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Evaluation of Active Coagulation Time in Stray Dogs in Kabul City

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ABSTRACT

Blood coagulation is a vital physiological process in animals, and any disturbance in this system may lead to serious clinical complications. It is a simple screening test used to assess hemostasis. This study aims to determine the Active Coagulation Time (ACT) in stray dogs in Kabul City and to compare the mean value with those reported in previous studies. This descriptive cross-sectional study was conducted from September 1 to September 15, 2020, at the Mayhew Clinic in Kabul City. A total of 40 clinically healthy stray dogs were included in this study. For ACT measurement, 2–3 drops of blood were collected from the cephalic vein and placed on a clean glass slide. The first fibrin strand was checked every 10–15 seconds. Data were analysed using correlation analysis and a one-sample t-test. The mean Active Coagulation Time was 159.85 ± 33.81 seconds. Age and sex had no statistically significant effect on ACT ($p > 0.05$). However, the one-sample t-test demonstrated a statistically significant difference between the mean ACT observed in this study and values reported in previous studies ($p < 0.001$). The ACT values in stray dogs in Kabul City differ significantly from those reported in earlier studies. Despite its limitations, the ACT is a practical and useful screening method for the preliminary assessment of blood coagulation in resource-limited settings, and its use before surgical interventions is recommended.

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INTRODUCTION

Blood is a valuable substance in the human and animal body that, in a normal state, appears as a liquid within the body's vessels (Hartenstein, 2006). Blood transports essential substances, such as nutrients and oxygen, to cells and tissues. The fluid component of blood consists of various elements and components. After centrifugation, these blood components separate based on differences in their specific gravity (Ashton, 2010). Blood is composed of two main parts, plasma and cells. There are three types of blood cells: red blood cells (RBCs), white blood cells (WBCs), and platelets. Red blood cells (RBCs) make up the majority of blood cells (Klinken, 2002). The primary function of red blood cells (RBCs) is to transport oxygen from the lungs to other parts of the body and carry carbon dioxide (CO_2) from the body back to the lungs. This ability is due to the presence of hemoglobin (Fdil, 2022).

On the other hand, the main role of white blood cells (WBCs) is to protect the body against pathogens and agents that cause disease. White blood cells are classified into two subgroups: granulocytes, which contain granules that help fight infections, and agranulocytes, which use different mechanisms to resist pathogens (Bain, 2018). The function of white blood cells (WBCs) is to protect the body against pathogens and other disease-causing agents (Glenn & Armstrong, 2019). The third group of cells is called platelets.

Platelets are cell fragments that form when megakaryocytes break apart. Platelets are Similar to red blood cells, and they are produced in the bone marrow(Holinstat, 2017). The primary function of platelets is to prevent blood loss. Platelets have a normal lifespan of about ten days. They are the smallest blood cells, measuring approximately 3.6 micrometers, and are often referred to as light-weight cells. Their low density allows them to move from the central part of the blood flow toward the walls of blood vessels. When platelets encounter sub endothelial matrix proteins, such as collagen and von Willebrand factor, they become activated (Chapin, 2015). The inner surface of blood vessels is lined with a single layer of endothelial cells that prevent blood from contacting external tissues. Under normal physiological conditions, platelets remain inactive (Neubauer & Zieger, 2022). When a blood vessel is injured and the surrounding cells come into contact with the bloodstream, platelets are the first responders. They adhere to the damaged vessel and tissues, initiating the healing process (Jurk et al., 2005). Thrombocytopenia occurs when the number of blood platelets drops below the normal range. This condition leads to increased blood coagulation time, resulting in improper blood coagulation(Babski et al., 2012).

The Activated Coagulation Time (ACT) test is a whole-blood coagulation assay that evaluates the intrinsic and common pathways of the coagulation cascade (Horton & Augustin, 2013). The Active Coagulation Time (ACT) test should be used to assess both normal and abnormal blood coagulation conditions (Bercovitz, 2018). The coagulation time test is a simple test commonly used in humans, and animals. The Activated Coagulation Time (ACT) test is a screening tool used to identify defects in the blood coagulation process. It is a straightforward, convenient test that does not require advanced laboratory facilities or complex medical equipment. However, it is not an ideal test, and its results may not always be highly reliable. One significant limitation of this test is its sensitivity to environmental factors, such as temperature and humidity (Babski et al., 2012).

Additionally, this test does not allow us to diagnose the initial and final phases of coagulation. The Active Coagulation Time (ACT) only measures the final coagulation time. However, compared to other laboratory tests, the ACT is preferred for several reasons. The ACT is a rapid alternative that detects coagulation defects in humans and animals, requires less blood, provides faster results, and can be performed by non-specialized personnel (Horton & Augustin, 2013).

The Active Partial Thromboplastin Time (APTT) test is a suitable and sensitive method for evaluating coagulation when compared to the Active Coagulation Time (ACT) test; however, it requires specialized equipment and laboratory facilities. Due to the limitations of other tests, the ACT was introduced by Hattersley in 1966. The ACT is a rapid test specifically designed to identify coagulation defects in humans and animals. Fewer studies have been conducted on the ACT in animals. Notably, in 1973, Kardinal and Wallin evaluated the ACT in normal dogs (Middleton, 1978). Dogs are among the most numerous domesticated animals worldwide, with approximately 800 million living globally, of which around 300 million are stray (Alizada et al., 2025).

In this study, the Active Coagulation Time (ACT) test was utilized to assess blood coagulation time in stray dogs in Kabul City. It should be stated that no previous study has been conducted on this topic in Kabul City, and this is the first study of its kind. Although this test may not be the most precise or sensitive method for determining coagulation time, it was considered suitable given the limited resources and laboratory equipment available. Despite the widespread clinical use of the ACT in human medicine, particularly in surgical settings, few studies have evaluated its use in veterinary medicine. Available data on ACT in animals are rare, and studies focusing on dog populations are particularly limited. Moreover, there is a lack of baseline coagulation data for stray dogs, especially in low-resource and developing regions. To the best of our knowledge, no previous study has assessed Active Coagulation Time in stray dogs in Kabul City.

1. The objective of this study is to determine blood coagulation time using the Active Coagulation Time (ACT) test in stray dogs in Kabul City.
2. Null Hypothesis (H_0): There is no statistically significant difference between the Activated Coagulation Time (ACT) of stray dogs in Kabul City and the reference values reported in previous studies.
3. Alternative Hypothesis (H_1): There is a statistically significant difference between the Activated Coagulation Time (ACT) of stray dogs in Kabul City and the reference values reported in previous studies.

MATERIALS AND METHODS

This study was designed as a laboratory-based observational investigation to assess blood coagulation time in stray dogs in Kabul City using the Activated Coagulation Time (ACT) test. Standard laboratory procedures and routinely available materials and equipment were employed to ensure methodological consistency and reproducibility. All experimental steps were performed under controlled conditions to maintain data accuracy and reliability.

Study Area

This study was conducted at the Mayhew International Small Animal Clinic, located in the Darul-Aman area of Kabul city. Kabul is the capital of Afghanistan and one of its most densely populated provinces, covering an area of 1,023 Km^2. As the largest city in Afghanistan, Kabul city comprises one of the fifteen districts of Kabul province and is further divided into twenty-two municipal districts (Figure 1). According to the National Statistics and Information Authority (NSIA), the population of Kabul city was estimated to be around 4.8 million in 2020 (Sangary & Mohmand, 2024). Reports suggest that approximately 30,000 stray dogs live in Kabul city (Alizada et al., 2025).

Figure 1: City and districts of Kabul province

Research Design

This study was a descriptive cross-sectional study designed to determine blood coagulation time at a specific point in time (15 days). This study design is appropriate for describing the existing condition and for obtaining baseline values of biological parameters without altering the study variables. It is widely used in epidemiological and clinical research (Wang & Cheng, 2020).

Data Collection

The population of stray dogs in Kabul City is increasing day by day, raising concerns among residents. Reports indicate that there are approximately 30,000 stray dogs in Kabul City, a number that has alarmed residents. To address this issue, the Mayhew International Clinic was established on June 29, 2019, in the Darul-Aman area of Kabul City, to control the stray dog population. In coordination with Kabul Municipality, stray dogs from various districts of the city are brought to the clinic daily for castration. Before undergoing the procedure, the dogs receive a physical examination. Dogs were included in the study if they appeared clinically healthy at the time of sampling and showed no obvious signs of systemic disease, dehydration, scabies, or severe clinical disorders.

In contrast, dogs with active wounds, evident bleeding, or clear signs of acute or chronic diseases were excluded from the study. All sampling procedures were performed humanely by trained personnel, following standard Veterinary and animal welfare guidelines. A total of 40 healthy dogs were included, consisting of 20 males and 20 females. Unfortunately, the breeds and birth dates of the dogs were not known. The approximate ages were estimated based on their teeth. After assessing the dogs' health status, age, and gender, 2-3 drops of blood were drawn from the cephalic vein using a needle and placed on a slide. Once the blood was on the slide, a timer was started, and the blood drop was examined with a needle every 10 to 15 seconds (Figure 2). Whenever signs of coagulation were observed, the timer was stopped, and the coagulation time was recorded. This study was conducted at a temperature of 15-20°C. This study commenced on September 1, 2020, and concluded on September 15, 2020, lasting a total of 15days.

Data Analysis

The data were initially collected in Excel format and then entered into SPSS version 25 for analysis. Descriptive statistics were employed to interpret the data, generating the mean, standard deviation, and tables using the software. Additionally, a Correlation analysis was used to evaluate the relationships among age, sex, and blood coagulation time. In addition, a one-sample t-test was performed to compare the mean blood coagulation time with values reported in previous studies.

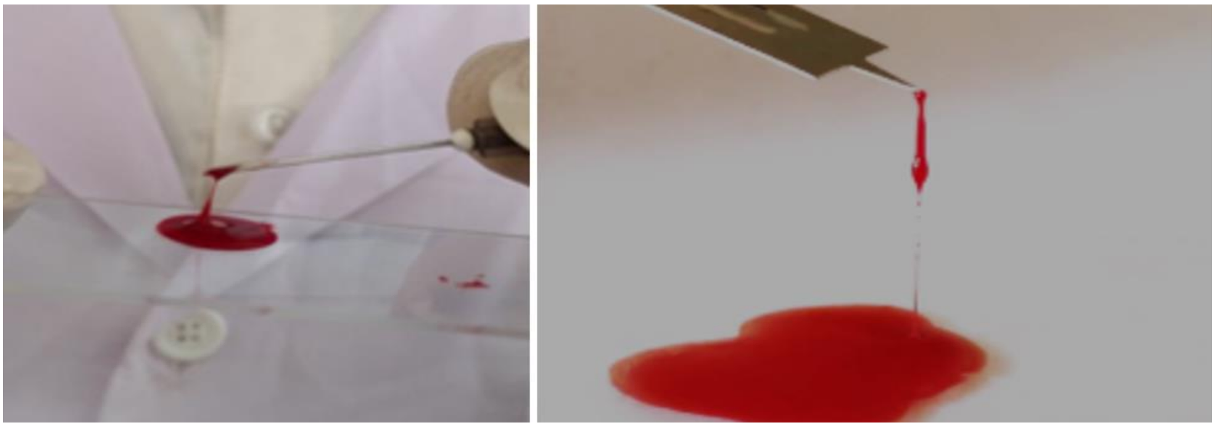

***Figure 2**: Active coagulation time test*

FINDINGS

The dogs included in the study were clinically healthy and showed no signs of disease, such as dehydration or scabies. Among these dogs, there were 20 females and 20 males. The age of the dogs was estimated based on the number and condition of their teeth. The average age of the male dogs was 24.15 months, with a standard deviation (SD) of 13.86 months. The minimum age of the male dogs was 10 months, while the maximum age was 60 months. The approximate ages of the female dogs were also determined using the same dental method. The average age of the female dogs was 25.90 months, with a standard deviation of 15.27

months. The minimum age recorded for the female dogs was 10 months, while the maximum age was 54 months. All dogs in the study were free of disease or abnormalities and appeared clinically healthy. As shown in Table 1, the active coagulation time (ACT) for male dogs averaged 169 seconds, with a standard deviation of 32.12 seconds. In comparison, the average ACT for female dogs was 150.7 seconds, with a standard deviation of 33.73 seconds. As shown in Table 2, the overall average active coagulation time in stray dogs from Kabul city (including both males and females) was 159.85 seconds, with a standard deviation of 33.81 seconds. Upon analyzing the data in SPSS using a correlation test, we found that neither age nor gender had a significant effect on active coagulation time ($P > 0.05$). While the results indicate a slight difference in active coagulation time between male and female dogs, this difference is not statistically significant. Furthermore, a one-sample t-test was used to compare the mean blood coagulation time of stray dogs in Kabul City with those reported in previous studies. The results of this test showed that there was a statistically significant difference between the mean blood coagulation time of stray dogs in Kabul City and the values reported in other studies ($P < 0.001$). Based on the results of the one-sample t-test, the null hypothesis (H_0), which states that there is no statistically significant difference between the mean blood coagulation time of stray dogs in Kabul City and the values reported in previous studies, was rejected. Consequently, the alternative hypothesis (H_1), indicating that a statistically significant difference exists between the mean blood coagulation times of stray dogs in Kabul City and those reported in previous studies, was accepted. Tables 1 and 2 summarize the descriptive statistics of Active Coagulation Time (ACT) and age distribution in stray dogs in Kabul City. As shown in Table 1, the mean ACT was slightly higher in male dogs (169.00 seconds) compared to females (150.70 seconds), although this difference was not statistically significant. The variability of ACT values, reflected by the standard deviation, was comparable between both sexes. Table 2 demonstrates that the overall mean ACT for all dogs was 159.85 ± 33.81 seconds, with values ranging from 100 to 212 seconds. Additionally, the mean age of the studied dogs was 25.03 ± 14.43 months, and no significant association was observed between age and ACT values.

Table 1. *Characteristics of active coagulation time in male and female dogs in Kabul city*

Characteristics	Sex	
Descriptive measures	Male	Female
Mean	169.00	150.70
Median	177.00	157.50
Mode	160[a]	106[a]
Std. Deviation	32.128	33.733
Range	112	100
Minimum	100	100
Maximum	212	200

Table 2*: The age and active coagulation time in male and female dogs in Kabul city*

Characteristics	Number of animals	Range	Minimum	Maximum	Mean
Animal age in month	40	50	10	60	25.03
Active coagulation time in seconds	40	112	100	212	159.85

DISCUSSION

The findings of this study indicated that the blood coagulation time in stray dogs in Kabul City was 159.85 ± 33.81 seconds. This result suggests that the mean coagulation time in this population is longer compared to standard values reported in previous studies (Middleton, 1978). This time may be influenced by environmental factors, the animals' health status, the availability of food for stray dogs, and the sampling conditions. A similar study was conducted in 1978 by Watson and colleagues in New York, USA. Watson and his team examined 42 healthy dogs without clinical signs of disease, measuring their active coagulation time (ACT) at 37°C and room temperature. Their findings revealed that both temperature and humidity affect ACT. At 37°C, the activated coagulation time in dogs ranged from 64 to 95 seconds, while at room temperature, it ranged from 83 to 129 seconds. Our findings indicate differences from those reported by Watson and colleagues. Several factors may have contributed to this discrepancy, including the temperature and humidity levels in the laboratory or testing area, both of which can affect active coagulation time. Temperature plays a significant role in blood coagulation; generally, lower temperatures result in longer coagulation times (Horton & Augustin, 2013). While Watson and his team conducted their study at 37°C and 25°C in 1978, our research took place in the pre-surgical room of the Meyhow Clinic, where temperatures typically ranged from 15°C to 20°C.

Green et al. (2001) reported that the active coagulation time (ACT) in 30 healthy dogs at room temperature ranged from 73 to 132 seconds. Similarly, Green.et al. (2001) studied the ACT in 10 dogs that were poisoned with heparin. They administered 1,000 units/kg of heparin subcutaneously and, after 2 hours, measured the ACT. Their findings indicated that the ACT in these dogs was 130 seconds, with an average increase of 15.8 seconds(Green et al., 2001). Tests including active coagulation time (ACT), one-stage prothrombin time (PT), and partial thromboplastin time (PTT) were compared in dogs poisoned with warfarin(Stroope et al., 2022).

A study conducted by See et al. (2009) involved 43 Cats and 50 healthy dogs and used MAX-ACT™ tubes to measure active coagulation time (ACT). The ACT for dogs ranged from 55 to 80 seconds, while for Cats it ranged from 55 to 85 seconds. This study was performed at 37°C (See et al., 2009). The results reported by AM See.et al. (2009) in their study appear to differ from those of this research. The discrepancies may be attributed to differences in temperature and in the testing methods used, such as the use of capillary tubes.

In a study by Nash et al. (2023), the active coagulation time (ACT) in dogs ranged from 55 to 85 seconds. The researchers examined 43 normal dogs and collected blood samples from the cephalic vein using C-ACT tubes. The blood-filled tubes were then placed in a water bath maintained at 37°C, and the coagulation time was recorded (Nash et al., 2023). The research conducted by Nash and his colleagues reveals discrepancies with our findings. One possible reason for this difference could be variations in temperature during testing.

A study found differences in coagulation times between overweight and lean dogs. The research involved 22 healthy dogs, all of which showed no clinical signs of disease or abnormalities. Of these dogs, 12 were female, and 10 were male. The participants were divided into two groups based on their Body Condition Score (BCS). The findings revealed that the average coagulation time for overweight dogs was 3.8 minutes, whereas it was 3.72 minutes for lean dogs (Barbosa et al., 2019). The study by Antonio Barbosa reveals some differences from our results. One likely reason for this discrepancy could be the variation in temperature and testing methods.

The main limitations of this study were the unknown exact age of the stray dogs, as age was estimated based on physical examination and dental condition, which may be subject to error. In addition, the breed of the dogs was not identified, although genetic differences may influence blood coagulation time. Furthermore, limited access to advanced laboratory equipment and automated instruments designed to measure active coagulation time (ACT) may have affected the accuracy of the measurements. Moreover, environmental conditions at the testing site, such as temperature and humidity, could not be fully controlled, which may have influenced the ACT results. Based on the present study limitations, the following recommendations are suggested for future research to obtain more accurate and reliable result:

1. Use samples with known age and breed to better evaluate their effects on coagulation time.
2. Include larger sample sizes and standardized instruments to improve ACT measurement accuracy and reliability.
3. Investigate the effects of nutritional status, hematological parameters, physiological conditions, and subclinical diseases on coagulation time.
4. Assess coagulation time before surgical procedures to reduce bleeding risk, minimize complications, and improve animal survival.

CONCLUSION

This study was conducted to evaluate Active Coagulation Time (ACT) in stray dogs in Kabul City and demonstrated a mean value of 159.85 ± 33.81 seconds. No statistically significant association was found between coagulation time and animal age or sex ($p > 0.05$). Although the mean ACT was slightly higher in male dogs than in females, this difference was not statistically significant. The results of the one-sample t-test indicated a significant difference between the mean coagulation time observed in this study and values reported in previous studies ($p < 0.001$), which is most likely attributable to environmental factors, particularly the lower testing temperature (15–20°C compared to 37°C), as ACT is sensitive to temperature and humidity. From a clinical perspective, these findings are important, as they suggest that environmental conditions can influence ACT results and should therefore be considered during interpretation. Despite its limitations, the ACT is a simple, rapid, and practical method for the preliminary assessment of coagulation status in resource-limited settings such as Kabul, and its use before surgical or invasive procedures is strongly recommended to prevent excessive bleeding and reduce the risk of complications and mortality. Finally, further studies with strict temperature control, standardized equipment, known age and breed information, and larger sample sizes are recommended to enhance the accuracy and clinical applicability of ACT measurements.

Authors Contributions

All authors made significant contributions to this study. Jalalzai and Stanikzai carried out the authorship and execution of the research project. Jalalzai, Zafari and sadat performed data analysis and interpretation. Data collection was conducted by Jalalzai, and Stanikzai scientifically supervised the study. All authors reviewed the manuscript and approved the final version.

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Data Availability Statement

The data supporting the findings of this study are available from the corresponding author (Jalalzai) upon reasonable request.

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Conflicts of Interest

The authors declare that there is no conflict of interest.

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