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MORPHOGENETIC QUALITATIVE ANALYSIS OF DERMATOGLYPHICS SIGNS IN BULGARIAN POPULATION

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Abstract: The purpose of this work is to establish a relationship between the relative frequency of alleles in the gene pool and frequency of genotypes in the population by Hardy-Weinberg principle. The study included individuals from three different ethnic groups (Bulgarian Christians, Bulgarian Muslims and Bulgarian Turks) aged between 17-35 years, a total of 1429 individuals of both sexes.
The formation of human fingerprints on the distal phalanx is carried out by three independent loci. According to the hypothesis of polygenic inheritance, loci A, L and W define different genotypes. The study included a number of 1173 fingers with a pronounced arch phenotype, 4929 with a spiral one and 8178 with a loop of the distal phalanges. When comparing the three ethnic groups with the lowest values were reported for allele dominant frequencies.

INTRODUCTION

Individuals from three different ethnic groups (Bulgarian Christians, Bulgarian Muslims and Bulgarian Turks, Fig. 1) were included in this study, aged between 17-35 years, and a total of 1429 individuals of both sexes. Papillary fingerprint images were determined according to the classification of Galton (Galton, 1892), separating them into arcs, loops and whorl (Fig. 2) according to the absence or presence of one, two or more radii in each image

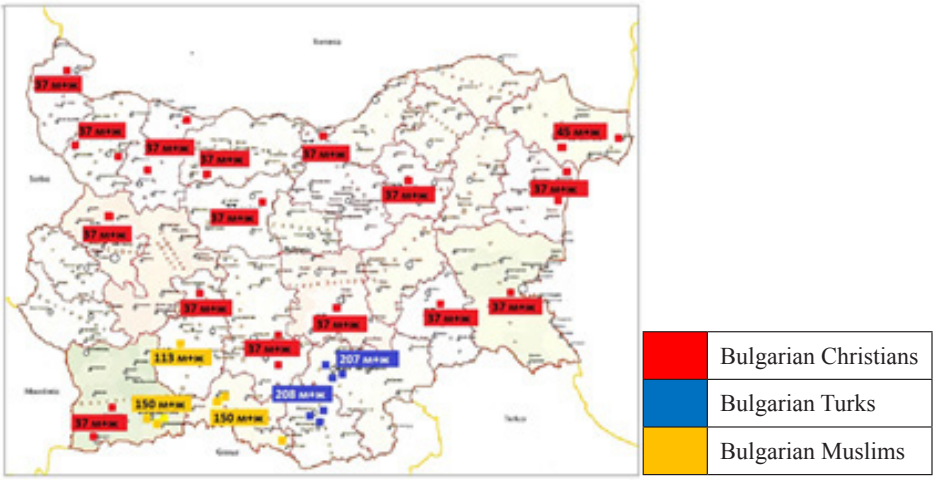

Figure 1. Location map of the three ethnic groups

MATERIALS AND METHODS

Dermatoglyphics genetics is part of Human genetics, which studies the mode of the transmission of dermatoglyphic images. The formation of the human fingerprint is carried out by three independent loci (Гусева И. 1971; Гусева И. 1973; Гусева И. 1986; Cheng X. 2009; Pal S. 2013; Babu E. 2015).

Fingerprints are determined by three major genes, A, L and W, which determine the three major characteristics of arcs, loops and the whorl (Хить Г. Л. 2013; Bhasin K. M. 2007; Fogle T. 2013; Kaloustian V. 2012; Schaumann B. 2012; Stoneking M. 2014) (Fig. 2)

Arcs – A Loop – L Whorl - W

Figure 2. Basic types of finger papillary patterns (arch – A, loop – L, whorl – W)

RESULTS AND DISCUSSION

The study covered 1173 fingers with a pronounced arch phenotype, 4929 with whorl which have distal phalanx and 8178 with loops of the distal phalanx. Allelic and genotype frequencies were calculated by the law of Hardy - Weinberg.

Table 1. Allele and genotype frequencies in the structure of the Bulgarian population of women with locus A.

Allele frequency %	Genotypic frequency %		
	AA	*Aa*	*aa*
A – 3.7	*0.13*	*7.12*	*92.73*
a – 96.3			

Table 2. Allele and genotype frequencies of the structure of Bulgarian population of women with locus L.

Allele frequency %	Genotypic frequency %		
	LL	*Ll*	*ll*
L – 37	*13.7*	*46.6*	*39.7*
l – 63			

Table 3. Allele and genotype frequencies of the structure of Bulgarian population of women with locus W.

Allele frequency %	Genotypic frequency %		
	WW	*Ww*	*ww*
W – 1.8	*3.24*	*29.5*	*67.4*
w – 8.2			

Table 4. Genetic structure of the Bulgarian population - men with the three loci A, L and W.

Allele frequency %	Genotypic frequency %		
A – 4 *a – 96*	*AA - 0.16*	*Aa - 7.68*	*aa - 92.3*
L – 35 l – 65	*LL -12.25*	*Ll - 45.5*	*ll - 42.2*
W – 20 w – 80	*WW - 4*	*Ww - 32*	*ww – 64*

Table 5. Genetic structure of Bulgarian Muslims with the three loci A, L, W.

Allele frequency %		Genotype frequency %	
women	*men*	*women*	*men*
A – 4 *a – 96*	*A – 3* *a - 97*	*AA - 0.16* *Aa - 7.68* *aa - 92.16*	*AA - 0.02* *Aa – 5.8* *aa - 94*
L – 35 *l - 65*	*L – 31* *l - 69*	*LL – 12.5* *Ll – 45.5* *ll – 42.25*	*LL – 9.6* *Ll – 42.7* *ll – 47.6*
W – 20 *w - 80*	*W – 25* *w -75*	*WW – 4* *Ww – 32* *ww - 64*	*WW – 6.2* *Ww – 37.5* *ww - 56.2*

Table 6. Genetic structure of the Turkish ethnicity with the three loci A, L and W.

Allele frequency %		Genotypic frequency %	
women	*men*	*women*	*men*
A – 7 *a – 93*	*A – 6* *a - 94*	*AA – 0.49* *Aa - 13* *aa – 86.5*	*AA - 0.36* *Aa – 11.2* *aa – 88.4*
L – 36 *l - 64*	*L – 36* *l - 64*	*LL – 13* *Ll – 46* *ll – 41*	*LL – 12* *Ll – 46* *ll – 42*
W – 16 *w - 84*	*W – 17* *w - 83*	*WW – 2.6* *Ww – 26.9* *ww – 70.5*	*WW – 2.8* *Ww – 28.2* *ww - 69*

The use of the Hardy - Weinberg law shows that the differences between the two allele frequencies - dominant and recessive in the female (A = 3.7%) and male (A = 4%) sex of the Bulgarians is very small (tab. 1 2, 3 and 4).

This reflects the fact that the phenotypic feature - arcs on the distal phalanges of the fingers is determined by an autosomal locus - A.

Low variation in allele frequency was also reported in relation to the other two dominant alleles (L and W) in males and females in the Bulgarian community.

Logically similar patterns can also be recorded with the genotypic frequencies (AA, Aa and aa) in both sexes.

It is noteworthy that in the three major phenotypic traits - arcs, loops, spiral skin relief, higher values show the frequencies of recessive alleles (a, l and w).

According to literature, it's not unusual for dermatoglyphic images without clearly expressed and shaped arcs and spirals to be found more often.

In the study of the genetic structure of Bulgarian Muslims, it has been found that higher differences in the alleles and genotypes respectively refer to the recessive allele (Tab. 5).

Again, the higher values of frequency of alleles and genotypes respectively refer to recessive, i.e. the recessive allele prevails in genotype frequencies.

In the outermost boundaries the dominant genotype frequencies are as follows: between women (AA - 0.16) and men (AA - 0.02). It is noteworthy that the overall results show that the values of allele frequencies in Table 6 are not dramatic, highly alternating between the two genders. This result shows that they are in line with the autosomal recessive-dominant nature of inheritance of Mendelian laws.

In the Bulgarian-Turkish community values of the dominant allele frequencies are: Women A = 4, L = 35, W = 20 for men A = 3, L = 31, W = 25. When comparing the three communities it is noticeable that the lowest values are related to the dominant allele frequencies (Table 6). The three communities - Bulgarian Christians, Bulgarian Muslims and Bulgarian Turks inhabit the same territory. They have undergone free exchange of genes. Geographical, climatic, environmental and genetic factors that would complicate communicative and genetic exchange between them are absent. This fact gives us reason to believe that the results are representative and credible.

Differences in allele and genotypic frequencies between the three communities in the Bulgarian population may be interpreted by the fact of different frequencies of different alleles; Population Genetics determines different frequencies, in principle, with which an allele is manifested phenotypically generally in a particular population whose individuals carry this allele; and not less with the independent inheritance of phenotypic signs - arcs, loops, spirals; in the sense of independent segregation of the alleles and their recombination which maintains equilibrium in genotype frequencies in the population.

In mixed populations allele frequency does not change in successive generations and the frequency of genotypes after one generation of random mating can be predicted based on the frequency of alleles.

CCONCLUSIONS

1. The additional conditions of the signs may not accumulate from generation to generation.

2. The genetic diversity can be maintained indefinitely as allele frequencies remain unchanged.

3. If the population size is limited gametes will carry only part of all alleles of the gene pool.

On a purely random composition this part will deviate from the composition of the entire gene pool and this could lead to a change in allele frequencies in the population. Allelic frequency of each allele is just as likely to increase as to decrease. The small population after time would incur a fixing in respect of one or other alleles (when 100% of individuals in the population are homozygous for a particular allele). In this specific research the sample is quite large and presenting a process such as genetic drift cannot be done and may not have regard to the resulting stable allelic and genotypic frequencies in the Bulgarian population.

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