



Effect of age on anti-rabies immune response in pet dogs of Thrissur district, Kerala, India: a cross-sectional study[#]

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Abstract

Kerala has recently experienced a surge in rabies cases despite ongoing vaccination efforts, prompting a need to assess the efficiency of these vaccinations. This cross-sectional study evaluated the effect of age on post-vaccination rabies antibody levels in 250 pet dogs in Thrissur district. Dogs were categorised into three: less than one year, one to five years, and above five years, and the immune response was measured using an indirect ELISA. The study found that 76.4 per cent of the dogs had protective antibody titres (≥ 0.5 EU/mL) with an average titre of 2.04 EU/mL. Dogs over five years had the highest seroconversion rate (92.3 per cent), while the younger age groups showed comparatively lower rates. Age significantly influenced vaccine response, while multiple-dose recipients showed higher protection than single-dose recipients. The study underscores the importance of booster doses and regular sero-monitoring for effective rabies control.

Keywords: Anti-rabies vaccination, age, iELISA, antibody titre

Rabies is a fatal viral disease that affects the central nervous system and vaccination is the most effective means of prevention for both humans and animals (Rupprecht *et al.*, 2002). Vaccines stimulate the production of antibodies against the glycoprotein G of the rabies virus, thereby providing protection. Age significantly influences vaccine efficacy; young dogs may exhibit reduced antibody levels due to maternal antibodies, while older dogs may show variations in immune response related to age-associated changes (HogenEsch *et al.*, 2004; Morters *et al.*, 2015). This underscores the necessity for age-specific vaccination strategies to ensure effective disease control. The current study employs the indirect enzyme-linked immunosorbent assay (iELISA) to evaluate immune responses in dogs from the Thrissur district of Kerala. This research aims to provide valuable insights into the effectiveness of rabies vaccination across different age groups in dogs.

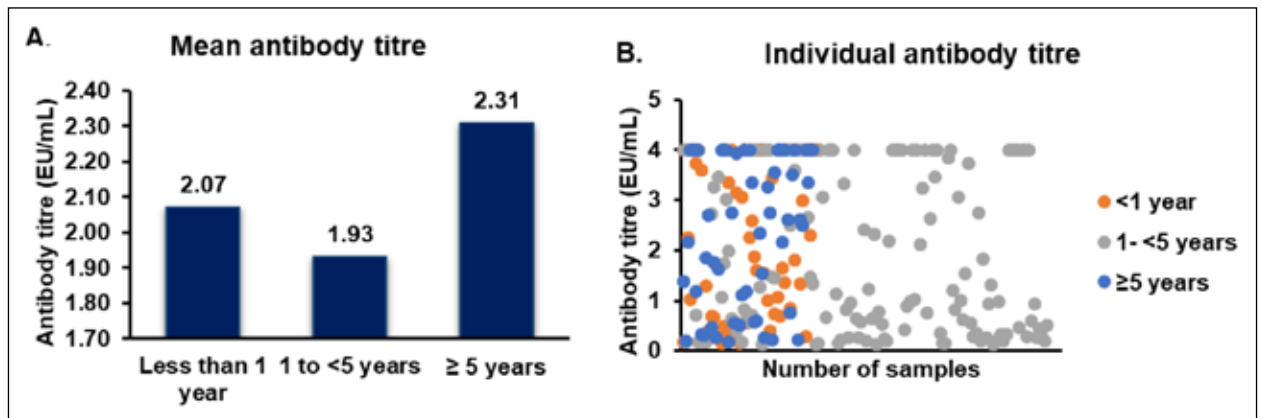
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Table 1. Rabies antibody titre based on age group

Variable	Group	Total no. of samples tested	No. of samples with titre >0.5 EU/mL	Percentage	Mean titre (EU/mL) \pm SD	P-value (Fisher's exact test)
Age	Less than 1 year	54	42	77.77	2.07 \pm 1.50	0.003
	1 to \leq 5 years	144	101	70.13	1.93 \pm 1.58	
	\geq 5 years	52	48	92.30	2.31 \pm 1.47	

**Fig. 1.** Antibody titres (EU/mL) by age at last vaccination less than one year, one to less than five years and above 5 years; **A:** Mean antibody titre, **B:** Scatter plot-individual titre value

Serum samples were collected from 250 pet dogs vaccinated against rabies at the Teaching Veterinary Clinical Complex in Mannuthy, the University Veterinary Hospital in Kokkalai and local kennels in the Thrissur district of Kerala. Only dogs vaccinated between one month and one year prior to blood collection were included in this study. Detailed information regarding the age and vaccination status of each dog was recorded. The humoral immune response to rabies glycoproteins was assessed using the Platelia Rabies II kit (Bio-Rad), following the manufacturer's instructions.

The study subjects were categorised into three age groups: under one year, between one and five years, and above five years (**Table 1**). Seroconversion rates were observed to be 77.77 per cent in dogs under one year, 70.13 per cent in those aged one to five years and 92.30 per cent in dogs older than five years. While all age groups exhibited sufficient levels of seroconversion, dogs above five years demonstrated the highest protection. The average antibody levels were also higher in animals aged five years and older, aligning with the findings of Yale *et al.* (2021). Interestingly, younger dogs have higher antibody titres compared to those aged one to five years (Fig. 1), suggesting that their developing immune systems are responding more robustly to vaccinations.

Some dogs received vaccinations on irregular schedules, which may explain the differences observed between the groups (Berndtsson *et al.*, 2011; Yakobson *et al.*, 2017; Wera *et al.*, 2022). Statistical analysis confirmed a significant difference in immune response across the different age groups (*P*-value: <0.05; 0.003), indicating

that age significantly influences the effectiveness of rabies vaccination in dogs.

Summary

The study highlights the importance of tailored vaccination strategies that take into account individual dog characteristics and vaccination history to optimise protection against rabies. Continued monitoring and further research are essential to ensure the effectiveness of rabies vaccination programs and to address any emerging gaps in immunity.

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Conflicts of interest

The authors declare that they have no conflict of interest.

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