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The prevalence of dog erythrocyte antigen 1 in relation to breed in the Daejeon area

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Abstract

This study was performed to collect the basic data of DEA 1.1 in four small breed (Maltese, Shih-tzu, Poodle, Yorkshire terrier) and in three large breed (German shepherd, Labrador retriever and Jindo) dogs in the Daejeon area. 105 dogs from 7 breeds (Maltese=20, Shih-tzu=19, Poodle=15, Yorkshire terrier=11, German shepherd=10, Labrador retriever=10, Jindo=20) were selected and tested using the dog blood typing Kit® (Korea Animal Blood Bank Inc., South Korea). The prevalence of DEA 1.1 was 83%, that of DEA 1.2 was 17%, and there was no DEA (−) blood type identified in this study. Prevalence according to breeds was Maltese (DEA 1.1, 85%; DEA 1.2, 15%), Shih-tzu (DEA 1.1, 95%; DEA 1.2 5%), Yorkshire terrier (DEA 1.1, 91%; DEA 1.2, 9%), Labrador retriever (DEA 1.1, 90%; DEA 1.2, 10%). One hundred percent of DEA blood type 1.1 was discovered in all of the Poodles and German shepherds, and a higher prevalence of DEA 1.2 was found (DEA 1.1, 40%; DEA 1.2 60%) in Jindo dogs. The prevalence of DEA 1.2 in the Jindo dogs was significantly higher than in other breeds ($P < 0.01$). German shepherds and Labrador retrievers may be more suitable as donor dogs than Jindo dogs in the Daejeon area. Larger scale studies are necessary from more dogs and other areas in South Korea.

Key words : Dog erythrocyte antigen (DEA), Prevalence, Donor, Dog

INTRODUCTION

The dog erythrocyte antigen (DEA) blood group system is the blood type found in dogs. The DEA system is comprised of 5 groups (DEA 1, 3, 4, 5, 7), and only DEA 1 has two phenotypes, which are DEA 1.1 and DEA 1.2. (Nelson and Couto, 2014; Hohenhaus, 2004; Cohen and Fuller, 1953). Among the DEA groups, DEA 1 is the most clinically important for blood transfusions due to its antigenic reaction (van der Merve et al, 2002).

A blood transfusion is necessary in several clinical situations, but dogs do not have natural antibodies against foreign blood (Swisher and Young, 1961).

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Therefore, they can only have antibodies after a blood transfusion or after pregnancy, but some reports have revealed a lack of association between pregnancy and the development of antibodies in dogs (Nelson and Couto, 2014).

The first transfusion is not generally critical for recipients, so it can proceed without the identification of blood type and knowledge of a dog's history of blood transfusions (Nelson and Couto, 2014). However, the probability of blood reacting may increase in the event of repeated transfusions. In the case of DEA 1, especially DEA 1.1, antibodies can cause complement activation and agglutination, resulting in hemolysis of targeted red blood cells (Giger et al, 1995). A second random transfusion would have a 15% possibility of a transfusion re-

action (Dudok de Wit et al, 1967). Therefore, knowledge of a dog's history of blood transfusions and the identification of blood types is necessary. DEA 1.2 causes less hemolysis, and the reaction is not usually detectable (van der Merve et al, 2002).

Some reports have described the prevalence of DEA 1 and the frequencies of DEA blood types depending on breeds (Ejima et al, 1986; Symons and Bell, 1991; Hale et al, 2008). According to these papers, there were differences among breeds and countries. In some cases, even the same breeds have demonstrated a different prevalence of DEA 1.1. van der Merwe et al (2002) reported that 23.6% of German shepherds had DEA type 1.1, Vanessa et al (2011) reported that 10% of such dogs had DEA type 1.1, while Novais (1999) reported that 36.84% of German Shepherds had DEA type 1.1. These differences may be the result of geographical variations or the differences in the number of samples.

This study was performed to collect the basic data of blood type DEA 1 for canine blood transfusion in four small breed and three large breed dogs in the Daejeon area, South Korea.

MATERIALS AND METHODS

Sample collection

The populations of client-owned dogs were prospectively recruited at the Veterinary Clinics, between May 2015 and September 2015. A total of 105 samples from 7 breeds (Maltese=20, Shih-tzu=19, Poodle=15, Yorkshire terrier=11, German shepherd=10, Labrador retriever=10, Jindo=20) were examined and they were all vaccinated and selected randomly without knowledge of their histories of blood transfusions. Blood was taken from jugular or cephalic veins and contained EDTA. Owner consent was obtained prior to blood collection. Physical examination, complete blood count (CBC), serum biochemistry analyses were used to monitor the health of the dogs.

Blood typing

Collected samples were tested immediately using the dog blood typing kit® (Korea Animal Blood Bank Inc., Sokcho, South Korea). A drop of blood from a 1ml-syringe (26-gauge needle) was placed in each column. Each column had clear and transparent monoclonal antibodies that is against DEA 1.1, 1.2 and DEA 1(−). The column was mixed gently and blood typing proceeded after 2 minutes. The blood type of a sample was evaluated which column presented the agglutination. If a sample showed agglutination of Anti-1.1 column, the sample was recorded as DEA 1.1. A sample with vague agglutination of Anti-1.1 or 1.2 column was not included in this study. All procedures were performed according to the manufacturer's instructions (Korea Animal Blood Bank Inc., Sokcho, South Korea).

Statistical analyses

Statistical analyses were performed using SPSS for windows (version 19.0, IBM, NY, USA). The prevalence of DEA 1 was examined among breeds using a Chi-squared test.

RESULTS

The results of this study revealed that 83% of the samples were of blood type DEA 1.1, 17% of the samples were of blood type DEA 1.2, and 0% of the samples were of blood type DEA 1(−). There was no significant difference between male and female subjects.

For Maltese dogs, out of 20 sample subjects, 17 (85%) had DEA 1.1 and 3 (15%) had DEA 1.2. For Shih-tzus, out of 20 sample subjects, 19 (95%) were discovered to have DEA 1.1 and the other 1 (5%) had DEA 1.2. For Poodles, out of 15 sample subjects, all of them (100%) turned out to have DEA 1.1. For Yorkshire terriers, out of 11 sample subjects, 10 (91%) had DEA 1.1 and only the other one (9%) had DEA 1.2. For Labrador retrievers, out of 10 sample subjects, 9 (90%) had DEA 1.1, and the other one (10%) had DEA 1.2. For German shepherds, out of 10, all of them (100%)

Table 1. Breed prevalence of DEA 1 in the Daejeon area, South Korea

Breed	Number		DEA 1.1 positive	DEA 1.2 positive	DEA 1 negative
	Males	Females			
Maltese	8	12	17	3	0
Shih-Tzus	8	11	18	1	0
Poodles	8	7	15	0	0
Yorkshire Terrier	5	6	10	1	0
Labrador Retriever	4	6	9	1	0
German Shepherd	5	5	10	0	0
Jindo	9	11	8	12*	0
Total (105)	47	58	87	18	0

DEA=dog erythrocyte antigen; *Significant difference of DEA 1.2 was observed between Jindo and other breeds ($P<0.05$).

had DEA 1.1. For Jindos, out of 20 sample subjects, 8 (40%) had DEA 1.1 and 12 (60%) had DEA 1.2, the blood type DEA 1.2 was significantly higher prevalence in Jindos than other respective breeds ($P<0.01$) (Table 1).

DISCUSSION

Several methods may be used to identify the blood type of dogs. These are card agglutination assay, tube testing, and the gel matrix method (Ferreira et al, 2011). The gel-based method is more accurate than other methods, but it requires specific equipment and a specific process. On the other hand, card assay is a rapid and simple test, and a vet does not need to send blood samples to a laboratory for blood typing. The most common method in South Korea is card agglutination assay, which is the only way commercially available at veterinary clinics.

This study has proved DEA 1.1 in the Daejeon area to be the more prevalent type than other studies. Blood type may be associated with the genetic origin of animals, and international traveling and interbreeding of dogs could cause geographical variations in the blood type ratios of dog populations.

Hale et al (2008) reported that 42% of dogs have DEA 1.1 and 12% have DEA 1.2. Ejima et al (1986) showed that 44% have DEA 1.1 and 22% have DEA 1.2 and they stated that 56.9% have DEA 1.1 and 43.1% have DEA 1.2. Unny et al (2014) discovered that 80% have DEA 1.1 and 20% have DEA 1.2. The results of this study revealed that 83% have DEA 1.1 and 17% have DEA 1.2. The dominance of DEA 1.1 in this study seems to be similar to the results of Unny et al (2014), showing a significantly higher rate of DEA 1.1 than the studies of Hale et al (2008), Ejima et al (1986) and Ferreira et al (2011). The difference in results may be due to variations of dog breeds and their numbers in each region.

Ejima et al (1986) reported a higher rate of DEA 1 in the Maltese, Shih-tzu, and Yorkshire terrier breeds. For Maltese dogs, DEA 1.1 was found in 33%, DEA 1.2 was found in 44%, and DEA 1(−) was found in 23%. For Shih-tzus, DEA 1.1 was found in 57%, DEA 1.2 was found in 14%, and DEA 1(−) was found in 29%. For Yorkshire terriers, DEA 1.1 was found in 80%, DEA 1.2 was found in 0%, and DEA 1(−) was found in 20%. Compared to Ejima et al (1986), the percentages of DEA 1.1 found in Maltese, Shih-tzu and Yorkshire terrier dogs in this study was higher, and the percentages of DEA 1.2 found in Maltese and Shih-tzu dogs has been discovered to be lower. DEA blood type 1(−) was not found in any breed in this study, whereas the results of Ejima et al (1986) discovered DEA 1(−) in Maltese, Shih-tzu and Yorkshire terrier dogs.

For German shepherd dogs, in their respective studies, Novais et al (1999) reported that DEA 1.1 was found in 36.84% and DEA 1.2 was found in 63.16%. Unny et al (2014) reported that DEA 1.1 was found in 70.59% and DEA 1.2 was found in 29.41%, and Ferreira et al (2011) discovered that DEA 1.1(−) was found in 100%, whereas van der Merwe et al (2002) identified DEA 1.1 as being present in 16%, and Vanessa et al (2011) reported that only 10% had DEA 1.1. In this study, the results revealed that 100% of the German Shepherd group had DEA 1.1, and this is the highest percentage of DEA 1.1 found in comparison to all the other studies above.

For Labrador retrievers, in their respective studies, Ferreira et al (2011) reported DEA 1.1 in 44.8% and DEA 1.2 in 55.2%. Unny et al (2014) discovered DEA 1.1 in 86.6% and DEA 1.2 in 13.4%. van der Merwe et al (2002) found DEA 1.1 in 55%. This study revealed 90% of the subjects to have DEA 1.1, and the rest,

10%, to have DEA 1.2. The result is similar to the study by Unny et al (2014). Conversely, the percentage of DEA 1.1 in this study is significantly higher than the percentages found by Ferreira et al. (2011) and van der Merwe et al (2002). Since only DEA 1.1 may cause a clinically important reaction against foreign blood, the identification of DEA 1.1 percentages would help choose donors.

Han et al (1988) reported a higher number of subjects with DEA type 1 in their Jindo and German shepherd groups. 32.9% DEA 1.1, 55.9% DEA 1.2 and 11.2% DEA 1(−) in the Jindo dogs, and 50% DEA 1.1 and 50% DEA .1(−) in the German shepherds. However, this study turned out to be different, revealing that 40% of Jindos had DEA type 1.1 and 60% had DEA type 1.2, and 100% of German shepherds had DEA type 1.1 without any subjects having DEA type 1(−). The ratio of DEA 1.1 to DEA 1.2 in the Jindo group in this study is similar to the results of Han et al (1998). However, the percentage of DEA 1.1 discovered in the German shepherd group in this study was higher than that of Han et al (1998). The percentage of DEA 1(−) in the German shepherd group in this study was non-existent. Different methods were used in these two studies. Han et al (1998) examined blood types using autologous serum, but this study used the dog blood typing kit® (Korea Animal Blood Bank Inc., Sokcho, South Korea). The dominant blood type of small breeds in this study was DEA 1.1, and the percentages of DEA 1.1 in the German shepherd group (100%) and the Labrador retriever group (90%) were higher than the Jindo group (40%). The German shepherd and the Labrador retriever might be more suitable as donor dogs in the Daejeon area. On the other hand, Jindo dogs might be more suitable as recipients of DEA type 1.2.

In conclusion, German shepherds and Labrador Retrievers may be more suitable as donor dogs than Jindo dogs in the Daejeon area. Larger scale studies are necessary from more various breeds and regions in South Korea.

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