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Genetic polymorphisms in Iranian native poultry breeds Part I. Blood groups and allele frequencies

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ABSTRACT

Blood samples were collected from five indigenous Iranian chicken breeds maintained as genetic reserve: Naked Neck, Dashtyary, Lary, Marandy and Common breed. Three blood group systems and 5 alleles were typed. A2, A6, B4, B7 and D4. Allele B7 was the most frequent in all the breeds (ranging from 0,24 to 0,31) the frequency of A2 was ranging 0,14 to 0,33, A6 0,14 to 0,26, B4 0,18 to 0,24 and D4 0,08 to 0,16. Based on these blood group alleles the heterozygosity index of the Iranian breeds are high (ranging 0.77-0.80), compared to the native breeds typed in Nepal and Bangladesh. The possibility and the accuracy to distinguish randomly chosen chickens from one breed to the other based on blood group alleles is possible with an accuracy of PD>0.90.
(Keywords: blood groups, native chicken, genetic polymorphism)

ÖSSZEFOGLALÁS

Irán helyi baromfi fajtáinak genetikai polimorfizmusa
I. rész: Vércsoportok és allél frekvenciák
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5 helyi iráni genetikai tartalékként tenyésztett kopasznyakú, Dashtyary, Lary, Marandy és parlagi tyúkfajta vérmintáit gyűjtötték össze. 3 vércsoport rendszert és 5 allél frekvenciát írtak le (A2, A6, B4, B7 és D4). A B7-es allél fordult elő a vizsgált fajtákban leggyakrabban (0.24-0.31 között), az A2 gyakorisága 0.14-0.33, az A6-é 0.14-0.26, a B4-é 0.18-0.24, a D4-é pedig 0.08-0.16. A vércsoport allélekre alapozva az iráni fajták heterozigozitás indexe magas (0.77-0.80) volt a nepáli és bangladesi helyi fajtákhoz viszonyítva. Annak lehetősége és pontossága, hogy egy fajtából véletlenszerűen kiválasztott csirkék megkülönböztethetőek legyenek egymástól a vércsoport allélek alapján PD>0.90.
(Kulcsszavak: vércsoport, helyi tyúkfajták, genetikai polimorfizmus)

INTRODUCTION

There are no informations known regarding blood group alleles and their frequencies in Iranian native chickens. About 34 million native chicken are reared in Iran. Because of the great importance of this rural poultry sector, a national genetic preservation program is in operation since 1981. Therefore it is needed to direct research efforts aimed at improving

our knowledge regarding the genetic properties of many indigenous breeds of great economic significance in a large number of developing countries among others to those of Iran. In this paper we present data on three blood group systems and their frequencies in five Iranian native breeds playing a predominant role in the rural economy of Iran providing a significant part of the population with eggs and poultry meat.

MATERIALS AND METHODS

The stocks

Blood samples were collected from five different indigenous Iranian chicken breeds Naked neck, Dashtyary, Lary, Marandy and Common breed reared in the Poultry Breeding Department of the Animal Science Research Institute of Iran. These breeds were maintained as a gene pool in this institute each population consisting of approximately 2000 hens and 200 cocks.

Determination of blood groups alleles

Blood was taken in citrated vacuum tubes directly from wing vein and centrifuged half an hour after sampling at 1500 rpm for ten minutes, to separate erythrocytes and serum. Erythrocytes were washed two times by sodium citrate solution (20g sodium citrate and 4.8 g sodium chloride to one litter distilled water) and stored in 4^{o}C until used for blood typing. Test sera used for determination of different blood group antigen belonged to the A, B and D blood group systems. Sera were diluted properly as follows: A2 1:10, A6 1:20, B4 1:8, B7 1:8, D4 1:8. For dilution of sera, saline 0.85% of NaCl solution were used. The nomenclature of blood group alleles used was given by *Briles* (1964).

Heterozygosity index

The frequency of the blood group alleles were estimated by simple counting method since these alleles are co-dominants. Genetic variability in the population was determined by measuring the heterozygosity index (h) which was calculated by the following formula:

$$h= 1-\Sigma q_i 2$$

where q_i is the frequency of the it h allele of the gene at one locus.

Blood groups can be also used as markers to detect the differences among individuals from each other with a probability depending on the number of polymorphic loci examined, and number of alleles in each of the loci, as well as the frequency of these alleles. The formula for distinguishing two individuals using polymorphic loci is

$$PD = 1 - (\Sigma p_i 4 + 4\Sigma P_i 2 P_j 2) \qquad i, j = 1, 2, ..., n$$

where PD is the probability of distinguishing one individual from another using only one polymorphic locus with n alleles. P_i and P_j are frequency of each gene at one locus.

RESULTS AND DISCUSSION

Allelic frequencies for different blood group systems tested are shown in *Table 1*. The number of animals sampled at random in each breed was representative of the breeds. The total number of the poultry populations investigated is approximately 2000 hens per breed, maintained in the genetic preservation program. According to methodological principles already 30 random samples per population would be regarded as appropriate but in our study's we took around 50 samples per population.

Allele B7 is the most frequent blood group allele in all the breeds tested. Its frequency was ranging from 0.24 to 0.31. The frequency of A2 was ranging from 0.14 to 0.23, A6 is ranging from 0.14 to 0.26, B4 from 0.18 to 0.24 and D4, from 0.08 to 0.16.

Our results which show B7 had higher frequency are in agreement with *Okada et al.* (1983) and also *Yamamoto et al.* (1992), who found in native chicken of Nepal and in the Jungle fowl and native breeds of Indonesia the allele A7 was the most frequent. *Okada and McDermid* (1969) proved that A7 antisera is identical with Af, latter symbol was used in the papers of *Okada et al.* (1983) and *Yamamoto et al.* (1992).

In Dashtyary, Lary, Marandy and Naked Neck the D4 allele had very low frequency, in the Common breed A2 had the lowest allele frequency. It is worthwhile to note that allele B7 was observed in homozygous state with high genotypic frequency. The assumption can not be excluded that there may be a relationship between B7 and the possible resistancy to some diseases and adaptability to harsh environmental conditions characteristic for Iranian native breeds. Further investigations are needed however in this direction. The heterozygosity index based on the three blood group systems studied is presented on *Table 2* for the Iranian native breeds tested.

Table 1

Frequency of blood group alleles in different breeds

Breeds(1)	Gene frequency(2)					
	n	A2	A6	B4	B7	D4
Dashtyary	50	0.140	0.260	0.240	0.280	0.080
Lary	35	0.228	0.142	0.228	0.314	0.085
Marandy	47	0.202	0.223	0.180	0.244	0.148
Naked-neck(3)	44	0.147	0.193	0.227	0.295	0.136
Common breed(4)	43	0.139	0.186	0.209	0.302	0.162

1. táblázat: A vércsoport allélek gyakorisága különböző fajtákban

Fajták(1), Génfrekvencia(2), Kopasznyakú(3), Parlagi(4)

Table 2

Heterozygosity index and the probability of distinguishing one individual from the other (PD)

Breeds(1)	Heterozygosity index(2)	PD(3)
Dashtyary	0.7704	0.9090
Lary	0.7690	0.9089
Marandy	0.7945	0.9248
Naked-neck(4)	0.7833	0.9189
Common breed(5)	0.7842	0.9194

2. táblázat: Az egyedek közötti heterozigozitás index és a megkülönböztethetőség valószínűsége (PD)

Fajták(1), Heterozigozitás index(2), Valószínűség(3), Kopasznyakú(4), Parlagi(5)

Overall it can be stated that the heterozygosity index for all Iranian breeds are high, there are small insignificant differences between them (ranging 0.7945 to 0.7690). It is of interest to note that based on the blood group alleles the heterozygosity index of the Iranian native breeds are higher than that of the native breeds of Nepal (*Yamamoto et al.*, 1992) and much higher compared to the Bangladesh native breeds (*Okada et al.,* 1988). In Nepal the range is 0.6481 to 0.4801 and in Bangladesh 0.529 to 0.353. The possibility and the accuracy to distinguish randomly chosen chickens from one breed from the other is possible, with high accuracy (PD>0.90) based on the blood group allele frequencies determined.

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