

Prevalence study of feline AB blood types in Bangkok and vicinities of Thailand by rapid immunochromatographic test during 2022-2024

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Abstract

The AB blood group system is a key classification for feline blood types, categorizing them as type A, B, or AB based on red blood cell surface antigens. This study aimed to update the prevalence of feline blood types among domestic and pedigree cats in Bangkok and vicinities from 2022 to 2024. A total of 114 blood samples, including 76 Domestic Shorthairs (DSH) and 38 pedigree cats, including 10 breeds, were analyzed using the rapid immunochromatographic feline blood typing. Results revealed that blood type A was predominant, present in 93.86% of cats, consistent with global findings. Blood types B and AB were rare, observed in 3.51% and 1.75% of cats, respectively, while one cat had an unidentified blood type. Breed-specific analysis showed blood type A to be most prevalent across nearly all breeds, especially in Domestic Shorthair and Persian cats, with B and AB types limited to a few breeds. This distribution emphasizes the importance of routine blood typing in clinical practice to prevent transfusion reactions, offering valuable insights for veterinary transfusion practices and breeding programs in Thailand.

Keywords: feline AB blood type, rapid immunochromatography, Thailand

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Introduction

The AB blood group system is the most clinically significant and extensively studied blood type classification in cats, categorizing as type A, B, or AB based on the molecular properties of blood group antigen on feline red blood cells (RBC) (Feldman, 1999; Gavazza *et al.*, 2021). Cats naturally produce antibodies, or alloantibodies, against RBCs of different blood types, indicating that prior sensitization via transfusion or pregnancy is not necessary (Knottenbelt, 2002). Objectively, type-B cats universally possess alloantibodies against type-A RBCs, while approximately one-third of type-A cats have low-titer, visibly detectable anti-B agglutinating alloantibodies. Type-AB cats, however, lack any detectable alloantibodies (Arikan and Akkan, 2004; Binvel *et al.*, 2021; Ejima *et al.*, 1986; Taylor and Bessant, 2021). These alloantibodies play a key role in transfusion reactions, which can occur even during a cat's first mismatched blood transfusion (Barfield and Adamantos, 2011). Mismatching blood transfusion causes acute, sometimes fatal, hemolytic reactions (Griot-Wenk and Giger, 1995; Taylor *et al.*, 2024). Additionally, type-B mothers can transmit anti-A alloantibodies to type-A and AB kittens through colostrum within the first 24 hours of life, causing neonatal isoerythrolysis (Nectoux *et al.*, 2019; Silvestre-Ferreira and Pastor, 2010).

Globally, type-A blood is the most common blood type in cats. Types B and AB are considered rare, especially in non-pedigree cats, as several previous studies have shown (Fosset and Blais, 2014; Gavazza *et al.*, 2021; Giger *et al.*, 1989). However, research highlights that feline blood type distribution in non-pedigree/pedigree cats varies both internationally and exhibits geographical differences within countries (Gavazza *et al.*, 2021; Mangiaterra *et al.*, 2021). Previously, feline blood type distributions in Thai studies showed type A, type B, and type AB prevalences in 2021 as 97.5%, 2.5%, and 0%, respectively (Sangkaew *et al.*, 2021). From 2022 to 2024, the Blood Bank at the Small Animal Teaching Hospital, Faculty of Veterinary Science, Chulalongkorn University, documented a total of 173 blood donors and 173 recipients. Hence, this study aimed to update the prevalence of feline blood type distributions in Bangkok and its vicinities, Thailand during 2022-2024.

Materials and Methods

Samples and populations: In this study, a total of 114 feline blood samples were obtained from the blood bank at the Faculty of Veterinary Science, Chulalongkorn University (CUVET blood bank). All cats were registered as blood donors and routinely screened negative for feline immunodeficiency virus (FIV) and feline leukemia virus (FeLV) using commercial immunochromatographic strips (Witness® FeLV/FIV Rapid Test, NJ, USA), as well as for hemoplasmosis through an in-house PCR assay. These samples were surplus blood, originally collected for clinical and diagnostic purposes, and were repurposed for this study in compliance with the university's ethical guidelines for animal research. The collection adhered to all relevant regulations, and as the blood

was surplus, formal ethical approval was not required for its use in this study.

Blood samples were handled and stored under conditions specified for optimal preservation. Each sample was recorded with relevant data, including the cat's age, sex, breed, and any available information about the origin of the sample. The study aimed to enroll all samples ($n = 114$) from Bangkok and its vicinities based on an expected 2.1% prevalence of type-AB blood in a previous study (Gavazza *et al.*, 2021), ensuring a sample size sufficient for a 95% confidence interval with a 1% margin of error.

Blood typing: Feline blood typing in this study was conducted using the Alvedia Quick Test BT Feline, a rapid immunochromatographic test designed for feline blood typing. The test facilitates quick and accurate identification of feline blood types A, B, and AB. In brief, 10 μ L of whole blood, plasma, or serum was applied to the sample application well on the Alvedia Quick Test cassette. After applying three drops of buffer solution, the sample migrated along the test strip, where monoclonal antibodies specifically targeted the relevant blood type antigens. Results were interpreted visually within two minutes, with a clear line appearing in the respective field on the test strip to indicate the blood type (A, B, or AB). The immunochromatographic test was validated against conventional typing methods to ensure consistency and accuracy, thus supporting its use as an efficient point-of-care (POC) test for feline blood typing in this study.

Statistical analysis: The prevalence of blood types and alloantibodies was calculated as the proportion of samples testing positive divided by the total number of tested samples and was presented as a percentage with a 95% confidence interval (95% CI). All statistical analyses were performed using a statistical software package (GraphPad Prism, GraphPad Software, Inc., San Diego, CA, USA).

The probabilities of a random mating resulting in kittens vulnerable to neonatal isoerythrolysis or the risk of transfusing type A or AB blood to a type B cat during a random transfusion within a population were determined by multiplying the proportion of type B cats by the proportion of type A and AB cats (Giger and Bucheler, 1991). Likewise, the risk of transfusing type B blood into a type A cat was determined by calculating the proportion of type B cats relative to type A cats (Malik *et al.*, 2005).

Result and Discussion

Distribution of feline blood group in enrolled samples: The study revealed that the majority of cats had blood type A, with 93.86% (107 out of 114 cats) testing positive for this type, which indicates a high prevalence of blood type A in the sampled population. Blood type B was found in 3.51% (4 out of 114 cats), suggesting it is relatively rare among cats in this region. Similarly, blood type AB was observed in 1.75% (2 out of 114 cats), also reflecting a low prevalence. Additionally, there was one cat with an unknown blood type, representing 0.88% of the sample. This

issue of an unidentified blood type may be due to the limitation of an immunochromatographic-based assay (Garcia-Arce *et al.*, 2023; Spada *et al.*, 2016). Thus, implementing more sensitive and specific blood typing methods is necessary to reduce the number of unknown blood types (Seth *et al.*, 2011; Spada *et al.*, 2016).

Altogether, these findings highlight the predominance of blood type A among cats in Bangkok and its surrounding areas, with blood types B and AB being significantly less common. Given the high prevalence of blood type A, veterinarians in Bangkok and vicinities can expect most cats to possess this blood type. However, the presence of B and AB types, though rare, necessitates blood typing before transfusions to prevent adverse reactions (Michel, 1975; Zaremba *et al.*, 2019). It should be considered that establishing a blood bank with a sufficient supply of blood type B and AB poses a challenge due to their low prevalence.

The probability of random mating resulting in kittens susceptible to neonatal isoerythrolysis or the risk of transfusing type A or AB blood to a type B cat was determined to be 3.4%. Additionally, the probability of transfusing type B blood to a type A cat during a random transfusion was calculated to be 3.3%. Combining these results, the overall estimated risk of transfusion reactions caused by blood group incompatibilities in unmatched transfusions was 6.7%. The current study observed a lower estimated risk of transfusion reactions due to random mating compared to a previous study conducted in New Zealand (Cattin, 2016).

Breed distribution: In Table 2, a total of 114 feline blood samples were analyzed for breed distribution. Among these, 76 were classified as non-pedigree cats, all of which were Domestic Shorthair (DSH). The remaining 38 samples represented various pedigreed breeds, including 12 Persian (P), 7 Scottish Fold (SF), 3 British Shorthair (BSH), 2 Bengal (B), 2 Maine Coon (M), 1 Siamese (Si), 1 American Shorthair (ASH), 1 Himalayan (H), 1 Exotic Shorthair (ESH), and 1 Sphynx (Sp). This diverse sample enabled the examination of blood type prevalence across both non-pedigree and multiple-pedigree cat populations within the study.

Breed-specific blood type distribution: Based on the breed-specific blood type distribution shown in Table 2, blood type A was predominant across nearly all breeds. Specifically, 76 out of 79 Domestic Shorthair (DSH) cats tested positive for blood type A, representing the majority of this breed. Among other breeds, 1 out of 1 Siamese (Si) cat and 7 out of 9 Scottish Fold (SF) cats tested positive for blood type A. Additionally, 12 out of 14 Persian (P) cats were also blood type A. Other breeds, including British Shorthair (BSH), American Shorthair (ASH), Exotic Shorthair (ESH), Maine Coon (M), Bengal (B), Himalayan (H), and Sphynx (Sp), each had at least one cat with blood type A, with smaller sample sizes ranging from 1 to 3 positive cases in each breed. The findings show that blood type A was predominant across all breeds, especially in Domestic Shorthair and Persian cats. Blood type B was only found in Domestic Shorthair and Persian cats, while blood type AB was only present in Scottish Fold and Persian cats. The data highlights breed-related variability in blood type distribution, with Domestic Shorthairs having the most diverse range of blood types (A and B) among the sampled breeds.

The high prevalence of blood type A is consistent with global feline blood type distributions (Bagdi *et al.*, 2001; Jensen *et al.*, 1994; Kehl *et al.*, 2019; Mangiaterra *et al.*, 2021; Tasker *et al.*, 2014; Zheng *et al.*, 2011). However, the specific percentages may vary by region and breed. Comparing these findings with data from other regions could reveal geographical or genetic factors influencing blood type distribution (Kehl *et al.*, 2019; Lipinski *et al.*, 2008). Further studies should be conducted with larger and more diverse cat breeds/populations to obtain more accurate prevalence estimates, especially for blood types B and AB. Taken together, these findings significantly provide implications for veterinary practices, especially concerning blood transfusions and breeding programs.

Table 1 Blood type prevalence of AB blood group system in cats from Bangkok and vicinities during 2023-2024.

Variable	n Positive/n Tested	Percentage (95% Confidence Interval)
Blood type	A	107/114
	B	4/114
	AB	2/114
	Unknown	1/114

Table 2 Blood type prevalence of AB blood group system in cats according to their breeds.

Variable	Breeds	n Positive											Total (n Positive /n Tested)
		DSH (n)	Si (n)	SF (n)	P (n)	BSH (n)	ASH (n)	ESH (n)	M (n)	B (n)	H (n)	Sp (n)	
Blood type	A	76	1	7	12	3	1	1	2	2	1	1	107/114
	B	3	0	0	1	0	0	0	0	0	0	0	4/114
	AB	0	0	1	1	0	0	0	0	0	0	0	2/114
	Unknown	0	0	1	0	0	0	0	0	0	0	0	1/114
Total		79	1	9	14	3	1	1	2	2	1	1	114/114

DSH, Domestic short hair
Si, Siamese
SF, Scottish fold
P, Persian
BSH, British short hair
ASH, American short hair
ESH, Exotic short hair
M, Mainecoon
B, Bengal
H, Hemalayan
Sp, Sphynx

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