N:62	Karan N:62	Gope N:60
7	0.000	0.008	0.000	0.016
8	0.000	0.008	0.000	0.016
9	0.008	0.016	0.024	0.050
10	0.122	0.161	0.096	0.133
11	0.254	0.314	0.354	0.266
12	0.447	0.282	0.354	0.316
13	0.157	0.209	0.145	0.183
14	0.008	0.000	0.024	0.016
H:	0.684	0.806	0.709	0.783
PH:	0.793	0.786	0.229	0.378
PE:	0.649	0.582	0.244	0.070
LR:	0.609	0.454	0.154	0.121

N: Sample size; H: Obs. Heterozyosity; PH: Homozyosity test; PE: Exact test; LR: Maximum likelihood ratio test based on 2000 shufflings.

TABLE 7—Observed allele frequencies and descriptive statistics of D13S317 in the four major populations of Orissa.

Allele	Oriya Brahmin N:57	Khandayat N:62	Karan N:62	Gope N:60
7	0.026	0.024	0.024	0.008
8	0.157	0.250	0.217	0.233
9	0.114	0.056	0.096	0.108
10	0.096	0.056	0.080	0.091
11	0.263	0.201	0.177	0.316
12	0.236	0.266	0.225	0.166
13	0.070	0.088	0.137	0.041
14	0.035	0.056	0.040	0.033
H:	0.824	0.887	0.774	0.750
PH:	0.167	0.019	0.049	0.907
PE:	0.267	0.017	0.036	0.854
LR:	0.156	0.010	0.048	0.889

N: Sample size; H: Obs. Heterozyosity; PH: Homozyosity test; PE: Exact test; LR: Maximum likelihood ratio test based on 2000 shufflings.

TABLE 8—Observed allele frequencies and descriptive statistics of D7S820 in the four major populations of Orissa.

Allele	Oriya Brahmin N:57	Khandayat N:62	Karan N:62	Gope N:60
6	0.000	0.000	0.000	0.008
7	0.008	0.016	0.016	0.025
8	0.166	0.225	0.137	0.183
9	0.078	0.080	0.096	0.100
10	0.271	0.225	0.274	0.241
11	0.289	0.233	0.290	0.316
12	0.140	0.169	0.169	0.100
13	0.043	0.024	0.016	0.025
14	0.000	0.024	0.000	0.000
H:	0.771	0.774	0.774	0.750
PH:	0.286	0.563	0.358	0.258
PE:	0.186	0.414	0.250	0.092
LR:	0.179	0.442	0.255	0.088

N: Sample size; H: Obs. Heterozyosity; PH: Homozyosity test; PE: Exact test; LR: Maximum likelihood ratio test based on 2000 shufflings.

TABLE 9—Observed allele frequencies and descriptive statistics of D16S539 in the four major populations of Orissa.

Allele	Oriya Brahmin N:57	Khandayat N:62	Karan N:62	Gope N:60
8	0.070	0.040	0.064	0.083
9	0.114	0.129	0.177	0.175
10	0.114	0.104	0.112	0.058
11	0.315	0.306	0.298	0.325
12	0.236	0.266	0.209	0.241
13	0.149	0.104	0.112	0.108
14	0.000	0.024	0.016	0.008
15	0.000	0.024	0.008	0.000
H:	0.789	0.741	0.838	0.816
PH:	0.378	0.248	0.237	0.754
PE:	0.601	0.123	0.095	0.754
LR:	0.544	0.179	0.104	0.747

N: Sample size; H: Obs. Heterozyosity; PH: Homozyosity test; PE: Exact test; LR: Maximum likelihood ratio test based on 2000 shufflings.

TABLE 10—Observed allele frequencies and descriptive statistics of CSF1PO in the four major populations of Orissa.

Allele	Oriya Brahmin N:57	Khandayat N:62	Karan N:62	Gope N:60
7	0.000	0.008	0.008	0.000
8	0.017	0.000	0.008	0.008
9	0.008	0.016	0.016	0.025
10	0.241	0.233	0.088	0.216
11	0.294	0.233	0.306	0.250
12	0.339	0.379	0.491	0.425
13	0.089	0.104	0.080	0.058
14	0.008	0.024	0.000	0.008
15	0.000	0.000	0.000	0.008
H:	0.785	0.661	0.661	0.700
PH:	0.441	0.935	0.822	0.943
PE:	0.135	0.616	0.657	0.634
LR:	0.094	0.866	0.374	0.521

N: Sample size; H: Obs. Heterozyosity; PH: Homozyosity test; PE: Exact test; LR: Maximum likelihood ratio test based on 2000 shufflings.

TABLE 11—Observed allele frequencies and descriptive statistics of Penta D in the four major populations of Orissa.

Allele	Oriya Brahmin N:57	Khandayat N:62	Karan N:62	Gope N:60
7	0.000	0.008	0.016	0.008
8	0.000	0.000	0.032	0.033
9	0.187	0.169	0.169	0.250
10	0.187	0.225	0.254	0.158
11	0.312	0.282	0.286	0.216
12	0.160	0.137	0.090	0.125
13	0.116	0.080	0.090	0.141
14	0.000	0.064	0.040	0.050
15	0.035	0.032	0.024	0.016
H:	0.750	0.758	0.836	0.833
PH:	0.119	0.528	0.373	0.729
PE:	0.155	0.412	0.366	0.476
LR:	0.168	0.436	0.188	0.542

N: Sample size; H: Obs. Heterozyosity; PH: Homozyosity test; PE: Exact test; LR: Maximum likelihood ratio test based on 2000 shufflings.

TABLE 12—Observed allele frequencies and descriptive statistics of vWA in the four major populations of Orissa.

Allele	Oriya Brahmin N:57	Khandayat N:62	Karan N:62	Gope N:60
13	0.008	0.008	0.000	0.008
14	0.192	0.120	0.139	0.108
15	0.070	0.056	0.081	0.058
16	0.236	0.217	0.319	0.208
17	0.263	0.258	0.262	0.258
18	0.192	0.225	0.147	0.258
19	0.035	0.080	0.040	0.100
20	0.000	0.032	0.008	0.000
H:	0.859	0.741	0.868	0.916
PH:	0.575	0.260	0.023	0.041
PE:	0.441	0.089	0.009	0.051
LR:	0.496	0.145	0.003	0.014

N: Sample size; H: Obs. Heterozyosity; PH: Homozyosity test; PE: Exact test; LR: Maximum likelihood ratio test based on 2000 shufflings.

TABLE 13—Observed allele frequencies and descriptive statistics of D8S1179 in the four major populations of Orissa.

Allele	Oriya Brahmin N:57	Khandayat N:62	Karan N:62	Gope N:60
8	0.009	0.000	0.008	0.000
9	0.009	0.000	0.000	0.000
10	0.163	0.217	0.196	0.200
11	0.063	0.040	0.073	0.058
12	0.054	0.088	0.098	0.058
13	0.200	0.169	0.155	0.150
14	0.227	0.161	0.180	0.225
15	0.163	0.217	0.172	0.191
16	0.081	0.088	0.098	0.100
17	0.018	0.008	0.016	0.016
18	0.000	0.008	0.000	0.000
19	0.009	0.000	0.000	0.000
H:	0.818	0.854	0.754	0.733
PH:	0.943	0.902	0.450	0.516
PE:	0.470	0.735	0.221	0.416
LR:	0.556	0.776	0.326	0.564

N: Sample size; H: Obs. Heterozyosity; PH: Homozyosity test; PE: Exact test; LR: Maximum likelihood ratio test based on 2000 shufflings.

TABLE 14—Observed allele frequencies and descriptive statistics of TPOX in the four major populations of Orissa.

Allele	Oriya Brahmin N:57	Khandayat N:62	Karan N:62	Gope N:60
8	0.363	0.311	0.358	0.275
9	0.136	0.172	0.133	0.158
10	0.100	0.131	0.091	0.083
11	0.345	0.327	0.391	0.433
12	0.045	0.040	0.025	0.050
13	0.009	0.008	0.000	0.000
14	0.000	0.008	0.000	0.000
H:	0.745	0.786	0.733	0.716
PH:	0.978	0.894	0.875	0.328
PE:	0.881	0.651	0.951	0.174
LR:	0.982	0.745	0.914	0.378

N: Sample size; H: Obs. Heterozyosity; PH: Homozyosity test; PE: Exact test; LR: Maximum likelihood ratio test based on 2000 shufflings.

TABLE 15—Observed allele frequencies and descriptive statistics of FGA in the four major populations of Orissa.

Allele	Oriya Brahmin N:57	Khandayat N:62	Karan N:62	Gope N:60
18	0.000	0.008	0.000	0.000
19	0.066	0.040	0.120	0.033
20	0.047	0.122	0.112	0.141
20.2	0.000	0.016	0.008	0.000
21	0.141	0.114	0.086	0.125
21.2	0.009	0.016	0.017	0.000
22	0.216	0.163	0.172	0.141
22.2	0.009	0.008	0.000	0.008
23	0.141	0.114	0.163	0.141
23.2	0.000	0.008	0.008	0.008
24	0.235	0.188	0.129	0.200
24.2	0.009	0.000	0.008	0.000
25	0.066	0.090	0.129	0.150
25.2	0.000	0.024	0.008	0.000
26	0.018	0.065	0.034	0.033
27	0.018	0.008	0.000	0.016
27.2	0.000	0.008	0.000	0.000
28	0.018	0.000	0.000	0.000
H:	0.811	0.819	0.879	0.866
PH:	0.970	0.999	0.916	0.995
PE:	0.174	0.222	0.212	0.987
LR:	0.219	0.327	0.180	0.981

N: Sample size; H: Obs. Heterozyosity; PH: Homozyosity test; PE: Exact test; LR: Maximum likelihood ratio test based on 2000 shufflings.