Print ISSN : 0972-8813
e-ISSN : 2582-2780

[Vol. 21(2) May-August 2023]

# Pantnagar Journal of Research

**(Formerly International Journal of Basic and Applied Agricultural Research ISSN : 2349-8765)**

G.B. Pant University of Agriculture & Technology, Pantnagar

# PANTNAGAR JOURNAL OF RESEARCH

Vol. 21(2) May-August, 2023

## CONTENTS

# Meta-analysis of rabies diagnostic tests in dogs

A. K. UPADHYAY*, R. S. CHAUHAN, MAANSI and N. K. SINGH

*Department of Veterinary Public Health and Epidemiology, College of Veterinary and Animal Sciences, G. B. Pant University of Agriculture and Technology, Pantnagar-263145 (U.S. Nagar, Uttarakhand)*
**Corresponding author's email ID: akupadhyay.vet@gbpuat-tech.ac.in*

**ABSTRACT:** Meta-analysis diagnostic test on rabies in India was done to estimate the prevalence of the disease in India. The data was obtained from the peer-reviewed articles and publications during 2010-2020. The data which was used in the present study includes the studies in which the samples were completely random. The Meta-analysis for the diagnostic tests of rabies was done on a total 15 studies out of which 6 for RFFIT and 9 for ELISA. The total sample size for prevalence estimation through RFFIT was 689 and total sample size for prevalence estimation through ELISA was 1856. The Sero-prevalence of diagnostic test of rabies in dogs showed non-significant Kendall's tau for RFFIT (0.4667, $p > 0.05$) and regression test revealed significant publication bias ($z= 0.3222$, $p>0.05$). The Sero-prevalence of diagnostic test of rabies in dogs showed non-significant Kendall's tau for ELISA (0.1111, $p> 0.05$) and regression test revealed significant publication bias ($z= 0.2142$, $p>0.05$).

**Key words:** Diagnostic test, Meta-Analysis, prevalence, rabies

Rabies poses a serious public health risk in underdeveloped nations, as shown by the fact that it claims the lives of more than 60,000 people annually, besides approximately 15 million people receive rabies post exposure prophylaxis (PEP) vaccines (Leung *et al.,* 2007). The incidence of rabies has remained stagnant and grossly under reported in India since a decade. There is a serious need to improve reporting systems to address the issue of lack of accurate data and its verification in a number of regions in the country to reflect true burden of the disease. A strategy based on rabies vaccination of dogs and cats followed by a rabies antibody assay before their admission to the territory has been implemented by Scandinavian nations, the UK, the European Union, and Japan. The WHO, OIE, and the European Commission have all advocated for this approach, which permits the unrestricted transfer of pets from rabies-free or rabies-controlled nations to rabies-free nations. Keeping the advantage of meta-analysis and considering the above facts of rabies infection as a public health concern the present research work has been designed to know about epidemiology of diagnostic test of Rabies.

## MATERIALS AND METHODS

For the epidemiological analysis, we used a descriptive design after collecting the data analysis of all the studies which were related to rabies for the past 10 years (2010-2020). The method for the collection was used computer search of literature and material search through non-electronic means like abstracts, thesis, journals, etc. Computer search for the literature was conducted from Science Direct, PubMed, Krishikosh, Google Scholar, ICAR-CeRA, Springer etc., on epidemiological and humanistic burden of dog bites and dog-mediated rabies. These data were entered into a Microsoft excel 2007 spread sheet for tabulation, analysis, ranking and other studies. In an excel spread sheet all the details like author, year of publication, sample size, diagnostic test and number of positive samples were included. State-wise subgroup analysis was carried out in Uttar Pradesh, Haryana, Punjab, Tamil Nadu, Andhra Pradesh, Kerala, Karnataka, Odisha, West Bengal, Rajasthan, Maharashtra, and Gujarat. The protocols used for the assessment of selected studies were Joanna Briggs Institute (JBI) and preferred reporting items for systematic review and meta-analysis protocols (PRISMA-Protocol). Forest plot (Hak *et al.,* 2016) was made and variance between the different studies was calculated by the method of Der-Simonian and Laird (Borenstein *et al.,* 2010) and the value that we got tau square which is the total amount of true heterogeneity present on an

absolute scale.

## RESULTS AND DISCUSSION

Total number of articles included in the meta-analysis was 6 studies (Table 1). The sample sizes for diagnosis of rabies by RFFIT in dogs were 689. The forest plot showed the proportion of positive rabies cases 72% (95%CI: 54.0-86.0) in dogs. A significant heterogeneity was noticed between the study of human rabies ($I^2$ = 95%, Ä $^2$ = 0.0455, p<0.01). Rank correlation test is not able to identify a significant relationship between sample size and effect size (Kendall's tau = 0.4667, p > 0.05). Egger's regression test result showed no significant publication bias (z= 0.3222, p>0.05).

The highest seroprevalence of anti-rabies antibodies by RFFIT test among all the studies seen in Karnataka and Himanchal Pradesh and lowest seroprevalence of anti-rabies antibodies by RFFIT test among all the studies seen in Maharashtra. The massive global efforts have been initiated to control the disease by launching public health awareness programmes in Asia and Africa, where canine rabies is enzootic and still accounts for more than 95% of fatalities. The bite of a rabid dog kills roughly 20,000 people in India each year (Sudarshan *et al.,* 2006; Li *et al.,* 2020). In India, rabies is an endemic disease. It is found in all of the country's states and union territories, with the exception of the Andaman and Nicobar Islands and the Lakshadweep Islands. India accounts for 35% of the global rabies burden (Hampson *et al.,* 2015). Researchers' hesitation to publish non-randomized results may be a factor contributing to high prevalence, in addition to the publishers' negligence.

**Table 1: Study included the meta-analysis of sero-prevalence of anti-rabies antibody in dog by RFFIT**

| S. No. | State | Total sample (n) | Sample showing positive/ protective antibody titer/Event |
|---|---|---|---|
| 1 | Madhya Pradesh | 50 | 8 |
| 2 | Haryana | 31 | 26 |
| 3 | Karnataka | 184 | 157 |
| 4 | Karnataka | 250 | 195 |
| 5 | Himanchal Pradesh | 25 | 19 |
| 6 | Andhra Pradesh | 149 | 122 |
| 7 | Total | 689 | 527 |

**Table 2: Study included the meta-analysis of sero-prevalence of anti-rabies antibody in dogs by ELISA**

| S. No. | State | Total sample | Sample showing positive/ protective antibody titer |
|---|---|---|---|
| 1 | Rajasthan | 500 | 437 |
| 2 | Punjab | 300 | 191 |
| 3 | Tamilnadu | 297 | 119 |
| 4 | Kerala | 40 | 34 |
| 5 | Madhya Pradesh | 50 | 10 |
| 6 | Chandigarh | 150 | 10 |
| 7 | Maharashtra | 120 | 47 |
| 8 | Karnataka | 250 | 142 |
| 9 | Maharashtra | 149 | 122 |
| 10 | Total | 1856 | 1112 |

Total number of articles included in the meta-analysis was 9 studies (Table 2). The sample sizes for diagnosis of rabies in dogs by ELISA were 689.The forest plot showed the proportion of positive rabies cases 53%, (95%CI, 33.0-73.0) in dogs. A significant heterogeneity was noticed between the study of human rabies I2 = 99%, Ä 2 = 0.0932, p<0.01). Rank correlation test is not able to identify a significant relationship between sample size and effect size (Kendall's tau = 0.1111, p> 0.05). Egger's regression test result showed no significant publication bias (z= 0.2142, p>0.05). When the neutralising antibody titre is at least 0.5 IU/ml in serum from vaccinated humans and animals, WHO and OIE consider pre-exposure vaccination effective (Nale *et al.,* 2021).

The highest seroprevalence of anti-rabies antibodies by ELISA test among all the studies was seen in Rajasthan, Maharashtra, Punjab, Tamilnadu and lowest seroprevalence of anti-rabies antibodies by RFFIT test among all the studies was seen in Chandigarh, Madhya Pradesh.

Researchers' hesitation to publish non-randomized results may be a factor contributing to high prevalence, in addition to the publishers' negligence.

## CONCLUSION

In this study, the epidemiological humanistic burden,

risk factors and diagnostic test of rabies in India was estimated. It has brought attention to the illness burden at the local, regional, and national levels, as documented in a variety of primary investigations, secondary data analysis, and modelling studies. Meta-analysis on the prevalence and sero-prevalence of diagnostic test of rabies in dogs revealed the pooled prevalence using random-effect model for rabies in dogs through RFFIT were estimated 72% (95%CI: 54%-86%) and Pooled prevalence using random-effect model for rabies in dogs through ELISA were estimated 53%, (95%CI, 33%-73%). The overall seroprevalence of anti-rabies antibody by RFFIT was about 76.48% and overall seroprevalence of anti-rabies antibody by ELISA was about 59.91%.

## REFERENCES

Borenstein, M., Hedges, L.V., Higgins, J. P. and Rothstein, H. R. (2010). A basic introduction to fixed effect and random effects models for meta analysis. *Resea. synth. metho.,* 1(2): 97-111.

Hak, T., Rhee, H. V. and Suurmond, R. (2016). How to interpret results of meta-analysis *Article in SSRN Elect. J.,* 10(2): 13-19.

Hampson, K., Coudeville, L., Lembo, T., Sambo, M., Kieffer, A., Attlan, M., Barrat, J.,Blanton, J. D., Briggs, D. J., Cleaveland, S. (2015). Estimating the global burden of endemic canine rabies. *PLoS. Negl. Trop. Dis.,* 9(4): 37-39.

Leung, A. K., Davies, H. D. and Hon, K. L. (2007). Rabies: Epidemiology, pathogenesis, and prophylaxis. *Adv. Ther.,* 24(15): 1340-1347.

Li, T., Wang, X. and Cheng, H. (2020). Meta-analysis of immunogenicity and safety of human rabies vaccination under Zagreb and Essen regimens. *J Comp Eff Res*., 9 (7): 459-468.

Nale, J. M., Pharande, R. R., Majee, S. B., Gandge, R. S., Sawane, M. P., Ingle, S. A. (2021). Serosurveillance of rabies antibodies in dogs in Mumbai region by using indirect ELISA. *Comp. Immunol. Microbiol. Infect. Dis.,* 76: 101655-101660.

Sudarshan, M. K., Mahendra, B. J., Madhusudana, S. N., Ashwath Narayana, D. H, Rahman, A., Rao, N. S. N., Meslin, F. X., Lobo, D., Ravikumar, K. and Gangaboraiah. (2006). An epidemiological study of animal bites in India: results of a WHO sponsored national multi-centric rabies survey. *J. Commun. Dis.,* 38(1): 32-39.

*Received: May 22, 2023*
*Accepted: August 10, 2023*