SHORT COMMUNICATION

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Polymarker, HLA-DQA1 and D1S80 allele data in a Zimbabwean Black sample population

Abstract Allele frequencies for the seven PCR-based loci (LDLR, GYPA, HBGG, D7S8, Gc, HLA-DQA1, and D1S80) were determined in a Black African population from Zimbabwe. All loci are highly polymorphic and meet Hardy-Weinberg expectations. An interclass correlation analysis detected only two significant departures from independence out of 21 pair-wise comparisons of the 7 loci. The Black African allele frequency data are similar to African American data at four of the seven PCR-based loci.

Key words Zimbabwe · Population databases · PCR · Hardy-Weinberg expectations · HLA-DQA1 · LDLR · GYPA · HBGG · D7S8 · Gc · D1S80

Introduction

The six loci HLA-DQA1, LDLR, GYPA, HBGG, D7S8, and Gc can be amplified simultaneously using the Ampli-Type PM+DQA1 PCR amplification and typing kit (Perkin Elmer Corporation, Norwalk, Conn.) [1, 2, 3]. A seventh locus D1S80, which is a VNTR locus, also can be amplified by PCR [4, 5, 6, 7, 8]. Typing for databases is facilitated by the availability of commercial kits. This paper presents allele frequency data in Black Africans from Zimbabwe for these seven PCR-based systems. The data are available for estimating DNA profile frequencies, particularly for cases in Zimbabwe, and will be useful for racial admixture studies in United States populations.

Materials and methods

The source of the blood samples and sample preparation were described previously [9]. The PM and HLA-DQA1 loci were amplified and typed using the AmpliType PM+DQA1 PCR amplification and typing kit (Perkin Elmer Corporation, Norwalk, Conn.) according to the manufacturer's protocol. The D1S80 locus was typed according to the method previously described [6]. Statistical analyses were the same as in [1].

Results and discussion

Allele frequency data for the PM, HLA-DQA1, and D1S80 loci in Black Africans from Zimbabwe are shown in Tables 1 and 2. All loci are highly polymorphic and meet

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Table 1 Observed allele frequency distributions for PM and HLA-DQA1 loci in 106 unrelated Black Africans from Zimbabwe

Allele	LDLR	GYPA	HBGG	D7S8	Gc	DQA1
A	0.198	0.486	0.368	0.712	0.099	
B	0.802	0.514	0.274	0.288	0.858	
C			0.358		0.042	
1.1						0.132
1.2						0.344
1.3						0.123
2						0.057
3						0.047
4.1						0.189
4.2/4.3						0.108
Exact test (*P* value)	0.563	0.541	0.875	0.152	0.387	0.167
PD	0.484	0.625	0.811	0.568	0.422	0.933
PE	0.134	0.187	0.366	0.163	0.127	0.612

Table 2 D1S80 allele frequencies in a sample of 101 unrelated Black Africans from Zimbabwe

Allele	Frequency
16	0.005
17	0.015
18	0.025
19	0.000
20	0.005
21	0.144
22	0.129
23	0.030
24	0.129
25	0.059
26	0.000
27	0.030
28	0.119
29	0.020
30	0.015
31	0.069
32	0.015
33	0.000
34	0.163
35	0.000
36	0.000
37	0.000
38	0.000
39	0.000
40	0.020
41	0.000
> 41	0.010
Exact test (*P* value)	0.478
PD	0.979
PE	0.784

The allele frequency data at the seven PCR-based loci in the Black African Zimbabwe population sample were compared with African American data [1, 5, 10]. The two groups were statistically similar at four of the seven loci. The loci that differed were D1S80 ($P < 10^{-3}$), Gc ($P < 10^{-3}$) and HLA-DQA1 ($P = 0.001$). The PCR-based loci may prove useful for estimating the amount of Caucasian admixture in African Americans (manuscript in preparation).

In conclusion, the data demonstrate that estimates of multiple locus profile frequencies can be obtained from the Zimbabwe database for identity testing purposes using the product rule under the assumption of independence.

Hardy-Weinberg expectations. The probability of discrimination (PD) and exclusion (PE) are displayed in Tables are shown in Tables 1 and 2. An inter-class correlation test detected two significant departures from independence out of 21 pair-wise comparisons of the 7 loci: HBGG/Gc ($P = 0.022$) and D7S8/Gc ($P = 0.036$). When the interclass correlation test was run on a total of 13 loci (the seven PCR-based loci in this study and six STR loci typed in the same Zimbabwe sample population in a previous study [9]), 3 additional significant departures were observed. These were CSF1PO/VWA ($P = 0.018$), CSF1PO/LDLR ($P = 0.027$), and FGA/HLA-DQA1 ($P = 0.032$).

References

1. Budowle B, Lindsey JA, DeCou JA, Koons BW, Giusti AM, Comey CT (1995) Validation and population studies of the loci LDLR, GYPA, HBGG, D7S8, and Gc (PM loci), and HLA-DQ∝ using a multiplex amplification and typing procedure. J Forensic Sci 40:45–54
2. Kloosterman AD, Sjerps M, Wust D (1995) Dutch Caucasian population data on the loci LDLR, GYPA, HBGG, D7S8, and Gc. Int J Legal Med 108:36–38
3. Nakajima T, Matsuki T, Ohkawara H, Nara M, Furukawa K, Kishi K (1996) Evaluation of 7 DNA markers (D1S80, HLA-DQ alpha, LDLR, GYPA, HBGG, D7S8, and GC loci). Int J Legal Med 109:47–48
4. Kasai K, Nakamura Y, White R (1990) Amplification of a variable number of tandem repeat (VNTR) locus (pMCT118) by the polymerase chain reaction (PCR) and its application to forensic science. J Forensic Sci 35:1196–1200
5. Budowle B, Baechtel FS, Smerick JB, Presley KW, Giusti AM, Parsons G, Alevy M, Chakraborty R (1995) D1S80 population data in African Americans, Caucasians, Southeastern Hispanics, Southwestern Hispanics, and Orientals. J Forensic Sci 40: 38–44
6. Budowle B, Koons BW, Errera JD (1996) Multiplex amplification and typing procedure for the loci D1S80 and Amelogenin. J Forensic Sci 41:660–663
7. Alonso A, Martin P, Albarran C, Sancho M (1993) Amplified fragment length polymorphism analysis of the VNTR locus D1S80 in central Spain. Int J Legal Med 105:311–314
8. Sepulchre MA, Wiegand P, Brinkmann B (1995) D1S80 (pMCT118): analysis of 3 ethnic subpopulations living in Brussels. Int J Legal Med 108:45–47
9. Budowle B, Nhari LT, Moretti TR, Kanoyangwa SB, Masuka E, Defenbaugh DA, Smerick JB (1997) Zimbabwe black population data on the six short tandem repeat loci – CSF1PO, TPOX, THO1, D3S1358, VWA, and FGA. Forensic Sci Int 90:215–221
10. Budowle B, Koons BW, Moretti TR (1998) Subtyping of the HLA-DQA1 locus and independence testing with PM and STR/VNTR loci. J Forensic Sci 43:657–660