ORIGINAL ARTICLE

Genetic and Demographic Characteristics of Population of Central Russia

Inna N. Sorokina[1], Kristina N. Sergeeva[2], Irina V. Batlutskaya[2], Evgenij N. Krikun[2], Natalia A. Rudyh[2], Svetlana S. Sirotina[2]

[1] *Belgorod State University, 308015, Belgorod, Pobedy Street, 85, Russia; e-mail: sorokina@bsu.edu.ru*
[2] *Belgorod State University, 308015, Belgorod, Pobedy Street, 85, Russia*

Abstract

The paper presents data on the assessment of the size of elementary population among the residents of Central Russia. It has been defined that population-genetic study of the residents of Central Russia should be carried out at the level of raion, which is an elementary population. The size of elementary population should be taken into account when forming the samples for further genetic and epidemiological surveys of population.

Keyword : Genetics,

1. INTRODUCTION

When conducting population genetic studies, an important task is to determine the size of elementary population. One of the indicators, allowing to estimate the size of elementary population, is the endogamy index. According to L.L. Cavalli-Sforsa and W.F. Bodmer, endogamy index is the proportion of husbands and wives, born in the same population (1). The higher is the level of endogamy in the population, the more often the spouses come from the same population, and the higher is likelihood that they are relatives and, therefore, they have the same genes, derived from common ancestors. Endogamy, in contrast to migrations, leads to an increase in genetic differences in the subpopulations, which are the part of a single population of higher level. The population can be considered as independent evolutionary unit, if it receives no more than 50% of gametes, occurring in the population and leading to childbirth (9). The endogamy index allows to establish, to a certain extent, the natural boundaries of populations. It is of great importance in the studies of population (4), in particular when forming samples for further medical-genetic and genetic-epidemiological research of the population (2).

The endogamy index was widely used in population-genetic studies, carried out in the Kostroma and Kirov oblasts (4) the Rostov oblast (7; 1), the Kursk oblast (6; 12), Moscow (8), in Krasnodar Krai (5) and in a number of other populations (11). The values of endogamy index in the studied Russian populations are distinguished by considerable variability. In general, the endogamy index is higher in rural populations, compared to urban, but the variability of endogamy index is high as in urban, as in rural populations.

In accordance with the foregoing, the endogamy index in four regional populations of three oblasts (Belgorod, Kursk, Voronezh) of Central Russia for the period 1990-2000, was studied in this research.

2. Materials and Methods

In order to estimate the size of elementary population, the endogamy index was calculated. 2015 records in the register books of marriages from the archives of Civil Registry Offices, located in 4 raions of the Belgorod, Kursk and Voronezh oblasts, were the material for the study of endogamy index. The data on the place of birth of spouses were received from the register books of marriages. The endogamy index was determined on the basis of the spouses' birth places. According to L.L. Cavalli-Sforsa and W.F.

Bodmer, the endogamy index for a given population is calculated as the proportion of husbands and wives, born in this population (3).

Correspondence Author: Inna N. Sorokina
Email address: *sorokina@bsu.edu.ru*
Received: 04-08-2018
Revised: 12-09-2018
Accepted:25-11-2018

accordance with the "administrative rank" of populations: at the level of rural municipality, at the raion level, at the oblast level. Existent administrative units - rural municipalities, raions, oblasts, as a rule,

are based on historically established hierarchical groups of populations (rural parish, county, governorate). Their current infrastructure also affects the structure of marital migrations. Elementary population is the population, which consists of at least 50% of endogamous marriages (9).

3. Results

It was defined, that the proportion of marriages, concluded within the rural municipality at the present time, was low (on average for 19 rural municipalities — 0.29). The index of endogamy in any of 19 rural municipalities of four districts of three regions did not exceed 0.38 (Table 1). In the rural municipalities of Krasnensky raion of the Belgorod oblast, the average value of endogamy index was 0.33, and varied from

0.23 to 0.36. In another raion of the Belgorod oblast (Prokhorovsky), the endogamy index at the level of rural municipality was even lower - 0.28, and varied from 0.17 to 0.37. Similar data were obtained for rural municipalities of the border raions of the Kursk oblast (0.26 with variability from 0.16 to 0.38) and the Voronezh oblast (0.27, varying from 0.13 to 0.38). Low values of the endogamy index don't allow to consider the rural municipality as an elementary population, both in the Belgorod, Kursk and Voronezh oblasts. Since, the elementary population should consist of at least 50% of endogamous marriages (9).

Then we considered a larger level of population structure - the level of administrative raions. Table 1 shows the proportion of marriages, concluded by the residents of rural municipalities within their raions. This means that we consider endogamy at the raion level of population organization.

Table (1) Index of endogamy at the population level of rural municipality in the Belgorod, Kursk and Voronezh regions (oblast) in the 1990s

Studied populations (rural municipality)	The population in 1998.	Sample size	Sources of marriage migrations		
			given rural municipality	given raion	given oblast
Prokhorovsky raion of the Belgorod oblast (1978–1995 s.)					
1. Plotavsky	770	101	0.17	0.50	0.69
2. Podoleshensky	2303	127	0.36	0.55	0.72
3. Prelestnensky	1232	76	0.20	0.50	0.63
4. Kolomytsevsky	1501	109	0.37	0.55	0.83
5. Kholodnyansky	1503	114	0.30	0.50	0.74
on average	1462	105	0.28	0.52	0.72
Krasnenskiy raion of the Belgorod oblast (1987–1999 s.)					
1. Gorkinsky	1255	104	0.36	0.50	0.60
2. Gotovsky	1165	101	0.36	0.47	0.59
3. Kamysinsky	2547	205	0.33	0.53	0.79
4. Krasnensky	2976	138	0.23	0.45	0.54
5. Raskhovetsky	1481	92	0.35	0.49	0.70
on average	1885	128	0.33	0.49	0.64
Pristenskii raion of the Kursk oblast (1991–2001 s.)					
1. Bobryshevsky	2036	89	0.28	0.50	0.59
2. Nagolensky	572	100	0.16	0.49	0.54
3. Pristenskii	509	102	0.17	0.57	0.61
4. Psaltery	803	96	0.38	0.56	0.69
5. Sredneolshansky	667	80	0.30	0.45	0.49
on average	917	93	0.26	0.51	0.58
Repyevsky raion of the Voronezh oblast (1994-2001 s.)					
1. Butyrsky	1583	54	0.28	0.54	0.70
2. The Krasnopolyevsky	1626	88	0.38	0.58	0.78
3. Platavsky	1182	82	0.29	0.44	0.67
4. Rep'evsky	6409	157	0.13	0.44	0.62
on average	2700	95	0.27	0.50	0.69

Notes: sources of marriage migrations (rural municipality, raion, oblast) were determined for each rural municipality, as the ratio of the number of marriages between the persons, born in the given population (rural municipality, raion, oblast), to the total number of marriages in this rural municipality.

The size of marriage migrations within the raion in the Belgorod oblast varies insignificantly: from 0.45 to 0.55. In rural populations of Prokhorovsky raion of the Belgorod oblast, the endogamy index at the raion level of organization was 0.52, with variability from 0.50 to 0.55. In Krasnensky raion of the Belgorod oblast, the endogamy index at the raion level was slightly lower and amounted to 0.49, varying from 0.45 to 0.53. In populations of the Kursk and Voronezh oblasts, the index of endogamy at the raion level exceeds the critical value of 0.50. In Repyevsky raion of the Voronezh oblast, this index corresponds to a critical value of 0.50, varying from 0.44 to 0.58. In Pristenskii raion of the Kursk oblast, the endogamy index at the raion level of population organization is 0.51, with variability from 0.45 to 0.57. The values of endogamy index, calculated for marital migrations, within the considered rural municipalities varied from 0.49 to 0.83, averaging 0.66.

The data obtained give reason to consider the rural municipality as an elementary population in the Belgorod, Kursk and Voronezh oblasts, since the endogamy indices for elementary population, located within one raion, are 0.50-0.52. This corresponds to the standard criterion for defining the elementary population —the population is considered as independent unit if it contains at least 50% of endogamous marriages. Krasnensky raion of the Belgorod oblast is also approaching to this criterion, although it does not reach it (0.49).

Since at present, the raion is the elementary population of the Central Black Earth Region, we have defined the endogamy index at the population level of raion. (Table 2). The value of endogamy index as a whole for Prokhorovsky raion of the Belgorod oblast and Pristenskii raion of the Kursk oblast was 0.52. The value of this index for Krasnensky raion of the Belgorod oblast and the adjacent Repyevsky raion of the Voronezh oblast was 0.49. On average, the value of endogamy index, calculated at the raion level, for the population from south of Central Russia was 0.51. This meets the criterion for defining the elementary population (0.5). These data confirm once again that the raion is the elementary population in Central Russia.

Table (2) The index of endogamy at the population level of raion in the Belgorod, Voronezh and Kursk oblasts in the 1990s

Studied raions	The population	Sample size	Sources of marriage migrations	
			given raion	*given oblast*
Krasnenskiy raion (Belgorod oblast)	16070	640	0.49	**0.66**
Prokhorovsky raion (Belgorod oblast)	32576	525	0.52	**0.73**
Repyevsky raion (Voronezh oblast)	18672	380	0.49	**0.68**
Pristenskii raion (Kursk oblast)	21368	465	0.52	**0.59**
on average	**22171**	**502**	**0.51**	**0.67**

Notes: sources of marriage migrations (raion, oblast) were determined for each raion, as the ratio of the number of marriages between persons, born in a given population (raion, oblast), to the total number of marriages, concluded in the area.

4. Discussion

Our research shows that the raion is the elementary population in the Belgorod, Kursk and Voronezh oblasts of Central Russia.

Obtained data are completely consistent with the results of population-demographic studies, carried out in the Kostroma (5) and Kursk oblasts (6). In the raions of the Kostroma oblast, the endogamy index was 0.48–0.64 (5). The authors of the work (6) showed, that in

1987-1990, the endogamy index was 0.46 in rural raion populations of the Kursk oblast.

Somewhat different results were obtained as a result of population-genetic study of the residents of Rostov oblast (7; 1). The authors have shown that the average index of endogamy for the rural population of the Rostov region was 0.34. At the same time, from 41% to 69% of marriages were registered on the territory of the Rostov region, and from 78% to 85% of marriages – on the territory of Russia. Based on these data, the authors conclude, that the elementary population for the rural residents of the Rostov region is practically the entire oblast.

5. Conclusion

Thus, as a result of the study, it was established that population-genetic and genetic-epidemiological studies of the residents of Central Russia should be carried out at the level of raion, which now is the elementary population.

REFERENCES

[1]　　Amelina, S.S., Vetrova, N.V., Amelina, M.A., Degtereva, E.V., Ponomareva, T.I., Elchinova, G.I., Zinchenko, R.A., Michailova, L.K., (2014). The load and diversity of hereditary diseases in four raions of Rostov oblast. Russian Journal of Genetics. 50 (1): 82-90.

[2]　　Demakova, N.A., (2018). Molecular and genetic characteristics of patients with hyperplasia and endometric polyps. Research Result. Medicine and Pharmacy. 4(2): 26-39.

[3]　　Cavalli-Sforza, L.L., Bodmer, W.F., (1971). The Genetics of Human Populations. San Francisco: Ed. W.H. Freeman and Company: 965.

[4]　　El'chinov, G., 2001. Application of population genetic analysis for the study of Russian populations with different genetic demographic structure. Extended abstract of doctoral (biol.) dissertation. Moscow: Medical Genetic Research Center of the Russian Academy of Medical Sciences: 48.

[5]　　El'chinova, G., Kriventsova, N.V., (2004). Methods for processing of population-genetic data: registers of voters. Medical genetics. 3 (5): 220-225.

[6]　　Ivanov, V.P., Churnosov, M.I., Kirilenko, A.I., (1997). Population demographic structure in Kurskaya oblast: migration. Russian Journal of Genetics. 33(3): 300-305.

[7]　　Kriventsova, N.V., Amelina, S.S., Elchinova, G.I., Zinchenko, R.A., (2005). The marriage migration characteristics of the Rostov oblast population. Russian Journal of Genetics. 41(7): 801-804.

[8]　　Kurbatova, O.L., Pobedonostsev, E.Yu., (1992). Genetic and demographic processes in urbanization: migration, outbreeding and marriage assortativity. Human heredity and the environment. M.: Nauka, 2: 7-22.

[9]　　Hereditary Diseases in Human Populations. 2002. Ginter, E.K., Ed., Moscow: Meditsina.

[10]　　Ponomarenko, I.V., (2018). Selection of polymorphic loci for association analysis in genetic-epidemiological studies. Research Result. Medicine and Pharmacy. 4(2): 40-54.

[11]　　Tarskaia, L.A., El'chinova, G.I., Vinokurov, V.N., (2003). Analysis of marital migrations in two regions in the Sakh Republic (Iakutiia). Russian J. Genetics. 39(12): 1698-1701.

[12]　　Vasilyeva, L.I., (2002). Dynamics of the Genetic Demographic Structure of the Kursk Oblast Population: Migration Processes. Russian J. Genetics. 38(4): 546-533.