Turk J Vet Anim Sci
24 (2000) 431-434

A Study on Blood Group Allelles of Denizli Fowl

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Received: 25.01.1999

Abstract : Blood group alleles and their frequencies were estimated within a Denizli fowl flock. Sixteen full sib family groups were formed to facilitate the identification of segregating alleles. Immune antisera were produced by means of reciprocal immunizations between the parents. Reference reagents were obtained from W. E. Briles, Department of Biological Sciences, Northern Illinois University. Reference reagents were used for the blood typing. In the flock in question, the allele genes which belong to blood group systems A, B, C, D, E and L were estimated and their frequencies calculated.

In the A blood group system, A^1, A^2, A^3, A^5, A^7 and A^{12} alleles were estimated and their frequencies were calculated as 0.07, 0.11, 0.39, 0.11, 0.01, and 0.31 respectively. Alleles of B^2, B^6, B^{14}, B^{19}, B^{21}, B^{25} were estimated in the B blood group system, frequencies were calculated as 0.09, 0.37, 0.19, 0.11, 0.21 and 0.03 respectively. Frequencies of C^1, C^2, and C^5 alleles that were estimated in the C blood group system were calculated as 0.32, 0.14, and 0.55 respectively. For D^1, D^2, D^4,D^5, D^6 and D^7 alleles in the the D blood group system, frequencies were calculated as 0.02, 0.09, 0.54, 0.07, 0.23 and 0.05 respectively. The frequency of L^1 allele the L in blood group system was calculated as 1.00 while frequencies of E^2, E^3 and E^5 alleles in the E blood group system were calculated as 0.40, 0.54 and 0.06 respectively.

In this study, in the D blood group system, a new allele D^7 was revealed apart from those 6 alleles which had been designated previously.

Key Words : Denizli fowl, blood group alleles, immune sera, gene frequencies

Denizli Tavuklarının Kan Grubu Allelleri Üzerinede Bir Çalışma

Özet : Bir Denizli tavuğu sürüsünde kan grubu allelleri belirlenmiş ve onların sürüdeki frekansları hesaplanmıştır. Allel genlerin dağılımının belirlenmesi amacı ile onaltı adet özkardeş aile grubu oluşturulmuştur. Babalar ve analar arasında karşılıklı immunizasyonlarla immun serumlar üretilmiştir. Referans antikorlar, W. E. Briles, Department of Biological Sciences, Northern Illinois University'den sağlanmıştır.

Referans antikorlar kullanılarak sürüde A, B, C, D, E, L kan grubu sistemlerine ait allel genler belirlenmiş ve eldeki sürü için onların frekansları hesaplanmıştır. A kan grubu sistemi içerisinde belirlenen A^1, A^2, A^3, A^5, A^7 ve A^{12} allellerinin frekansları sırası ile 0.07, 0.11, 0.39, 0.11, 0.01 ve 0.31 olarak hesaplanmıştır. B kan grubu sistemi içerisinde B^2, B^6, B^{14}, B^{19}, B^{21} ve B^{25} allelleri belirlenmiş ve bu allellerin frekansları sıra ile 0.09, 0.37, 0.19, 0.11, 0.21 ve 0.03 olarak bulunmuştur. C kan grubu sistemi içerisinde belirlenen C^1, C^2 ve C^5 allellerinin frekansları sırası ile 0.32, 0.14 ve 0.55 olarak bulunmuştur. D kan grubu sistemi içerisinde belirlenen D^1, D^2, D^4, D^5, D^6 ve D^7 allellerinin frekansları sırası ile 0.02, 0.09, 0.54, 0.07, 0.23 ve 0.05 olarak belirlenirken, L kan grubu sistemi içerisinde belirlenen L^1 allelinin frekansı 1.00. olarak hesaplanmıştır. E kan grubu sistemi içerisinde belirlenen E^2, E^3 ve E^5 allellerinin frekansları sırası ile 0.40, 0.54 ve 0.06 olarak bulunmuştur.

Bu çalışma ile D kan grubu sistemi içerisinde, şimdiye kadar belirlenen altı allelden farklı bir allel, D^7 belirlenmiştir.

Anahtar Sözcükler : Denizli tavuğu, kan grubu allelleri, immun serum, gen frekansı

Introduction

The human ABO blood group system was discovered by Karl Landsteiner (1) in 1900. A number of investigators searched for the presence of blood group systems in a variety of animals afterwards.

In 1924, Landsteiner and Miller (2) showed that red blood cell differences existed in chickens. Detailed studies made by W. E. Briles and his co-workers on chicken blood typing led to the identification of five separate blood group systems which have been designated as A, B, C, D,

and E (3-5). In addition, D. G. Gilmour (6) identified two other systems whic he designated as L and N systems.

With the exception of the A and E systems, the above blood group loci show independent segregation suggesting they are located on separate chromosomes. Each blood group system consists of an allelic series of genes. The exact number of alleles in any one system is unknown (7).

The B system was later shown to constitute the major histocompatibility complex (MHC) of the chicken (8,9). Differences in B group alleles produce induction of hemolytic disease in chicks, graft reaction, mixed lymphocyte reaction, and induction of tolerance to B incompatible grafts (10). Therefore, chicken lines homozygous in different B (MHC) alleles were different with respect to resistance to some diseases such as Marek's disease, lenfoid leucosis, salmonellosis, and coccidiosis.

Although considerable information is available on blood groups of the chicken, relatively little information has been published on blood groups of local breeds of domestic fowl of different provinces of the world. The present investigation is concerned with the blood groups of Denizli fowl, a local layer type chicken breed (*Gallus domesticus*) of Western Anatolia, very famous for the long singing ability of the males. A previous trial was made on the blood groups of Denizli fowl (11). A^1, A^2, A^3, A^4, A^5, A^6, A^7, A^8, A^{10} and A^{11} alleles in the A blood group system, C^1, C^2, C^3, C^4 and C^5 alleles in the C blood group system, D^1, D^2, D^3, D^4, D^5, and D^6 alleles in the D blood group system, E^1, E^2, E^3, E^4 and E^5 alleles in the E blood group system, and L^1 allele in the L blood group system were estimated and their frequencies calculated. Estimation of the B blood group system was not possible in that study due to some unexpected cross reactions and the more complicated structure of the B blood group system of the chicken.

Materials and methods

This study was conducted at the experimental farm of the Veterinary Faculty, Ankara University.

Live material of the trial consisted of Denizli fowl (*Gallus domesticus*), 107 progeny of 11 sires and 16 dams randomly taken. Sixteen full sib family groups were formed to facilitate the identification of segregating alleles (Table 1).

Table 1. Full sib families were formed within a Denizli fowl flock by using 11 sires, 16 dams and 107 sibs.

Sire's number	Dam's number	Full sib families and number of sibs
1	1	9
	2	6
2	3	8
	4	8
3	5	13
	6	2
4	7	9
5	8	16
6	9	6
7	10	5
8	11	4
	12	3
9	13	5
	14	2
10	15	7
11	16	4
Total: 11	16	107

Reference reagents were obtained from W. E. Briles, Department of Biological Sciences, Northern Illinois University.

Parents were kept in individual cages, marked by the wing bands and artificially inseminated. Progeny chicks hatched in the pedigree boxes and were marked by wing bands in the hatchery. Progeny chicks were raised in the litter house and transferred to the individual cages at 20 weeks of age.

For the blood typing, 2 ml of blood samples through *vena subcutanea ulnaris* were taken from each parent and their progeny. Erythrocyte cell suspensions 2% were prepared in physiological saline. One drop (50 µl) of cell suspension was added to two drops of appropriately diluted reference antiserum or reagent in 10 X 75 mm glass tubes. Tubes were then shaken, incubated for 1.5 h at 20°C, overnight at 4°C, again shaken, incubated 1h at 20°C and scored for the degree of agglutination. Degree of agglutination was scored as 0, 1, 2, 3 or 4 based on the sedimentation pattern. Blood type genotypes of the individuals were evaluated in every family group according to the reference reagents and their agglutination results. Interpretation of the results was also made by W. E. Briles for the investigation. Gene frequencies were calculated by the direct counting method and standard errors were estimated by means of formula 1 (12) .

$$Sq_p = Sq_r = \sqrt{\frac{q_p \times q_r}{2n}} \quad (1)$$

Results

Alleles of the A, B, C, D, E, L blood group systems were estimated by using reference antibody reagents and their frequencies were calculated for an Anatolian local breed of domestic fowl, Denizli.

A1, A2, A3, A5, A7 and A12 alleles in the A blood group system, B2, B6, B14, B19, B21, B25 alleles in the B blood group system, C1, C2, and C5 alleles in the C blood group system, D1, D2, D4,D5, D6 and D7 alleles in the D blood group system, E2, E3 and E5 alleles in the E blood group system, and L1 allele in the L blood group system were estimated and their frequencies were calculated (Table. 2). A new allele D7 in the D system was observed which was different from the other six alleles known before.

Table 2. A , B, C,D,L and E blood group gene frequencies and standard errors.

Blood group	Allele	Gene frequencies	$S_{\bar{x}}$
A	A^1	0.07	±0.010
	A^2	0.11	±0.022
	A^3	0.39	±0.034
	A^5	0.11	±0.022
	A^7	0.01	±0.007
	A^{12}	0.31	±0.032
B	B^2	0.09	±0.012
	B^6	0.37	±0.021
	B^{14}	0.19	±0.017
	B^{19}	0.11	±0.014
	B^{21}	0.21	±0.018
	B^{25}	0.03	±0.007
C	C^1	0.31	±0.019
	C^2	0.14	±0.014
	C^5	0.55	±0.021
D	D^1	0.02	±0.006
	D^2	0.09	±0.012
	D^4	0.54	±0.022
	D^5	0.07	±0.011
	D^6	0.23	±0.018
	D^7	0.05	±0.008
L	L^1	1.00	±0.000
E	E^2	0.40	±0.023
	E^3	0.54	±0.024
	E^5	0.06	±0.011

Discussion

Alleles of the A, B, C, D, E, L blood group systems were estimated by using reference antibody reagents and their frequencies were calculated for an Anatolian local breed of domestic fowl, Denizli. A new allele D7 in the D system was observed which was different from the other six alleles known before. The flock was homozygous with respect to the L1 allele while the number of alleles present in the A, B, C, D and E blood group systems were 6, 6, 3, 6 and 3 respectively.

In our previous study (11) the number of alleles present in the A, C, D, E and L blood group systems were reported as 10, 5, 6, 5, 3 and 1 respectively for the same breed but a different flock. Differences between the flocks within the same breed suggest the large variability of the erythrocyte surface antigens of Denizli, a local breed of domestic fowl.

It is planned to produce specific blood group reagents of the Denizli fowl by reciprocal immunizations.

For the next step, chicken lines homozygous in different B (MHC) alleles will be produced in the flock. Disease resistance of those lines will be tested by means of different disease exposures afterwards.

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