Journal of Reproduction and Infertility 13 (1): 01-04, 2022
ISSN 2079-2166

DOI: 10.5829/idosi.jri.2022.01.04

Blood Groups Polymorphism and Fertility in Farm Animals

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Abstract: Blood types or groups are determined by specific antigens found on the surface of erythrocytes. In humans, there is the ABO system of blood types, whereas animals have a variety of different blood types.The current article aimed to investigate the possible relationship between blood groups and fertility in farm animals. Blood groups in farm animals containing many blood factors. Researchers studied the correlation between blood groups and reproductive performance in Holstein cattle and they concluded that the antigen U1` (Ssystem) was predominates in females that had highest conception rate while, The UH` antigen predominates with animals had lowest conception rate. It was found that, Z blood antigen in Brown Swiss bulls was associated with reduced. Sheep and goat recorded 16 blood group including about 37 antigens. It has been reported that normal kidding in goat was associated with high frequency of A_3 , B, cb antigens while, blood group A showed natural resistance against some reproductive The relationship between the marker genes of blood groups and fertility status in equine has been reported. Another important issue that closely related to blood groups is histocompatibility complex (MHC). It was concluded that there is a tight relationship between blood groups and some fertility parameters in farm animals.

Key words: Blood Groups · Polymorphism · Fertility · Farm Animals

INTRODUCTION

Blood types or groups are determined by specific antigens found on the surface of erythrocytes. In humans, there is the ABO system of blood types, whereas animals have a variety of different blood types. There are two types of antibodies to blood group antigens; naturally occurring antibodies and antibodies acquired after exposure to the blood group antigen. Naturally occurring antibodies occur in most species and vary in their pathological significance, i.e. some will not produce a transfusion reaction. Acquired antibodies are produced after exposure to an incompatible blood type [1]. No enough data are available on the relation between blood group and fertility in farm animals, so the current article aimed to investigate the possible relationship between blood groups and fertility in farm animals

Blood Groups Polymorphism and Fertility in Farm Animals: Blood groups in cattle ranges form 10-13 groups (A, B, C, F, J, L, M, R, S, T and Z) containing more than 100 blood factors [1-4].

Kantanen *et al.* [5] studied the correlation between blood groups and reproductive performance in Holstein cattle involving the service period, Open days and conception by third service. They concluded that the antigen U1` (S.system) was predominates in females that had highest conception rate while, The UH` antigen predominates with animals hadlowest conception rate. Moreover, results from S system were confirmed by those obtained by Zaabal [2] for crossbreds of Black pied and Red steps cattle. Also, Weir [3] found that F-V blood group of cattle is related to higher conception in its heterzygote form (Fv/Fv) and combination of F/F x F/F have higher conception rate than those of F/F / F/V. Moreover, It was found that (A) blood group system is more related to the open days while, there was a significant correlation between L antigen frequency and abortion before 150 day of gestation. Cows with M_2M` factor had higher probability of conception, Miller *et al.* [6]. In bulls, Shin-ichi and Misao [7] reported 9 blood group systems in Holstein breed in Japan and concluded that antigen (allele) $G_2$ $Y_2$ $E`_2$ was correlated to high fertility.

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For breeding purposes, it is important to know how pedigree errors influence the precision of progeny tests and diminish the selection response. Blood grouping is used not only for detection of misidentification of daughters to sires, but also of daughters to dam and can exclude errors in estimating breeding values and heritability [8].

In dairy cattle breeding, Progeny tests are of central importance. The precision of these depends on number of off springs per sire, heritability of the trait and the fraction of incorrectly identified individuals and this breeding value could be measured by means of blood grouping [8-10]. Moreover, Blott *et al.* [4] surveyed seven red cell antigens and they concluded that the expected average heterozygosity in fertile Hereford breed ranged between 0.19 (±0.062) and 0.26 (± 0.074). The genetic distances between the Hereford populations ranged between 0.011(±0.009) and (0.12±0.052). Moreover, studies on the effect of introgression of Holstein genes into European populations of Black and White cattle to improve the performance of production traits (milk yield and protein) indicated that, there was an unfavorable effect on fertility trait [11].

In cattle, analysis of allelic variation at red cell antigen (blood groups) could potentially used to evaluate temporal changes in genetic diversity. To confirm this theory, Kantanen *et al.* [5] used blood groups to evaluate genetic variation of North European cattle and they found that blood group M has gained new genetic associated with high ovulation rate and maintained of gestation through flow.

Christenson *et al.* [12] found that, Z blood antigen in Brown Swiss bulls was associated with reduced fertility, mainly due to increased early embryo mortality.

Andersson *et al.* [13] studied the relationships of 10 blood group systems (A, B, C, F, J, L, M, S, Z and R`) in relation to male fertility using the non return rate of 1447 young Swedish Red-and-White bulls. They found that high fertile bulls showed high frequency of F, B, Tf, S and C systems.

The relationship between blood groups and fertility could be a reflection of the effect of such antigens on the health status as well as their responsibility for natural resistance against diseases such as antigens T_2 and X_1 in which are responsible for leucosis and Z`, P_1, P_2, B`` and L`` which gave natural resistance against mastitis [2].

Blood groups of sheep (A, B, C, D, M, R and X) and goat (A, B, C, M and J) has been established by Marzanov [14] who recorded 16 blood group systems in sheep and goats including about 37 antigens. Moreover, the relation between blood group system and fertility of sheep and goat has been reported by Marzanov [14], Okhanov and Berendeva [15] and Zaabal *et al.* [16]. It has been reported that normal kidding in goat was associated with high frequency of A_3 , B, cb antigens while, blood group A showed natural resistance against some reproductive diseases [15]. However, the presence of M and L antigens is usually associated with dystocia in goats [16, 17].

The relationship between blood groups and fertility in sheep has been reported by Marzanov [14] who reported association between twinning rate and A, D, R and X antigens. In the sometime there were no association between blood system and abortion of sheep. Moreover, Gailp [18] reported a significant correlation between high erythrocyte potassium (EK) and fertility in sheep.

There are over 30 blood groups in horses, of which only 8 are major systems. Of these 8, 7 are internationally recognized (A, C, D, K, P, Q and U), whilst the T system is primarily of research interest [1]. Therelationship between the marker genes of blood groups and fertility status in equine has been reported [19-22]. In this respect, Oliveira [23] used blood group forthe discrimination of monozygotic and dizygotic twins, the identification of freemartins and the identification of individual animals and parentage. Moreover, Neash [24] cited data indicating a relationship between fertility and Ac Ab and Ddel blood group alleles in Hutsal horse in Poland and the frequency of these blood group alleles were 0.251, 0.254 and 0.438, respectively.

Another important issue that closely related to blood groups is histocompatibility complex (MHC). In this respect, Neppert and Jungi [25] have analyzed the effect of polyclonal and monoclonal antibodies of distinct IgG isotypes direct against products of major histocompatibility complex on the function of Fc gamma receptors types 1 (Fc gamma R1) and II(Fc gamma RII)Moreover, Davies *et al*. [26] reported two specificities, A16 and A32 (antigens) to BolA-A locus and they recorded 3 now specificities for this locus W51, W52 and W53. However, class Igenes of bovine major histocompatibility complex (MGC) were investigated by southern blot hybridization and by serological analysis [27].

The close relationship between M blood group and BoLA is also reported by Hines and Ross [28] who found that M1. blood group factor produced antisera specifically with lymphocyte and erythrocyte from M1 reactive cattle. The results indicate that blood group M` and BoLA W16 share a similar antigenic structure. It has been reported that there is a linkage at recombination frequency of 0.10 or less between the bovine major histocompatility system and the B, C and L red blood cells groups and albumin, hemoglobin and transferrin loci. The first locus physically mapped in river buffalo was that of the major histocompatibility complex (MHC-Bubu). This gene complex was found to be located to BBU2p22 and BTA 23p22. Both chromosomes and chromosome bands were homologous and allowed to definitively confirm the homology between BTA23 and Bbu2p [29].

Rasero *et al.* [30] recoded polymorphic of erythrocyte milk enzyme in buffalo and they found four phenotypes controlled by 3 codominant alleles (ME_1^A, ME_1^B and ME_1^C) and 3 codominant alleles of ALB locus.

CONCLUSION

It was concluded that there is a tight relationship between blood groups and some fertility parameters in farm animals and the Major blood groups of clinical interest are shown in Table 1.

Table 1: Major blood groups of clinical interest

Species	Blood groups
Equine	A, C, Q
bovine	B, J
ovine	B, R

Source: The Merck Veterinary Manual [31]

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