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COMPARATIVE POPULATION-GENETIC ANALYSIS ON THE ABO AND Rh BLOOD GROUP FACTORS OF THE POPULATION FROM THE ZLATOGRAD REGION (SOUTH-EAST RHODOPES)

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ABSTRACT. A total of 268 clinically healthy persons of both sexes from the Zlatograd region have been investigated by immunohematological methods for determining the blood group phenotypes of the ABO and Rh systems. In a comparative-population aspect the inhabitants of the Zlatograd region shows a higher incidence of the O blood group mainly at the expense of A blood group (r = 0.644; p = 0.219; q = 0.137) and a considerably higher incidence of the Rh/d/ gene (0,586). This fact defines its special position among all populations included in the comparative analysis. According to the genetic distances the Zlatograd population proved to be closest to the Basques i.e. the most plausible genetic heirs of the indigenous population of Europe (protoEuropoids). The results from the comparative cluster analysis showed that the population of the Zlatograd region and the so-called Karakachani form a subcluster that we have named „paleo-Balkan“ and the two Basque samples form another subcluster – the „paleo-Iberean“. These two subclusters shape a „paleo-Europoid“ cluster with a prevalence of the proto-Europoid genetic heritage. The „neo-Europoid“ cluster which is with a prevalence of the Former-Asian genetic heritage is found at a far greater distance from it (GD = 49,75). It includes all other Balkan and Eastern European populations together with the Former – Asia ones.

KEY WORDS. seroanthropological, ABO and Rh blood group, cluster analysis, gene distance, , local endogamy, Rhodopean population.

INTRODUCTION

The phenotypic diversity of the blood group antigens is comparatively well explored (21,8). In the different human populations their distribution is uneven which is the result from micro- and macromigration processes and natural selection. The population-demographic peculiarities such as the endogamy, the effect of the founder, „the transition through the bottleneck“, etc. also can lead to local changes in

the incidence of different genetic markers (20,15,13). The study of the changes taking place in the blood group systems as a result from these processes renders a possibility for tracing the geno-geography and ethnic history of the populations.

In that respect the Rhodope – mountain population provokes a special interest. In the course of over 300 (three hundred) years a part of the Rhodope population has been matrimonially isolated from the rest of the Bulgarian population due to confessional differences (islamization). As a result from a chain of historic and geographic reasons a more complex socio-demographic structure related to local endogamy, retardation of the demographic transition, etc. is typical for this population (11).

The aim of the present study is to investigate the distribution of the blood group systems of ABO and Rh(D) in a population from the Zlatograd region and using the comparative population-genetic analysis of other populations to establish certain specific features in its genetic stucture.

Materials and Methods

A total of 268 clinically healthy persons of both sexes have been examined for determining their ABO and Rh system blood group phenotypes using immunohematological methods. The obtained data have been subjected to mathematico-statistical processing with the absolute and relative distributions and mathematical anticipation of the ABO system phenotypes being scrupulously calculated. The statistical significance and uniformity have been determined with the X2 – criterion and t-criterion. The gene distances after Nei (1972) have been also determined (22). 19 other populations have entered the comparative – population analysis and the weighted pair-group cluster method has been applied (18,9,16).

Results and Discussion

The results from the study on the distribution of the ABO system blood groups in the population from the Zlatograd region are presented in Table № 1. It has been established that the difference between the observed and expected values is insignificant and so the studied population is in a state of genetic equilibrium as follows from the Hardy-Weinberg law. The gene frequencies found in this study (r = 0.644; p = 0.219; q = 0.137) differ from the data for the rest of Bulgarian population (1). The difference is in the higher incidence of the O blood group mainly at the expense of blood group A. Previous studies of ours in the Devin region (3) have also established a higher incidence of the O blood group. The data of S.Lalchev (1984) having investigated a population from the whole Smolyan region (Zlatograd including) also confirm these results (5).

The distribution of the blood – group phenotypes of the Rh/D/ system in the Zlatograd population yielded the following results: 34,33 percent Rh(-) and 65,67 percent Rh(+). These frequencies differ significantly from the data obtained for the Devin region, Smolyan as a whole and from the data of Bliznakov and Popvassilev (1980) for an overall Bulgarian group – 13,8 percent and 86,2 percent respectively. The high incidence of Rh(d) gene in the Zlatograd population outlines its special position among all populations used as comparison.

The data from the comparative – population analysis of the ABO and Rh(D) systems are pressented in Table № 2. Populations from the Rhodopes, Balkan peninsula, Middle and East Europe, Former Asia and the Pyrenees have been included. The selection of the samples has been made on the basis of : 1/ territorial proximity – samples from the Rhodopes (Smolyan, Shiroka Luka, Devin and the Greek part of the Rhodopes) and also from the Balkans (Bulgarian and Greek samples as a whole, Christians and Muslims from Western Thrace, Karakachani from Bulgaria); 2/ migrations during the early Middle Ages of Slavonic population to the Balkan peninsula – samples from Middle and Eastern Europe (Poles from Poland and Byelorussia, Byelorussians, Lithuanians and Russians from Byelorussia); 3/ presence of ancient seroanthropological characteristics – two Basque samples as the most plausible genetic heirs of Europe's indigenous population (proto-Europoids); 4/ search for traces of genetic expansion - as demic diffusion or migration of Former Asian population to Europe during the period of neolithic revolution – three samples of Turks, Arabs and Persians.

The results from the comparative cluster analysis (Table № 3, Fig.№ 1 and № 2) are rather impressive. The entire material is divided into two clusters at the level of the very great genetic distances (GD=49,75). The first cluster includes two Basque samples.We named it „paleo-Europoid cluster" with prevalence of proto-Europoid genetic heritage. The second one encompasses the three Former-Asian samples and has been maned „neo-Europoid" cluster with the Former-Asian genetic heritage prevailing. There are two subclusters to be discerned in the second cluster: „South-Eastern" (Bulgarian Mohammedans from Greece and the Devin region, the population from the Smolyan region, Mohammedans and Christians from Western Thrace, Greeks, Bulgarians, Turks, Persians and strikingly Russians from Byelorussia) and a Mid-European one which includes a population from Shiroka Luka, two Polish samples, Lithuanians, Byelorussians as well as the specifically positioned Arabs from Iraq. This subdivision corresponds with the following three subgroups – 1/ with strong prevalence of Former-Asian genes („South-Eastern" cluster); 2/ with weak prevalence of Former-Asian genes („Mid-European" cluster); 3/ a proper Former-Asian subgroup – Arabs. To us the first cluster, the paleo-Europoid one was of special interest. It can definitively be subdivided into two subgroups – the „paleo-Iberean cluster (the two Basque samples and the „paleo-Balkan" one – comprising the samples from the Zlatograd region and the one of the Karakachani. There has been a long record of authors' contributions to the links of Karakachani with the indigenous population of the Balkans and Europe based on ethnological and anthropological data (6,25,7,4,12,17). A much greater interest is provoked by the fact that according to the genetic distances the Zlatograd population proved to be closer to the Basques i.e. the most plausible heirs of the genes of the indigenous population of Europe (the proto-Europoids) rather than the Karakachani. The latter together with the Bulgarians from Shiroka Luka are to be found on the border between the two major clusters – the paleo-Europoid and the neo-Europoid one.

CONCLUSION

The results obtained by us are in full accordance with the historical data according to which the zone of the medium-height mountains (about 500 m above the sea level) is the most densely populated one by the human in Southern Europe till the 17 th century and is the one with the most stable settlement system (2). The settlements in the Zlatograd region are situated in such a mountainous zone as well. The ancient Balkan genetic heritage in them can be attributed to the early and intensive cultivation of the low –and medium height mountainous regions and the stability of the settlement system. Once populated the mountains lead to a genetic isolation (local endogamy) which has been boosted by the Islamization of a part of the Rhodopes population about 300 years ago. The hard to get to in the past mountainous labyrinth like regions as well as the religious isolation of the Zlatograd population have favoured the formation of small populations with a limited gene influx. The preservation of „relics“ testifying to ancient seroanthropological characteristics is quite possible to be found in them due to the processes of isolation.

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Table № 1. Established and expected number of AB0 phenotyes in the Zlatograd region

Genetype	Pheno – type	Established control numbers	Expected incidence	Expected number	X^2
0	0	109	$r^2 = 0.4154$	111.3	0.0475
A0	A	91	$2pr = 0.2819$	88.4	0.0765
AA			$P^2 = 0.0478$		
B0	B	55	$2qr = 0.1764$		
BB			$q^2 = 0.0887$	52.3	0.1394
AB	AB	13	$2pq = 0.0598$	16.0	0.5625
Total		268	1.0000	268	0.8256

V=3

Table № 2. Comparative data for the ABO and Rh system gene frequency

Population	Author	Gene frequency				
		System AB0			System Rh	
		r	p	q	d	D
1.Basques (Rosario)	Rosario, 1984	0.777	0.205	0.018	0.527	0.473
2.Basques (Boyd)	Boyd, 1950	0.756	0.239	0.008	0.536	0.464
3.Zlatograd	**Present study**	**0.644**	**0.219**	**0.137**	**0.586**	**0.414**
4.Karakachani	Tsacheva, Boev 1974	0.620	0.275	0.105	0.485	0.515
5.Shiroka Luka region	Kavgazova, Janeva, 1981	0.636	0.221	0.143	0.436	0.564
6. Poles (Byelorussia, Lithuania)	Salivon et al.1980	0.614	0.248	0.138	0.421	0.579
7. Lithuanians	Salivon et al.1980	0.611	0.214	0.175	0.401	0.599
8. Byelorussians	Salivon et al.1980	0.605	0.251	0.144	0.396	0.604
9.Poles	Tegako et al.1981	0.583	0.269	0.148	0.401	0.599
10.Bulgarian Mohammedans (Greek part of Rhodopes)	Xirotiris,1980	0.668	0.265	0.068	0.367	0.633
11.Smolyan district	Lalchev, 1984	0.612	0.271	0.117	0.357	0.643
12.Devin region	Kavgazova, Janeva 1981	0.624	0.244	0.132	0.350	0.650
13. Western Thrace-Muslims	Paidousis, Krimbas, 1980	0.620	0.245	0.135	0.350	0.650
14. Persians	Mohammad et al., 2004	0.597	0.236	0.145	0.349	0.651
15. Greec (total)	Paidusis, Krimbas, 1980	0.636	0.266	0.098	0.315	0.685
16. Russians (Byelorussia)	Salivon et al., 1980	0.565	0.286	0.150	0.361	0.639
17. Bulgarians	Bliznakov, Popvasilev,1980	0.559	0.310	0.131	0.371	0.629
18. Turks	Boyd, 1950, Perzen, 1996	0.581	0.293	0.116	0.354	0.646
19. Western Thrace – Christians	Paidousis, Krimbas, 1980	0.579	0.301	0.119	0.335	0.665
20. Arabs	Boyd, 1950	0.581	0.226	0.208	0.321	0.679

Table № 3. Genetic distances after Nei between the populations examined /x1000/

Population	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1.Basques (Rosario)	0																			
2.Basques (Boyd)	0.78	0																		
3. **Zlatograd**	15.93	14.37	0																	
4. Karakachani	15.96	13.60	12.78	0																
5. Shiroka Luka region	21.94	22.87	23.04	4.82	0															
6. Poles (Byelorussia, Lithuania)	27.88	27.78	28.91	5.19	0.85	0														
7. Lithuanians	37.07	38.81	36.70	11.82	2.11	1.72	0													
8. Byelorussians	36.05	36.21	38.67	9.39	2.58	0.71	1.25	0												
9. Poles	39.80	38.92	38.87	9.02	3.82	1.16	2.33	0.41	0											
10. Bulgarian Mohammedans (Greek Rhdopes)	31.09	31.53	51.24	14.84	8.25	5.99	8.80	4.87	6.66	0										
11. Smolyan district	45.04	45.03	56.08	16.73	8.16	4.52	5.19	2.02	2.60	2.47	0									
12. Devin region	45.82	47.21	57.61	19.23	7.74	4.96	3.88	2.21	3.53	3.18	0.58	0								
13. Western Thrace-Muslims	46.77	48.10	57.84	19.35	7.83	4.96	3.79	2.15	3.36	3.49	0.58	0.01	0							
14. Persians	51.49	52.92	59.90	21.05	8.65	5.57	3.58	2.41	3.39	5.41	1.12	0.35	0.25	0						
15. Greece (total)	55.18	56.30	75.97	28.34	15.90	11.52	11.10	7.33	8.84	3.48	1.88	1.85	1.95	2.75	0					
16. Russians (Byelarussia)	56.83	55.81	58.82	18.74	10.58	5.80	5.77	2.74	1.98	7.79	1.60	2.64	2.38	1.94	5.14	0				
17. Bulgarians	54.72	52.38	56.63	16.49	11.56	6.18	8.14	3.62	2.27	7.75	2.26	4.46	4.20	4.13	6.50	0.61	0			
18. Turks	52.85	51.65	61.30	18.77	11.48	6.46	7.73	3.41	3.03	4.80	0.67	2.15	2.02	2.25	2.85	0.76	0.76	0		
19. Western Thrace- Chistians	61.31	60.17	71.45	24.42	15.60	9.74	10.38	5.67	5.23	6.33	0.48	2.91	2.74	2.82	2.38	1.26	1.48	0.38	0	
20. Arabs (Baghdad)	75.14	77.81	78.01	35.27	17.17	13.47	7.54	8.37	9.17	15.74	6.95	4.78	4.43	2.95	7.84	5.19	9.31	7.65	7.03	0

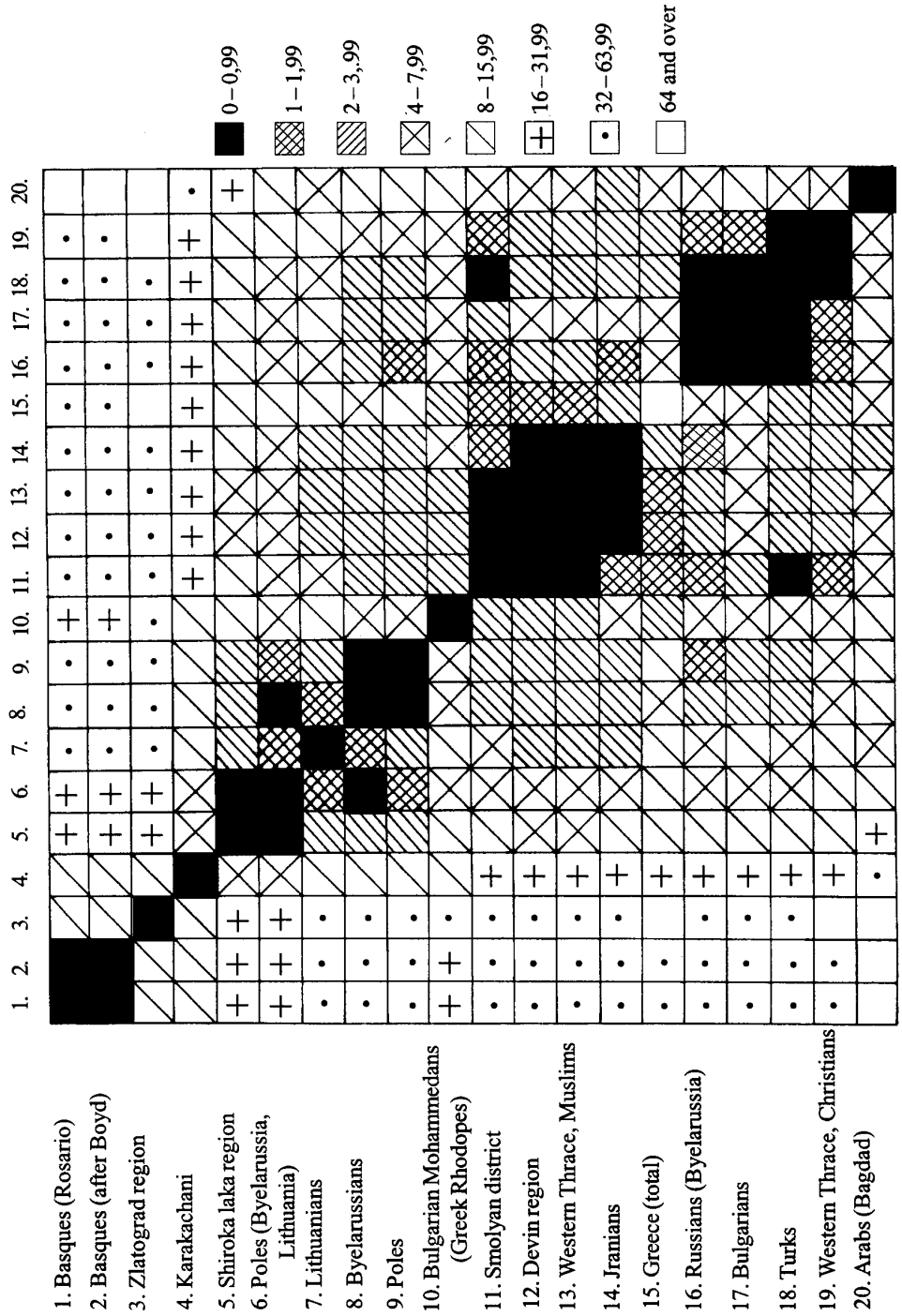

Fig. 1. *Genetic distances after Nei between the populations examined.*

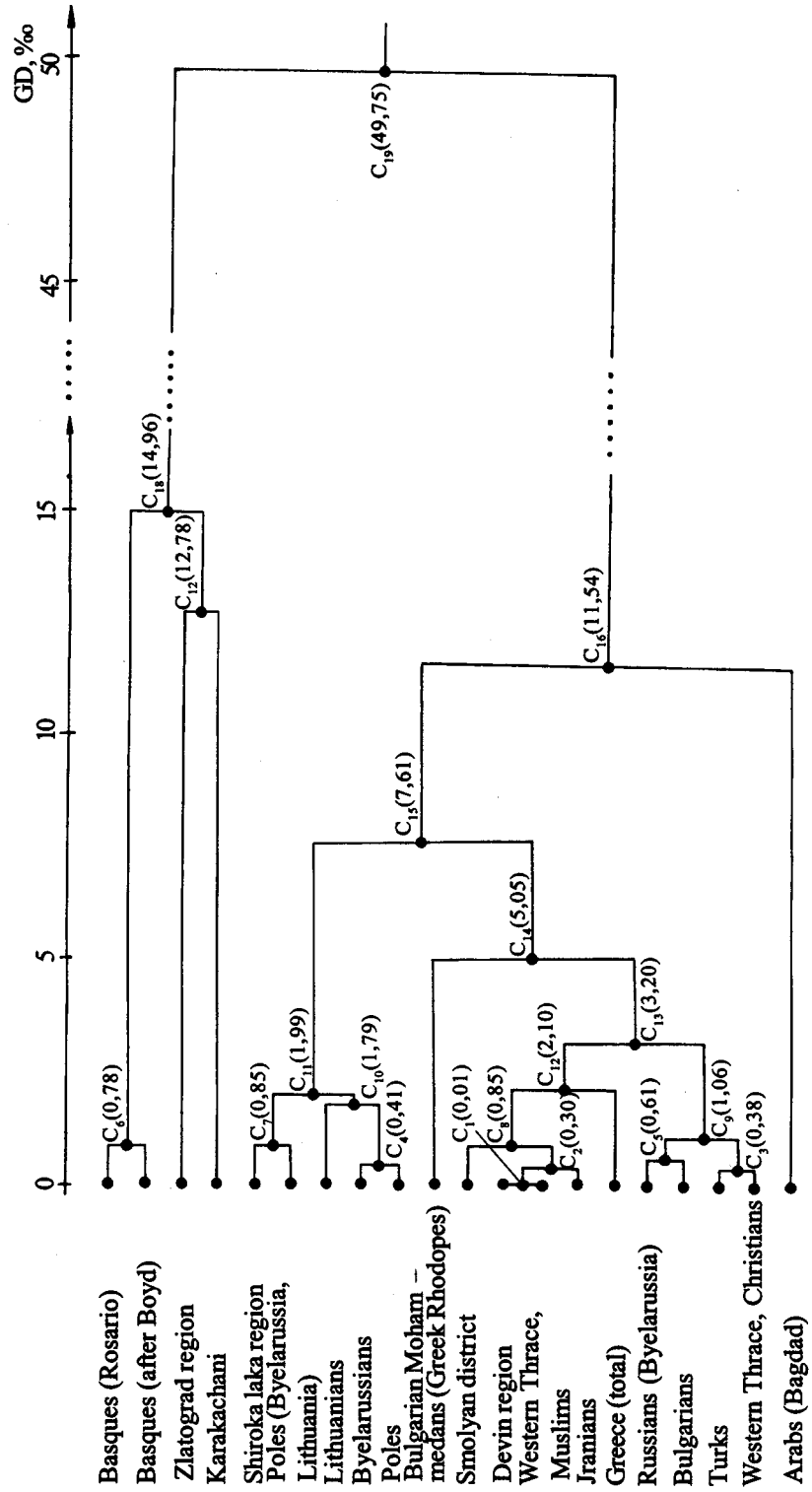

Fig. 2. *Cluster analysis of the populations examined.*