*Epidemiology and Infection*

Pastoral production is associated with increased *Peste des petits ruminants* seroprevalence in northern Tanzania across sheep, goats, and cattle

C. M. Herzog1, W. A. de Glanville2, B. J. Willett3, T. J. Kibona4, I. M. Cattadori1, V. Kapur1, P. J. Hudson1, J. Buza4, S. Cleaveland2, and O. N. Bjørnstad1

**Supplementary Material**

**Supplementary Figure S1.** PPRV overall seroprevalence by species among 20 northern Tanzanian villages.

70

60

50

40

30

20

10

0

**Seroprevalence (%)**

**Supplementary Table S1.** Selection of Model Interactions

|  |  |
| --- | --- |
|  | All Species Model |
| Interaction | **AIC** |
| Species : Sex | 5507.6 |
| Sex : Management | 5505.4 |
| Species : Management | 5483.4 |

An all-species model with all three two-way interactions did not converge, and one of three all-species models containing two two-way interactions did not converge. So we compared among three all-species models with fixed effects (sex, species, management system) and one two-way interaction each (all converged) to select the most important interaction by AIC.

**Supplementary Text**. Additional References that Tested the Significance of Sex for PPRV Seroprevalence

Significant Sex

Significant sex differences are described in the literature with thirteen studies reporting females have a significantly increased risk [1,2,11–13,3–10], four studies reporting males with a significantly higher risk [14–17]. In three of these studies, the sex difference was significant for goats but not sheep [4,17], and in one study the sex difference was significant for sheep but not goats [15]. Additionally, a significant age\*sex interaction was reported in one study [17].

Non-significant Sex

Twelve studies reported no significant difference between the sexes (Dejene 2016, unpublished master thesis) [18,19,28–31,20–27].

Supplementary Text References

1. **Torsson E, *et al.*** Seroprevalence and risk factors for peste des petits ruminants and selected differential diagnosis in sheep and goats in Tanzania. *Infection Ecology & Epidemiology* Taylor & Francis, 2017; **7**: 1368336.

2. **Salih HAM, *et al.*** Seroprevalence and risk factors of peste des petits ruminants in sheep and goats in Sudan. *Journal of Advanced Veterinary and Animal Research* 2014; **1**: 42–49.

3. **Kardjadj M, *et al.*** Seroprevalence, distribution and risk factor for peste des petits ruminants (PPR) in Algeria. *Preventive Veterinary Medicine* 2015; **122**: 205–210.

4. **Gari G, *et al.*** Serological investigation of peste des petits ruminants in east Shewa and Arsi zones, Oromia region, Ethiopia. *Veterinary Medicine International* 2017; **2017**: 1–5.

5. **Patel YR, *et al.*** Seroprevalence of peste des petits ruminants (PPR) in Navsari and Valsad districts of South Gujarat. *International Journal of Current Microbiology and Applied Sciences* 2017; **6**: 221–228.

6. **El-Yuguda AD, *et al.*** Seroprevalence of peste des petits ruminants among domestic small and large ruminants in the semi-arid region of north-eastern Nigeria. *Veterinary World* 2013; **6**: 807–811.

7. **Abubakar M, *et al.*** Peste des petits ruminants (PPR) in Pakistan: Analysis of a national level serological data. *Small Ruminant Research* 2017; **155**: 57–65.

8. **Bello AM, *et al.*** Research for peste des petits ruminants ( PPR ) virus antibodies in goats, sheep and gazelle from Bauchi and Gombe states, north eastern Nigeria. *Direct Research Journal of Agriculture and Food Science* 2016; **4**: 193–198.

9. **Megersa B, *et al.*** Serological investigation of peste des petits ruminants (PPR) in small ruminants managed under pastoral and agro-pastoral systems in Ethiopia. *Small Ruminant Research* 2011; **97**: 134–138.

10. **Abdalla AS, *et al.*** Sero-prevalence of peste des petits ruminants virus ( PPRV ) in small ruminants in Blue Nile, Gadaref and North Kordofan states of Sudan. *Journal of Public Health and Epidemiology* 2012; **4**: 59–64.

11. **Rahman A, *et al.*** Evaluation of risk factors for peste des petits ruminants virus in sheep and goats at the wildlife-livestock interface in Punjab province, Pakistan. *BioMed Research International* 2016; **2016**: 1–6.

12. **Khan HA, *et al.*** Prevalence and distribution of peste des petits ruminants virus infection in small ruminants. *Small Ruminant Research* 2008; **79**: 152–157.

13. **Mebrahtu K, *et al.*** Sero-epidemiological study of peste des petits ruminants (PPR) in sheep and goats under different production systems in South Omo, southern Ethiopia. *Small Ruminant Research* 2018; **169**: 90–93.

14. **Kivaria FM, *et al.*** The incursion, persistence and spread of peste des petits ruminants in Tanzania: Epidemiological patterns and predictions. *The Onderstepoort Journal of Veterinary Research* 2013; **80**: 1–10.

15. **Swai ES, *et al.*** Prevalence and distribution of Peste des petits ruminants virus antibodies in various districts of Tanzania. *Veterinary Research Communications* 2009; **33**: 927–936.

16. **Mahajan S, *et al.*** Risk of seroconversion to peste des petits ruminants (PPR) and its association with species, sex, age and migration. *Small Ruminant Research* 2012; **104**: 195–200.

17. **Kihu SM, *et al.*** Sero-epidemiology of peste des petits ruminants virus infection in Turkana county, Kenya. *BMC veterinary research* 2015; **11**: 1–14.

18. **Mbyuzi AO, *et al.*** Sero-prevalence and associated risk factors of peste des petits ruminants and contagious caprine pleuro-pneumonia in goats and sheep in the southern zone of Tanzania. *Preventive Veterinary Medicine* 2014; **116**: 138–144.

19. **Ishag O, Intisar K, Ali Y**. Detection of antibodies to peste des petits ruminants virus using passive haemagglutination test and cELISA in the White Nile state - Sudan, comparative study. *African Journal of Microbiology Research* 2014; **8**: 3475–3481.

20. **Dayhum A, *et al.*** Sero-prevalence and epidemiology of peste des petits ruminants in Libya. *Transboundary and Emerging Diseases* 2017; : 1–7.

21. **Waret-Szkuta A, *et al.*** Peste des petits ruminants (PPR) in Ethiopia: Analysis of a national serological survey. *BMC Veterinary Research* 2008; **4**: 1–10.

22. **Rony MS, *et al.*** Peste des petits ruminants risk factors and space – time clusters in Mymensingh, Bangladesh. *Transboundary and Emerging Diseases* 2017; **64**: 2042–2048.

23. **Parvez MA, Khatun R, Noman MA Al**. Prevalence and associated risk factors of peste des petits ruminants (PPR) in goat in Chittagong district, Bangladesh. *Research Journal for Veterinary Practitioners* 2014; **2**: 14–17.

24. **Thakor R, *et al.*** Seroprevalence of Peste des Petits Ruminants in Goats of South Gujarat. *Indian Journal of Small Ruminants* 2016; **22**: 25–254.

25. **Muse EA, *et al.*** Clinico-pathological findings of the 2011 outbreak of Peste des Petits Ruminants (PPR) in Tandahimba district, southern Tanzania. *Research Opinions in Animal & Veterinary Sciences* 2012; **2**: 256–262.

26. **Woma TY, *et al.*** Serosurvey of peste des petits ruminants virus in small ruminants from different agro-ecological zones of Nigeria. *The Onderstepoort Journal of Veterinary Research* 2016; **83**: 1–9.

27. **Afera B, Hussien D, Amsalu K**. Seroprevalence of peste des petits ruminants in goats of southern parts of Tigray region. *Global Veterinaria* 2014; **12**: 512–516.

28. **Faris D, *et al.*** Seroprevalence and sero-conversion after vaccination against peste des petits ruminants in sheep and goats from Awash Fentale District, Afar, Ethiopia. *Preventive Veterinary Medicine* 2012; **103**: 157–162.

29. **Islam K, *et al.*** Prevalence and clinico–pathological features of peste des petits ruminants. *Journal of Infection and Molecular Biology* 2014; **2**: 43–48.

30. **Woma TY, *et al.*** Serological evidence of camel exposure to peste des petits ruminants virus (PPRV) in Nigeria. *Tropical Animal Health and Production* 2015; **47**: 603–606.

31. **Bari S, *et al.*** Hemato-biochemical parameters of Pesti-des Petits Ruminants (PPR) affected goats in Chittagong, Bangladesh. *Journal of Advanced Veterinary and Animal Research* 2018; **5**: 211–217.