

DISTRIBUTION OF TRANSFERRIN (TF), RED CELL ACID PHOSPHATASE (EAP), ESTERASE D (ESD) AND GROUP SPECIFIC COMPONENT (GC) PHENOTYPES IN CHINA

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INTRODUCTION

Population data on electrophoretic genetic markers are necessary for a statistical evaluation of forensic evidence. Since the heterozygosity of Tf, EAP, EsD and Gc polymorphism in population is high, they are very useful in paternity testing and identification. The purpose of this work is to present the databases of Tf, EAP, EsD and Gc that are phenotypes and gene frequencies in unrelated adult Chinese; to provide the probability of discrimination and the probability of excluding paternity in four polymorphisms mentioned above; and to compare the databases in Chinese with that in other populations.

MATERIALS AND METHODS

Erythrocytes were washed three times in physiological saline solution and subsequently hemolyzed by freezing and thawing for EAP, EsD analysis; serum without additive was prepared for Tf, Gc analysis. The methods of phenotyping these four polymorphisms was according to references 1-4. The population data were analyzed using the chi-square statistic. The discriminating probability (D_p) and probability of excluding paternity (Q_n) were based on the following formula:

$$D_p = 1 - \sum_{i=1}^n p_i^2$$

$$Q_n = \sum_{i=1}^n p_i (1 - p_i)^2 (1 - p_i + p_i^2) + \sum_{i=1}^{n-1} \sum_{j=i+1}^n p_i p_j (p_i + p_j) (1 - p_i - p_j)^2$$

RESULTS AND DISCUSSION

The number of observed phenotypes, expected phenotypes and allelic frequencies for Tf, EAP, EsD and Gc are shown in Tables 1-4. The distributions of the phenotypes for each of the genetic markers are in Hardy-Weinberg equilibrium. Furthermore, a comparison between our data and other geographical locations are shown in Tables 5-8. It is obvious that the data for this paper (Asian) are not the same to the Causasoid and Negroid races. There is no obvious statistical difference among the Asian populations. However, pooled different population data would produce an improper statistical value, for individuals of either geographical location's population. The D_p and Q_n for each marker for Chinese are shown in Table 9. For individual identification and paternity testing purpose, the first markers to type would be EsD, then Tf or Gc, and finally, EAP would be typed according to D_p and Q_n .

Table 1: Distribution of Tf Subtypes in Taiyuan (China)

<i>Subtypes</i>	<i>Observed</i>	<i>(%)</i>	<i>Expected</i>	<i>(%)</i>	χ^2	<i>Gene Frequencies</i>
Tf C1	119	(58.05)	117.19	(57.17)	0.0279	TfC1=0.7561
Tf C2-1	64	(31.22)	69.56	(33.93)	0.4444	
Tf C2	14	(6.83)	10.32	(5.03)	1.3122	TfC2=0.2244
Tf C1D	7 _b	(3.41)	5.30	(2.59)	0.5453	TfD=0.0171
Others ^a	1	(0.0041)	2.63	(1.28)	1.0102	
<i>Totals</i>	205	(99.51)	205.00	(100.00)	3.34	

a: Tf DD, Tf C1B, Tf C2D, Tf C2B, Tf BB and Tf B δ ; b: Tf C1B;
df = 6; 0.75 < P < 0.9; based on the Hardy-Weinberg equilibrium.

Table 2: Distribution of EAP Phenotypes in Taiyuan (China)

<i>Phenotypes Observed</i>	<i>(%)</i>	<i>Expected</i>	<i>(%)</i>	χ^2	<i>Gene Frequencies</i>	
EAP B	266	(66.86)	220	(65.28)	0.1636	Pb=0.0876
EAP BA	94	(27.81)	104	(30.86)	0.9615	
EAP A	18	(5.33)	13	(3.86)	1.9231	Pa=0.1920
<i>Totals</i>	338	(100.00)	337	(100.00)	3.0482	

df=1; P > 0.05; based on the Hardy-Weinberg equilibrium.

Table 3. Distribution of EsD Phenotypes in Taiyuan (Chinese)

<i>Phenotypes Observed</i>	<i>(%)</i>	<i>Expected</i>	<i>(%)</i>	χ^2	<i>Gene Frequencies</i>	
EsD 1	118	(38.61)	112	(36.84)	0.3214	EsD1=0.6065
EsD 2-1	134	(43.93)	145	(47.69)	0.8345	
EsD 2	53	(17.38)	47	(15.46)	0.7659	EsD2=0.3934
<i>Totals</i>	305	(100.00)	304	(99.99)	1.9218	

df=1; P > 0.1; based on the Hardy-Weinberg equilibrium.

Table 4: Distribution Gc of phenotypes in Taiyuan (China)

<i>Phenotypes Observed</i>	<i>(%)</i>	<i>Expected</i>	<i>(%)</i>	χ^2	<i>Gene Frequencies</i>	
Gc 1	219	(57.48)	217	(57.11)	0.0184	Gc1=0.7559
Gc 2-1	138	(36.22)	140	(36.84)	0.0286	
Gc 2	24	(6.29)	43	(6.05)	0.0435	Gc2=0.2441

df=1; P > 0.5; Based on the Hardy-Weinberg equilibrium.

Table 5: Tf gene frequencies in some populations

<i>Population</i>	<i>No.</i>	<i>TfC1</i>	<i>TfC2</i>	<i>TfC3</i>	<i>TfD</i>	χ^2	<i>P</i>
Germany	1108	0.79	0.13	0.07		9.1733	< 0.01
France	250	0.78	0.13	0.05		10.7915	< 0.025
White (USA)	947	0.77	0.16	0.05		3.7189	> 0.05
Black (USA)	232	0.84	0.11		0.05	16.6589	<< 0.005
Japanese	342	0.76	0.23		0.01	0.5590	> 0.5
this paper	205	0.75	0.22		0.071	./.	./.

Table 6: EsD gene frequencies in some populations

<i>Population</i>	<i>No.</i>	<i>EsD1</i>	<i>EsD2</i>	<i>EsD5</i>	χ^2	<i>P</i>
White (USA)	208	0.8490	0.1213	0.0297	96.9241	<< 0.005
Black (USA)	181	0.9365	0.0635		163.5002	<< 0.005
White (GB)	4611	0.8820	0.0973	0.0207	120.5355	<< 0.005
Black (GB)	1149	0.9019	0.0870	0.0039	135.3659	<< 0.005
Indian (GB)	309	0.8074	0.1764	0.0162	60.8244	<< 0.005
this paper	305	0.6065	0.3934			

Table 7: EAP gene frequencies in some populations

<i>Population</i>	<i>No.</i>	<i>AcpB</i>	<i>AcpA</i>	<i>AcpC</i>	<i>Others</i>	χ^2	<i>P</i>
White (USA)	208	0.6130	0.3389	0.0481		43.1285	<< 0.005
Black (USA)	181	0.7845	0.1934	0.0138	0.0083	1.7258	> 0.5
Britain	367	0.60	0.36	0.04		52.3520	<< 0.005
Oriental	77	0.805	0.195			1.7029	> 0.5
this paper	338	0.8076	0.1920			./.	./.

Table 8: Gc gene frequencies in some populations

<i>Population</i>	<i>No.</i>	<i>Gc1</i>	<i>Gc2</i>	χ^2	<i>P</i>
Sweden	3394	0.75	0.25	0.1363	> 0.90
Britain	100	0.73	0.26	0.7460	> 0.50
Germany	1523	0.74	0.26	65.0892	<< 0.005
France	256	0.67	0.31	9.6090	< 0.01
White (USA)	7274	0.71	0.27	1.9677	> 0.25
Black (USA)	540	0.85	0.10	45.7269	<< 0.005
Japanese	531	0.72	0.24	0.1304	> 0.90
this paper	381	0.7559	0.2441	./.	./.

Table 9: The discriminating probabilities and probabilities of excluding paternity of Tf, EAP, EsD and Gc for Chinese

<i>Discriminating Probabilities</i>		<i>Excluding Paternity Probabilities</i>	
<i>Marker</i>	<i>Dp</i>	<i>Marker</i>	<i>Qn</i>
EsD	0.6270	EsD	0.1817
Tf	0.5579	Tf	0.1650
Gc	0.5245	Gc	0.1505
EAP	0.4727	EAP	0.1312

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