

Hematologic Profile of Local Dogs Post-Rabies Vaccination in Kupang City

(Profil Hematologi Anjing Lokal Setelah Vaksinasi Rabies di Kota Kupang)

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ABSTRAK

Rabies merupakan penyakit zoonosis yang fatal dan tetap menjadi ancaman kesehatan masyarakat di wilayah berisiko tinggi seperti Provinsi Nusa Tenggara Timur (NTT). Kota Kupang sebagai salah satu wilayah di NTT dengan upaya vaksinasi intensif memerlukan data ilmiah terkait keamanan vaksin rabies pada anjing lokal. Penelitian ini bertujuan mengevaluasi perubahan parameter hematologi pada anjing lokal berusia lebih dari satu tahun sebelum dan setelah vaksinasi rabies. Sebanyak 10 ekor anjing sehat dipilih menggunakan metode purposive sampling. Sampel darah dikumpulkan sebelum vaksinasi, satu bulan setelah vaksinasi, dan tiga bulan setelah vaksinasi. Analisis hematologi dilakukan menggunakan uji Shapiro–Wilk untuk normalitas, One-Way ANOVA untuk data berdistribusi normal, dan Kruskal–Wallis untuk data non-normal, dengan batas signifikansi ditetapkan pada $p < 0.05$. Hasil penelitian menunjukkan tidak terdapat perbedaan signifikan pada parameter RBC, HGB, PCV, MCV, MCH, MCHC, dan WBC ($p > 0,05$), dan meskipun terdapat fluktuasi ringan antar waktu, seluruh nilai tetap berada dalam kisaran fisiologis normal. Temuan ini mengindikasikan bahwa vaksin rabies aman secara hematologis bagi anjing lokal yang sehat dan tidak menimbulkan respon inflamasi sistemik hingga tiga bulan setelah vaksinasi. Berdasarkan penelusuran literatur, penelitian ini merupakan kajian awal yang mengevaluasi respons hematologi pasca-vaksinasi rabies pada anjing lokal di Kota Kupang. Penelitian lanjutan disarankan untuk menilai titer antibodi dan faktor nutrisi guna memahami hubungan antara status hematologi, respons imun, dan efektivitas vaksinasi.

Keywords: Anjing, Hematologi, Kupang, Rabies, Vaksinasi

INTRODUCTION

Rabies is a highly fatal zoonotic disease that continues to pose a serious threat to public health in many regions of the world (WHO, 2018). The causative agent, the rabies virus of the *Rhabdoviridae* family, transmits the disease primarily through the saliva of infected animals via bites, scratches, or contact with mucosal surfaces. Vaccination remains the most effective preventive measure, and the World Health Organization (WHO) recommends achieving at least 70% coverage in the dog population to establish herd immunity and interrupt transmission (WHO, 2018).

Although many low- and middle-income countries implement rabies vaccination programs, systematic evaluations of vaccine effectiveness—typically defined by antibody titers above 0.5 IU/mL—remain limited (Yale et al., 2021). Information on the duration of post-vaccination antibody persistence is also scarce, particularly in endemic or high-risk areas. Previous studies have shown that antibody titers generally persist for approximately one year (Yale et al., 2021). However, immune responses may be reduced in animals that are clinically ill at the time of vaccination (Phuyal et al., 2024). Several factors, including age, breed, body size, vaccine type, and sampling time, also influence post-vaccination immune responses, with young dogs producing lower antibody levels than adults (Kennedy et al., 2007).

In Indonesia, the health authorities first detected rabies in West Java in 1884, and the disease has since spread to various regions (Kementerian Kesehatan RI, 2019). As of April 2023, national reports recorded 31,113 bite cases and 11 rabies-related deaths (Kemenkes RI, 2023). East Nusa Tenggara (NTT) Province remains a high-risk region, with confirmed cases reported in several areas, including South Central Timor (TTS) and Kupang Regency (Wera et al., 2022). In 2024, the Kupang Regency Health Office documented one human rabies fatality, indicating that transmission risks persist in the region.

Rabies prevention efforts in Indonesia include mass vaccination campaigns, public education, and dog population management (Kemenkes RI, 2019). Although hematological changes following vaccination have been documented in several animal species, no study has examined the hematological effects of rabies vaccination in local dogs in Kupang City. Evaluating hematological responses is important for ensuring vaccine safety, particularly in high-risk regions where routine veterinary monitoring is limited.

Based on current literature, this study is the first to evaluate hematological profiles of local dogs before and after rabies vaccination in Kupang City. These findings strengthen scientific evidence regarding the hematological safety of

rabies vaccination in the local dog population and provide a foundation for further research on immunological effectiveness and its influencing factors. Therefore, this study aimed to

evaluate hematological changes before and after rabies vaccination in local dogs under field conditions in Kupang.

MATERIALS AND METHODS

Ten healthy local dogs aged over 12 months were selected using a purposive sampling method (Arifin, 2019; Budiman, 2013). All dogs were clinically healthy, showed no signs of illness, and had no history of rabies vaccination. Before blood collection, each dog underwent a physical examination, including assessment of body temperature, respiratory rate, and heart rate. Approximately 3 mL of blood was drawn aseptically from the cephalic vein (*Vena cephalica antebrachii*) using sterile syringes (Latimer, 2011). Baseline blood samples were collected one day before vaccination (D0).

Each dog received 1 mL of Nobivac® Neo Rabivet (MSD Animal Health) administered subcutaneously. Follow-up blood samples were collected 1 and 3

months after vaccination to evaluate changes in hematological parameters.

Blood samples were stored in EDTA Vacutainer tubes and analyzed using an Auto Hematology Analyzer. Parameters measured included red blood cell count (RBC), hemoglobin (HGB), packed cell volume (PCV), mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC), and white blood cell count (WBC). Data normality was assessed using the Shapiro–Wilk test. Normally distributed variables were analyzed using One-Way ANOVA, while non-normally distributed variables were analyzed using the Kruskal–Wallis test. The level of statistical significance was set at $p < 0.05$.

RESULTS AND DISCUSSION

All hematological parameters, including RBC, HGB, PCV, MCV, MCH, MCHC, and WBC, remain within the normal physiological range for healthy dogs across all sampling points (D0, D30, and D90). The hematological parameters fluctuated slightly across the different time points, but these variations did not

indicate any hematologic abnormalities (Table 1).

The Shapiro–Wilk test showed that RBC, MCV, MCH, and WBC followed a normal distribution across all sampling periods. In contrast, HGB, MCHC, and PCV did not meet normality assumptions at one or more time points. Therefore,

One-way ANOVA was applied to RBC, MCV, MCH, and WBC, while the Kruskal-Wallis test was used for HGB, MCHC, and PCV. The statistical analysis did not identify any significant differences between

sampling times for all measured parameters ($p > 0.05$) (Table 2). These findings indicate that rabies vaccination did not induce measurable hematologic alterations up to 90 days post-vaccination.

Table 1. Hematological features of local dogs before (D0), 30 days (D30), and 90 days (D90) after rabies vaccination

Parameter	Normal Range	Mean		
		D0	D30	D90
RBC ($\times 10^6/\mu\text{L}$)	5.5 – 8.5	6.728	7.366	6.809
HGB (g/dL)	12.0 – 18.0	13.20	14.80	12.68
PCV (%)	37 – 55	43.88	47.71	41.42
MCV (fL)	60 – 77	65.59	65.97	69.05
MCH (pg)	19.5 – 26	19.63	20.15	19.98
MCHC (g/dL)	32 – 36	29.86	30.56	32.05
WBC ($\times 10^3/\mu\text{L}$)	6.0 – 17.0	12.80	11.86	17.26

Table 2. Statistical analysis of hematological parameters of local dogs before (D0), 30 days (D30), and 90 days (D90) after rabies vaccination

Parameter	Normality Test (Shapiro-Wilk)			Used Test	p-value
	D0	D30	D90		
RBC	0.501	0.715	0.718	One-way ANOVA	0.526
HGB	0.019	0.956	0.207	Kruskal-Wallis	0.346
PCV	0.020	0.953	0.371	Kruskal-Wallis	0.333
MCV	0.762	0.477	0.081	One-way ANOVA	0.143
MCH	0.457	0.151	0.052	One-way ANOVA	0.203
MCHC	0.802	0.002	0.258	Kruskal-Wallis	0.081
WBC	0.228	0.512	0.451	One-way ANOVA	0.277

Erythrocyte-related parameters such as RBC, HGB, PCV, MCV, MCH, and MCHC reflect the oxygen-carrying capacity, red blood cell indices, and erythropoietic activity in animals. The overall stability of these values suggests that the vaccination did not interfere with erythropoiesis, hemoglobin synthesis,

or red cell morphology (Hoffbrand & Pettit, 1996; Latimer, 2011). Although HGB, PCV, and MCHC showed deviations from normality at specific sampling points, the values remained within physiological reference ranges and did not indicate anemia, dehydration-related PCV shifts, or other hemolytic processes.

These findings are aligned with previous studies reporting that vaccination does not alter erythrocyte indices in healthy animals (Natalia, 2008; Rafdinal et al., 2016).

Leukocyte profiles also demonstrated no significant changes following vaccination, indicating the absence of systemic inflammatory responses. Leukocytes typically increase during infections, tissue damage, or immune-mediated reactions (Murphy et al., 2006). The stable WBC values found in this study show that the rabies vaccine did not trigger detectable leukocytic activation or stress responses. These results support findings from previous research in vaccinated dogs in India, where leukocyte profiles remained stable across post-vaccination periods (Yale et al., 2021). Similar patterns were also reported in studies involving vaccinated Kintamani dogs, which found that rabies vaccination did not significantly alter leukocyte composition (Sudira et al., 2018).

The hematological stability observed in this study is consistent with the biological characteristics of inactivated rabies vaccines, which stimulate humoral immune pathways without substantially altering hematopoietic or inflammatory functions (Singh et al., 2017; Khariri & Noviantari, 2022). Although minor fluctuations were detected, such as slight increases or decreases in individual parameters, these changes remained within normal physiological ranges and were statistically non-significant. Such

variations are likely due to normal biological variability rather than vaccine-induced effects.

It is important to note that stable hematological values do not always correspond to uniform antibody production. Kennedy et al. (2007) and Yale et al. (2021) reported high variability in post-vaccination antibody titers among dogs despite stable hematologic values. Nutritional status, stress, and environmental conditions can influence the humoral immune response, particularly in free-roaming or undernourished dogs. In Kupang, many local dogs exhibit inconsistent feeding patterns and marginal nutritional conditions, which may reduce antibody response despite standard hematological profiles (Dibia et al., 2015; Murphy et al., 2006). Although this study did not evaluate antibody titers or body condition scores, some animals showed signs of suboptimal nutrition, which may influence immune performance under field conditions.

Overall, the results of this study indicate that rabies vaccination is hematologically safe for healthy local dogs and does not induce hematologic stress or systemic inflammation up to 90 days post-vaccination. These findings provide important baseline data for monitoring the physiological impact of rabies vaccination in Kupang City and contribute to strengthening regional rabies control strategies. Future research should incorporate serological assays and assessments of nutritional status to better correlate

hematologic stability with protective immunity.

CONCLUSION

This study demonstrated that rabies vaccination did not produce significant changes in the hematological parameters of healthy local dogs up to 90 days post-vaccination. All values remained within normal physiological ranges, indicating that the vaccine did not induce hematologic stress, systemic inflammation, or adverse physiological responses. These findings support the continued implementation of mass vaccination programs in Kupang.

These findings also support the vaccine's hematological safety under field conditions and provide baseline data that may assist in monitoring post-vaccination health status in local dog populations. Future research should incorporate serological assessments and evaluations of nutritional status to correlate hematologic stability with protective immunity better and to identify factors influencing immunological variability among vaccinated dogs.

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