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Distribution of the ABO and Rh Blood Group Antigen System in the Population of Long Livers in the Carpathian Region

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The features of distribution of the ABO and Rh blood group antigen system in the population of the long livers in the Carpathian region have been analysed. Associated analysis of the duration of life of the ABO and Rh blood group antigen system determined that long livers of Carpathian region had the highest percentage of owners of phenotype A (II) (39.09%). As for the frequency of phenotypes of the ABO antigen system among long livers the following proportion was done: male long livers - A (II) > B(III) > 0(I) > AB(IV) and female long livers - 0(I) > A(II) > B(III) > AB(IV). In 86.97% of long livers, the Rh (Rh +) trait was shown but in the control group the same trait was in 85.95% of the people. The findings allow to create complex prognostic models of human longevity.

Keyword: Longevity, Blood Types, Population

1. Introduction

Recently in most countries there is a tendency to increase in life expectancy, leading to the rise in the number of elderly people who want to maximize the period of their normal physical, social and psychological activity. Therefore, the priority medicines pay much attention to the anti-aging programs based on the development of a thorough knowledge of the mechanisms of formation of life and longevity.

In accordance with the modern ideas, aging refers to a multidimensional process of physical, psychological and social changes accompanied by increased incidence of cancer and degenerative diseases. Longevity is proved to be a multifactorial trait, and both exogenous and endogenous factors effect on it. At present active search for candidates of various biological

markers of genetic predisposition to the formation of longevity is carried on. (Table 1)

However, the study of their polymorphism or mutation states require specialized, expensive procedures and specialists. Therefore, for the purposes of medical practice it is necessary to use evidence, not expensive and available methods. The previous studies have proven our ability to predict hereditary trait, namely life expectancy by clinical and genealogical analysis.

At present, numerous works devoted to the association between the ABO, Rh, MN, Le, P blood group systems and certain polymorphic characteristics and diseases. In particular, the evidence of the relationship of individual polymorphic blood systems with anthropometric indicators is represented. The author also conducted research on the interdependence

between different systems of blood groups and the rate of aging indicators.

2. The Aim of the Study:

Investigation of the distribution of the ABO and Rh blood group antigen systems among the population of the Carpathian long - livers.

3. Materials and Methods:

To achieve this goal the research of blood antigens of 412 long livers and 220 persons of control group (people of different ages having no long livers in their family trees). All persons having been examined for 10 years and more were residents of Ivano-Frankivsk region.

Table 1: Genes of Polymorphisms having been Investigated in Association with Longevity

Genes	Function	Associated Diseases	Association with life expectancy
ApoE	The metabolism of lipoproteins (HDL apoprotein, LOVP)	AD, CVD	±
ApoB	Homeostasis cholesterol (LDL apoprotein)	Coronary arterial hypertension	+
ApoSHT-455C	Signal transmission of insulin	type 2 diabetes	+
ApoA-IV	The metabolism of lipoproteins (HDL apoprotein, LOVP)	AD?	+
ACE	Angiotensin converting enzyme	IM, stroke, AD, EH	+
CYP2D6, CYP2C19, CYP2C19	Family of cytochrome P450 genes	cancer	±
HLA клас I и клас II	Immune response	immune disorders	+
P53	Anti oncogene	Cancer, apoptosis	-
Factors V, VII, PAI-1	Blood coagulation, fibrinolysis proteins	IM, thromboembolism	+
Fibrinogen	Plasma coagulation factor	Coronary arterial hypertension	±
Prothrombin	Blood clotting and protein prothrombin	IM	±
MTHFR	methylation of homocysteine	CVD, cancer	+
Mitochondrial DNA	Oxidative phosphorylation	mitochondrion disease, AD? diabetes?	+
PARP	DNA repair, apoptosis	?	-
TPA (tissue plasminogen activator)	Fibrinolysis / Thrombolysis	IM? Stroke	-
AGT (angiotensinogen)	Renin-angiotensin system	EH, CHD, CVD, CAD	-
GP2b3a	clotting	CHD	-
Thyroid peroxidase	thyroid metabolism	?	-
Tyrosine hydroxylase	Synthesis of catecholamines	?	+
TH-INS-FokI	Sensitivity to insulin	diabetes	-
SOD2	Binding of ACF, apoptosis	?	+
WRN (Werner)	DNA helicase	Werner syndrome	+

(+) Positive association (-) no association. AD - Alzheimer's disease, PD - Parkinson's disease, MI - myocardial infarction, EH - Essential hypertension, CVD - Cardiovascular disease, CAD - Coronary Artery disease, CHD - Coronary Heart disease.

In two samples (long livers and the control group) the frequency of two traits was compared, e.g. A to 0 or A + B + AB to 0 are compounded:

$$X = \frac{A \text{ long} - \text{livers} \times 0 \text{ control group}}{0 \text{ long} - \text{livers} \times A \text{ control group}}$$

If the ratio A / 0 was the same in those two samples – there was no association. The value of X was equal to 1 when there was no difference between comparable groups of individuals. If the association value of X was more or less than 1,

while the rate of increase described the value expectancy.

4. Results and Discussion:

To investigate the genetic predisposition to longevity the association between the life expectancy and the ABO and Rh blood group antigen systems has been examined. This method is considered to be a classic one in genetics to calculate the risk of multifactorial traits. The analysis of quantification and relative distribution of the control group and the long livers according to the phenotype of the ABO and Rh blood group

systems has been done. The I(0) blood group was founded in 36.66% of long livers and in 23.81% of the control group (Fig. 1). Somewhat less advantage was in long livers with the II (A) blood group compared with those of control individuals (39.09% and 28.57% respectively). It was an interesting fact that the number of carriers of antigens B (III) in the study group was in 1.72 times less compared to the performance benchmarks. The lowest rate in both groups was registered among the persons with the IV (AB) blood group. However, the advantage of the control group was also true (14.29% in control group and 4.84% in the long livers).

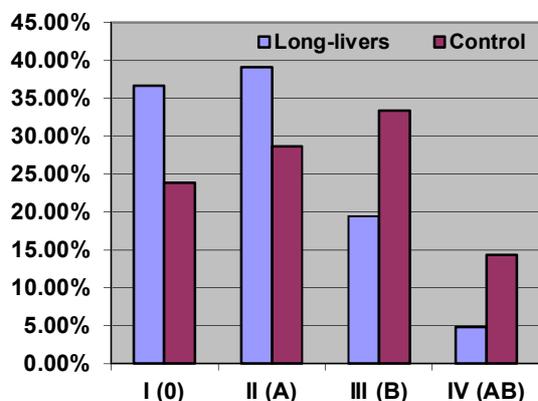


Fig 1: Distribution of the AB0 blood group system of the Carpathian long livers

The results of distribution of blood groups of the long livers were similar to the general population indices of Ukrainian population.

The next stage of work was to study the distribution of blood groups of long livers by gender (Table 2).

Table 2: Distribution of blood groups of long livers by gender (Ivano-Frankivsk region)

Blood group	Men, %	Women, %
I (0)	27,50	40,96
II (A)	33,33	42,38
III (B)	28,34	14,38
IV (AB)	10,83	2,38

It was found that among long livers there were more women having the I(0) blood group systems and antigens A. However, the carriers of the III(B) and IV(AB) blood group systems showed quite the opposite results

As for the frequency of the AB0 antigen system male long livers are divided as follows: A(II)> B(III)> 0(I)> AB (IV), and female long livers 0(I)> A(II)> B(III)> AB(IV).

To determine the association between the genes of life expectancy and the Rh antigen system the Rh antigen analysis was done for all individuals. In 86.97% of long livers the (Rh+) trait was shown and in the control group the same trait was manifested in 85.95%. Compared to other populations, the largest number of people with the (Rh-) people are registered among the residents of Australia (19%), the UK (17%), Sweden (16%) and Denmark (16%) and the smallest number- among those people who live in China (1,1%) and South Korea (0.35%). Having done the distribution of long-lived persons, the carriers of Rh antigen system by gender, it was revealed that 24.17% of men had no Rh antigens as opposed to 9.52% of female long livers (Table 3).

Table 3: Distribution of Rh antigens of long livers by gender (Ivano-Frankivsk region)

Rhesus factor	Men	Women
Rh+	75,83 %	90,48 %
Rh-	24,17 %	9,52 %

Analysis of associations between the carriers of Rh blood group system and longevity found some relative risk characteristics of displaying the trait. The Rh-positive men and women have much higher chance to be long livers than the Rh-negative ones. This may be due to the fact that in the population of the Carpathian region the Rh-positive people are dominated, as in other populations.

The next stage of the work was to study the association between the AB0 blood group antigen system and life expectancy (Table 4)

Table 4: Association between the AB0 blood group antigen system and life expectancy.

Comparative groups (AB0 system)	Value of probability compared to control
0:A	1,109
0:B	2,627
0:AB	4,305
A:0	0,901
A:B	0,380
A:AB	0,232
B:AB	1,638

As can be seen from Table 4, in long livers the most significant association between the formation of life expectancy and the group 0 (I) was found, especially compared to AB(IV) and B(III). Individuals with phenotype A (II) compared to native antigens AB(IV) and B(III) found no association of more than 1.

The logical continuation of the study was to identify associations between the AB0, Rh antigen systems and life expectancy. Data on the relative ability of longevity depending on the AB0 and Rh phenotypes are given in the table (Table 5).

It was found that the carriers of the AB0 and Rh positive antigen system of 0 variant in general are more likely to be long livers compared to those with antigen A(II), B(III) and AB(IV). (Table 5)

Table 5: Association between antigens of the AB0 and Rh blood groups and longevity

Comparative group	Value of probability
AB0 system	Long livers
0 Rh ⁺ : A Rh ⁺	1,142578
0 Rh ⁺ : B Rh ⁺	2,68125
0 Rh ⁺ : AB Rh ⁺	3,988636
A Rh ⁺ : B Rh ⁺	2,346667
A Rh ⁺ : AB Rh ⁺	3,490909
B Rh ⁺ : AB Rh ⁺	1,487603
0 Rh ⁻ : A Rh ⁻	0,857143
0 Rh ⁻ : B Rh ⁻	1,125
0 Rh ⁻ : AB Rh ⁻	6
A Rh ⁻ : B Rh ⁻	1,3125
A Rh ⁻ : AB Rh ⁻	7
B Rh ⁻ : AB Rh ⁻	5,333333

As for the frequency of the AB0 and Rh positive antigen associations long livers are divided as

follows: 0(I)> A(II)> B(III)> AB(IV). Among the owners of phenotypes A(II) B(III), AB(IV) and with Rh negative the persons with blood group (II) were considered to be long livers. Large values of probability were shown by the persons with blood group (I) as well. As for the frequency of association the owners of the AB0 and Rh negative antigen systems are divided as follows: A(II)> 0(I)> B(III)> AB(IV). This regularity is observed in the Ukrainian population too.

5. Conclusions

1. It was found that the highest percentage of the Carpathian long livers have the persons with phenotype A (II) (39.09%)
2. Having analysed the frequency of phenotypes of AB0 antigens among long livers the following division was done: male long livers (II)> B(III)> 0(I)> AB(IV) and female long livers 0(I)> A(II)> B(III)> AB(IV).
3. It was proved that among the long livers the Rh-positive women have much higher percentage compared to the men (respectively 90.48% and 75.83%)
4. It was shown that as for the frequency of associations of the AB0 and Rh positive antigen system long livers are divided as follows: 0(I)> A(II)> B(III)> AB(IV), and Rh negative - A(II)> 0(I) > B(III)> AB(IV).

The findings allow to create complex prognostic models of human longevity.

6. References

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