

Biochemical Analysis and Coagulation Profiling of Canine Fresh Frozen Plasma

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ABSTRACT

In India, canine plasma transfusion therapy in veterinary clinical practice has risen exponentially over the past few decades. Several indications for the use of canine fresh frozen plasma (FFP) have been considered, including coagulopathies associated with liver disease, rodenticide poisoning, hypoalbuminemia, acute pancreatitis and as a resuscitative fluid in septic shock. Healthy canine blood donors were subjected to jugular phlebotomy for whole blood collection. Canine FFP was prepared as per standard centrifugation protocols in the TANUVAS Animal Blood Bank (TABB), Madras Veterinary College Teaching Hospital and stored aliquots of samples were subjected to *in vitro* analysis. The findings indicated that canine FFP is hyperglycemic (384 ± 10.54 mg/dL), hypernatremic (158.1 ± 2.61 mEq/L), with normal protein (5.32 ± 0.11 g/dL) and lower albumin (2.25 ± 0.03 g/dL). Moreover, FFP was found to retain hemostatic activity, ascertained by normal prothrombin time (PT) (7.04 ± 0.7 sec) and activated partial thromboplastin time (APTT) (22.01 ± 0.89 sec), and normal fibrinogen (4.5 ± 0.26 g/dL). These observations may serve as reference of the canine fresh frozen plasma constituents.

Key words: Canine, Coagulation, Electrolytes, Fresh Frozen Plasma

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INTRODUCTION

Canine Fresh Frozen Plasma (FFP) is plasma made from whole blood and anticoagulant solution consisting of citrate, phosphate, dextrose and adenine (CPDA), that is frozen within six to eight hours of collection (Lucas, *et al.*, 2004). FFP contains all clotting factors and can be kept active for 12 months if frozen at -30°C or lower in a blood bank freezer (Culler *et al.*, 2017). In medical practice, the use of FFP is recommended in the presence of active bleeding, prolonged bleeding times or prior to invasive procedures like biopsy (Weingarten and Sande, 2015). Canine FFP is used most commonly in veterinary practice to treat dogs with haemorrhage secondary to acquired coagulopathies, such as liver disease and anticoagulant rodenticide intoxications (Giger *et al.*, 2015). Human FFP is a hyperosmolar, hyperglycemic and hypernatremic solution (Ewalenko *et al.*, 1986). Plasma made from whole blood with CPDA preservative has negligible calcium concentrations, as citrate ions in CPDA bind calcium (Knight and Ben-Schlomo, 2020). This study was aimed to biochemically analyse and to do basic coagulation profiling on canine fresh frozen plasma stored at Animal Blood Bank, TANUVAS, Chennai, India.

MATERIALS AND METHODS

Collection of Whole Blood from Canine Donors

During the study period of 8 months (March-October 2022), volunteer blood donor dogs ($n=10$) between 2-8 years of age, presented to the Transfusion and Animal Blood Bank (TABB), Madras Veterinary College, Chennai (India) were screened against the presence of haemoprotozoan diseases and selected. 350 mL of whole blood was collected into double

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bag systems (M/s Mitra Industries Pvt. Ltd., Faridabad, India) from each of the donors by jugular phlebotomy. Collection time for each animal lasted less than ten minutes.

Preparation of Canine FFP

The double blood bags were centrifuged at $3000 \times g$ in a refrigerated centrifuge at 22°C for 15 min (Cryofuge 5500ITM, Thermo Fischer Scientific, Inc., Cleveland, Ohio, USA). The blood bag was then placed in a manual plasma expessor (Terumo PenpolTM, Thiruvananthapuram, India), and plasma was allowed to flow into the attached plasma bag. The plasma line was sealed using a heat sealer (Terumo PenpolTM, Thiruvananthapuram, India). Multiple seals were made, with each segment containing the similar blood bag

number to enable plasma sample testing. The plasma bags were appropriately labelled and stored in a cardboard plasma storage box at -40°C . The plasma samples were thawed in a warm water bath to 37°C before assessment.

Analysis of Samples

The samples were subjected to analysis by a blood gas analyser (Epoc[®] Blood Analysis System, Siemens Healthineers, Mumbai, India) for biochemical and electrolyte profiling, and a semi-automated coagulation analyser (Mispa ClogTM, Agappe Diagnostics, Kochi, India) for a coagulation profile, which included prothrombin time (PT), activated thromboplastin time (APTT) and estimation of fibrinogen concentration. The data were expressed as means \pm standard error.

RESULTS AND DISCUSSION

In the analysed canine FFP samples (Table 1), glucose (384 ± 10.54 mg/dL) and sodium (158.1 ± 2.61 mEq/L) contents were high. Calcium values were not determined by blood gas analysis which could have been lowered as citrate ions in the CPDA preservative solution bind calcium in plasma, as seen in the findings of Knight and Ben-Schomo (2020). The levels of potassium (3.1 ± 0.15 mEq/L) and chloride (81.02 ± 0.67 mEq/L) were similar to the findings of Ewalenko *et al.* (1986) and Knight and Ben-Scholmo (2020), who reported similar findings in human plasma made from whole blood collected in Citrate-Phosphate-Dextrose (CPD) preservative. Bicarbonate levels in canine FFP samples analysed (10.66 ± 0.35 mEq/L) were found to be slightly lower than the values reported in human FFP (Ewalenko *et al.*, 1986). Lactate levels in FFP were seen to be similar to that in healthy dogs, as reported by Stevenson *et al.* (2007).

Table 1: Gas, electrolyte, metabolite and coagulation profile of canine FFP samples (n=10)

Parameter	Mean \pm SE
pH	7.34 \pm 0.07
pCO ₂ (mmHg)	24.37 \pm 1.84
pO ₂ (mmHg)	149.98 \pm 1.42
Bicarbonate (HCO ₃ ⁻) (mEq/L)	10.66 \pm 0.35
Sodium (Na ⁺) (mEq/L)	158.1 \pm 2.61
Potassium (K ⁺) (mEq/L)	3.1 \pm 0.15
Chloride (Cl ⁻) (mEq/L)	81.02 \pm 0.67
Lactate (mEq/L)	2.46 \pm 0.22
Total protein (g/dL)	5.32 \pm 0.11
Albumin (g/dL)	2.25 \pm 0.03
Glucose (mg/dL)	384 \pm 10.54
Cholesterol (mg/dL)	91 \pm 6.15
BUN (mg/dL)	8.7 \pm 1.19
Urea (mg/dL)	2.51 \pm 0.3
Creatinine (mg/dL)	0.99 \pm 0.04
PT (sec)	7.04 \pm 0.7
APTT (sec)	22.01 \pm 0.89
Fibrinogen (g/dL)	4.5 \pm 0.26

pCO₂ = Partial pressure of carbon dioxide, pO₂ = Partial pressure of oxygen, PT= Prothrombin time, APTT= Activated partial thromboplastin time.

Total protein and albumin were found at the levels of 5.32 ± 0.11 g/dL and 2.25 ± 0.03 g/dL, respectively. These findings validated Snow *et al.* (2010) that the use of fresh frozen plasma is not recommended for albumin supplementation, as it requires administering large volumes of plasma for relatively small increments in serum albumin of the patient. By measuring the prothrombin time (PT) (7.04 ± 0.7 sec) and activated partial thromboplastin time (APTT) (22.01 ± 0.89 sec), it was confirmed that FFP still had hemostatic activity, and was a rich source of fibrinogen (4.5 ± 0.26 g/dL), the most abundant clotting factor in plasma.

From the study it is concluded that the administration of fresh frozen plasma has to be done scrupulously, considering the hyperglycemic and hypernatremic nature of the fluid. Stringent precautions must be employed for patients with impaired glucose tolerance (eg. patients with diabetes) or low sodium requirements (patients with renal or cardiac disease). Owing to its hemostatic function, FFP can be recommended to be used as a source of clotting factors in hypocoagulative states arising from defects in secondary haemostasis (eg. liver failure, acquired or inherited von Willebrand's disease, deficiencies of other clotting factors, neoplastic conditions, etc). Further studies on canine fresh frozen plasma need to be explored in larger populations to develop guidelines for use in veterinary clinical practice.

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REFERENCES

- Culler, C.A., Iazbik, C. & Guillaumin, J. (2017). Comparison of albumin, colloid osmotic pressure, von Willebrand factor, and coagulation factors in canine cryopoor plasma, cryoprecipitate, and fresh frozen plasma. *Journal of Veterinary Emergency and Critical Care*, 27(6), 638-644.
- Ewalenko, P., Deloof, T. & Peeters, Jacques (1986). Composition of fresh frozen plasma. *Critical Care Medicine*, 14(2), 145-146.
- Giger, U. (2015) Transfusion Therapy. In: *Small Animal Critical Care Medicine*, Eds., Silverstein, D.C. and K. Hopper. St Louis: Elsevier/Saunders, pp. 327-332
- Knight, L.N. & Ben-Shlomo, G. (2020). Electrolyte composition of tears in normal dogs and its comparison to serum and plasma. *Experimental Eye Research*, 201, 108265.
- Lucas, R., Lentz, K. & Hale, A. (2004). Collection and preparation of blood products. *Clinical Techniques in Small Animal Practice*, 19(2), 55-62.
- Snow, S.J., Ari Jutkowitz, L. & Brown, A.J. (2010). Retrospective study: Trends in plasma transfusion at a veterinary teaching hospital: 308 patients (1996-1998 and 2006-2008). *Journal of Veterinary Emergency and Critical Care*, 20(4), 441-445.
- Stevenson, C.K., Kidney, B.A., Duke, T., Snead, E.C., & Jackson, M.L. (2007). Evaluation of the accutrend for lactate measurement in dogs. *Veterinary Clinical Pathology*, 36(3), 261-266
- Weingarten, M.A. & Sande, A.A. (2015). Acute liver failure in dogs and cats. *Journal of Veterinary Emergency and Critical Care*, 25(4), 455-473.