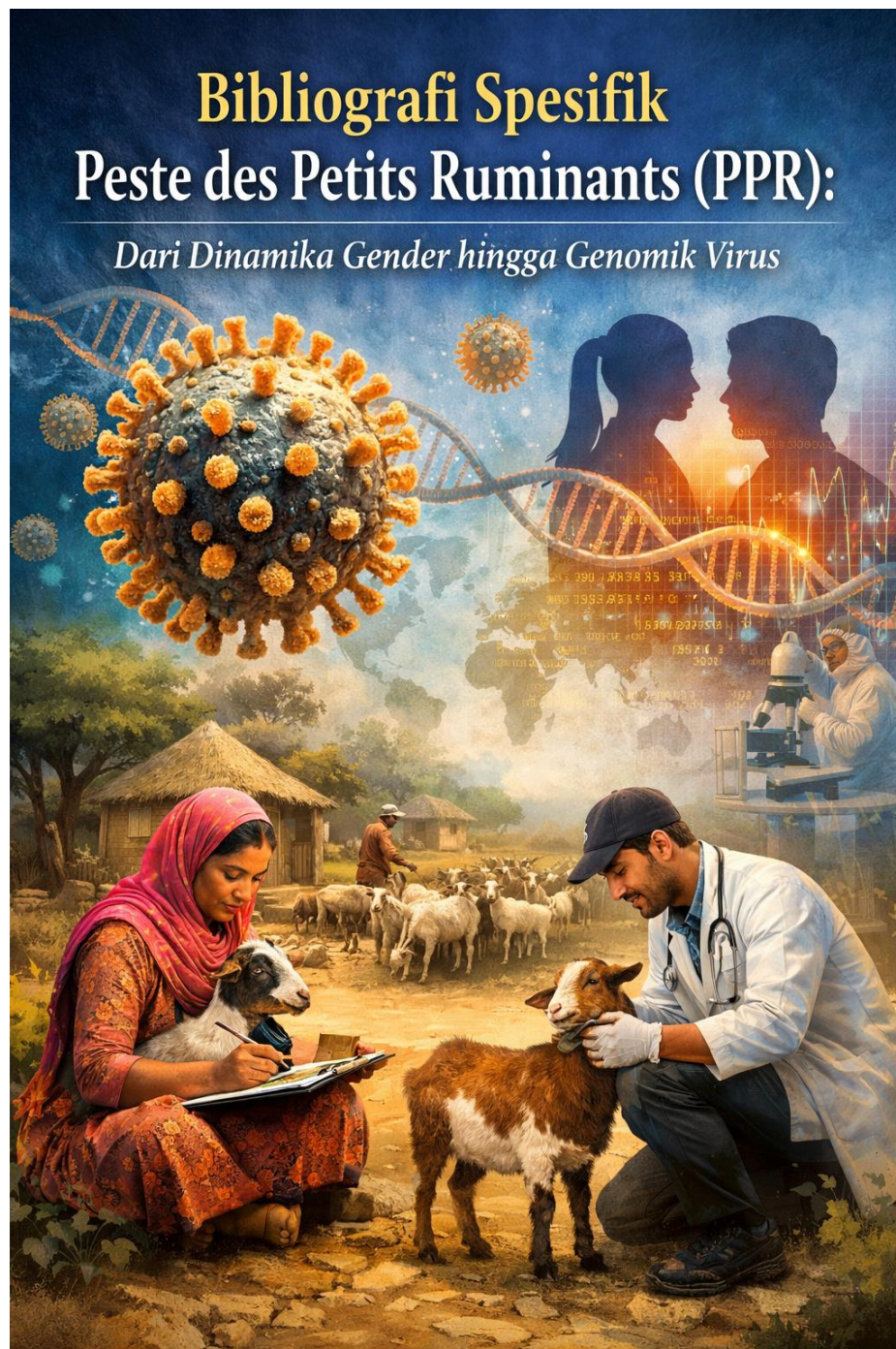


Bibliografi Spesifik Peste des Petits Ruminants (PPR):

Dari Dinamika Gender hingga Genomik Virus



PERPUSTAKAAN BALAI BESAR PERAKITAN DAN MODERNISASI VETERINER

BADAN PERAKITAN DAN MODERNISASI PERTANIAN

KEMENTERIAN PERTANIAN

2026

KATA PENGANTAR

Puji syukur kami panjatkan ke hadirat Tuhan Yang Maha Esa karena atas rahmat dan karunia-Nya, Perpustakaan BRMP Veteriner dapat menyelesaikan penyusunan **“Bibliografi Spesifik Peste des Petits Ruminants (PPR)”** ini. Bibliografi ini disusun sebagai upaya untuk menyediakan akses cepat dan terarah terhadap literatur ilmiah mutakhir mengenai salah satu penyakit viral paling penting pada ruminansia kecil, yaitu Peste des Petits Ruminants (PPR).

Penyakit PPR, yang disebabkan oleh virus Morbillivirus caprinae, telah lama menjadi ancaman serius bagi ketahanan pangan dan mata pencaharian peternak di kawasan Afrika, Timur Tengah, dan Asia, termasuk Indonesia. Upaya global untuk memberantas PPR pada tahun 2030 menuntut ketersediaan informasi yang komprehensif, tidak hanya dari aspek virologi dan epidemiologi, tetapi juga dari sisi sosial-ekonomi, dinamika gender, strategi vaksinasi, serta pendekatan *One Health*.

Bibliografi ini memuat 50 judul publikasi ilmiah internasional yang terbit antara tahun 2022 hingga 2026, yang dihimpun dari berbagai jurnal terakreditasi seperti *Agricultural Systems*, *Preventive Veterinary Medicine*, *Heliyon*, *mBio*, hingga *Jurnal Veteriner*. Cakupan topiknya sangat luas, mulai dari model dinamika sistem dengan pertimbangan gender, studi seroprevalensi dan faktor risiko di berbagai negara (Senegal, Ethiopia, Nigeria, Bangladesh, Uganda), mekanisme molekuler infeksi PPRV (termasuk peran lncRNA, m6A methylation, dan ISG15), hingga pengembangan alat diagnostik dan aplikasi mobile untuk kalkulasi kerugian ekonomi.

Kami berharap bibliografi ini dapat menjadi acuan yang bermanfaat bagi para peneliti, dokter hewan, akademisi, mahasiswa, serta pengambil kebijakan di bidang kesehatan hewan. Dengan adanya kompilasi ini, diharapkan proses penelusuran literatur, penyusunan proposal riset, serta pengembangan strategi pengendalian PPR di lapangan dapat berlangsung lebih efisien dan berbasis bukti terkini.

Kami menyadari bahwa bibliografi ini masih memiliki keterbatasan. Oleh karena itu, kritik dan saran yang membangun dari para pengguna sangat kami harapkan untuk perbaikan di masa mendatang.

Akhir kata, semoga karya sederhana ini dapat memberikan kontribusi nyata bagi kemajuan ilmu pengetahuan dan pengendalian penyakit PPR, baik di tingkat nasional maupun global.

Daftar Isi

No	Judul	Halaman
1.	<u>Economic impact of peste des petits ruminants on small ruminant production in Senegal: Gender considerations within a system dynamics modelling approach</u>	6
2.	<u>Risk factors for Brucellosis and knowledge-attitude practice among pastoralists in Afar and Somali regions of Ethiopia</u>	7
3.	<u>Peste des petits ruminants virus virulence is associated with an early inflammatory profile in the tonsils and cell cycle arrest in lymphoid tissue</u>	7
4.	<u>Changes in m6A RNA methylation of goat lung following PPRV infection</u>	9
5.	<u>Perspectives on the social sciences in global animal health governance: A qualitative study of experts</u>	9
6.	<u>PARAMETRA: A transmission modelling database for livestock diseases</u>	10
7.	<u>Development of a competitive ELISA using monoclonal antibodies for detecting neutralizing antibodies against Peste-des-petits-ruminants virus</u>	11
8.	<u>An operational framework for wildlife health in the One Health approach</u>	11
9.	<u>Establishment of goat infection model of the peste des petits ruminants virus isolated in China for vaccine efficacy evaluation</u>	12
10.	<u>Seroprevalence and risk factors of Peste des petits ruminants in different production systems in Uganda</u>	13
11.	<u>Development and validation of SR-DISVAXFIC: A mobile phone application for estimating the herd-level financial impact of small ruminant diseases and the potential benefits of vaccination in the field</u>	13
12.	<u>Serological study and risk factor analysis on Peste des Petits Ruminants in sheep in Bangladesh</u>	14
13.	<u>The impact of movement and vaccination on Peste des Petits Ruminants disease spread between two different agroecological zones</u>	15
14.	<u>Farmers' valuation and willingness to pay for vaccines to protect livestock resources against priority infectious diseases in Ghana</u>	15
15.	<u>The long noncoding RNA APR attenuates PPRV infection-induced accumulation of intracellular iron to inhibit membrane lipid peroxidation and viral replication</u>	16
16.	<u>African swine fever in Nepal: risk factors, impacts, and strategies for control</u>	18
17.	<u>Insights into the mechanism of Morbillivirus induced immune suppression</u>	18

18.	<u>Economic assessment of animal disease burden in Senegalese small ruminants</u>	19
19.	<u>Modeling the Peste des Petits Ruminants (PPR) disease transmission dynamics with impacts of vaccination and restocking in small ruminant population in Amhara region, Ethiopia</u>	19
20.	<u>Gender transformative innovation: Women's inclusion in livestock vaccine systems in northern Ghana</u>	20
21.	<u>Mapping risk areas for the occurrence of Peste des petits ruminants in the Plateau, Bauchi, and Kano states in Nigeria by combining expert knowledge and field surveys on animal mobility</u>	21
22.	<u>Small ruminant value chain in Al-Ruwaished District, Jordan</u>	22
23.	<u>First report of contagious caprine pleuropneumonia (CCPP) in Bangladeshi goats: Seroprevalence, risk factors and molecular detection from lung samples</u>	22
24.	<u>Modelling flock heterogeneity in the transmission of peste des petits ruminants virus and its impact on the effectiveness of vaccination for eradication</u>	23
25.	<u>Epidemiological Investigation and Risk Factors of Peste des Petits Ruminants (PPR) in Goats of Northeastern Bangladesh</u>	24
26.	<u>Seroprevalence and associated risk factors of Peste des petits ruminants in selected districts of Awi zone, Northwest Ethiopia</u>	25
27.	<u>Typology of Red Maradi goat farming systems in Benin based on farmers' survey</u>	25
28.	<u>Building an institutionalised in-service field epidemiology capacity-building program: Experiences and lessons learned from the China Field Epidemiology Training Program for Veterinarians (CFETPV)</u>	26
29.	<u>Genomic analysis of peste des petits ruminants virus in Europe: Common origin for emergence in Greece, Romania, and Bulgaria</u>	26
30.	<u>Role of maternal variables on the development of neonatal hypoglycaemia and influence of neonatal hypoglycaemia on performance of goat kids</u>	27
31.	<u>Mycoplasma ovipneumoniae identified as the main aetiological agent of respiratory disease in goats from a case-control study in Savannakhet province of Lao PDR</u>	28
32.	<u>Assessment and verification of chemical inactivation of peste des petits ruminants virus by virus isolation following virus capture using Nanotrap magnetic virus particles</u>	28
33.	<u>Free ISG15 Inhibits the Replication of Peste des Petits Ruminants Virus by Breaking the Interaction of Nucleoprotein and Phosphoprotein</u>	29
34.	<u>Climate change, ecosystem disruption, and disease emergence in the Himalayas and one health perspective</u>	30
35.	<u>Access to vaccination services for priority ruminant livestock diseases in Ghana: Barriers and determinants of service utilization by farmers</u>	31

36.	<u>Fluctuations of wild goat populations in relation to weather factors in central Alborz Protected Area</u>	32
37.	<u>A targeted vaccination strategy: Integrating vaccines into biosafety, biosecurity, and one health initiatives</u>	33
38.	<u>Gender, culture, and dietary diversity among livestock keepers in Karamoja</u>	33
39.	<u>Spatial analysis of livestock disease data in sub-Saharan Africa: A scoping review</u>	34
40.	<u>Phytochemical screening, in vitro and in vivo effects of an aqueous extract of the bark of Combretum glutinosum Perr ex DC. (Combretaceae) on gastrointestinal strongyles</u>	35
41.	<u>Feeding alfalfa silage inoculated with feruloyl esterase-producing Limosilactobacillus reuteri to lactating dairy goats is associated with better hepatic antioxidant capacity</u>	35
42.	<u>Seroprevalence and associated risk factors of pox infection among sheep and goats in selected districts of Afar region, Ethiopia</u>	36
43.	<u>Factors associated with foot-and-mouth disease seroprevalence in small ruminants and identification of hot-spot areas in northern Nigeria</u>	37
44.	<u>Vimentin inhibits peste des petits ruminants virus replication by interaction with nucleocapsid protein</u>	38
45.	<u>A Review of Pre-clinical Data on the Pharmacotherapeutic Potential of Black Seeds (Nigella sativa) against Influenza Virus Infection</u>	39
46.	<u>A review of coxiellosis (Q fever) and brucellosis in goats and humans: Implications for disease control in smallholder farming systems in Southeast Asia</u>	40
47.	<u>When farmers' knowledge matters: Improving epidemiological understanding of Peste des petits ruminants in northern Nigeria</u>	40
48.	<u>Prevalensi Peste des Petits Ruminant serta Analisis Faktor Risikonya pada Kambing Melalui Pemeriksaan Ulas Mata atau Hidung</u>	41
49.	<u>Peste des petits ruminants: past, present, and future scope</u>	41
50.	<u>Epidemiological and pathomorphologic investigation of peste des petits ruminants in Western Algeria: A comprehensive study of clinical and histopathological findings</u>	42

1. J. Aboah, Z.A. Campbell, M. Dione, P. Kotchofa, I. Guy, B. Wieland, M.M. Lo, K.M. Rich, **Economic impact of peste des petits ruminants on small ruminant production in Senegal: Gender considerations within a system dynamics modelling approach**, *Agricultural Systems*, Volume 217, 2024, 103928, <https://doi.org/10.1016/j.agsy.2024.103928>.

Abstract:

CONTEXT

Peste des petits ruminants (PPR) remains a persistent challenge for small ruminant production in Senegal, leading to economic losses for livestock keepers. Gender dynamics and socio-cultural factors influence production decisions at the household level. Despite its relevance, economic impact models of PPR have not incorporated gender dynamics.

OBJECTIVE

This paper seeks to redress this gap by disaggregating the farm-level impacts of PPR based on the gender of the household head and implementers of routine and management activities in small ruminant production at the household level.

METHODS

To quantify the gendered economic impacts of PPR, a system dynamics model was developed with four modules: integrated production-epidemiology, economics and profitability, disease control, and marketing. The model was parameterised based on survey data from 747 households in 49 agro-pastoral and pastoral villages in Senegal and augmented by secondary data. The model was validated (structurally and behaviourally) and simulated for 30 years with a weekly timestep. A set of disease scenarios were run for ten different farm household typologies based on the gender of the household head and household members who perform production management activities (like purchasing, selling, gifting, and vaccinating animals) and routine activities (like feeding, cleaning pens, and caring for sick animals).

RESULTS AND CONCLUSIONS

Model results estimated annual reductions in farm profitability of 51% to 61% with a hypothetical 25% incidence rate of PPR, corresponding to an average of \$1051 to \$1246 USD lost per household per year. In the two most impacted household typologies, management activities were performed by either men only or women only, and in the three least impacted household typologies, management activities were shared by men and women. The least impacted household typology with the highest gross margins without PPR (\$2429 USD per year) and the lowest percentage of loss (51%) was female-headed households with men and women doing management tasks and primarily women or girls doing routine activities.

SIGNIFICANCES

Households with both women and men engaged in management activities were less impacted by PPR, highlighting the crucial role of women's agency in management decisions taken in small ruminant production at the farm level. The findings further provide the empirical grounding for considering gender dynamics in interventions to control PPR and other livestock diseases in small ruminant production systems.

Keywords: Systems thinking; Gender; Livelihoods; Peste des petits ruminants; Goats; Sheep

2. Rea Tschopp, Ashenafi GebreGiorgis, Oumer Abdulkadir, Wassie Molla, Muhammed Hamid, Yayehyirad Tassachew, Henok Andualem, Mahlet Osman, Mulugeta Waji Waqqira, Abdulkadir Mohammed, Maria Negron, Henry Walke, Melissa Kadzik, Gezahegne Mamo, **Risk factors for Brucellosis and knowledge-attitude practice among pastoralists in Afar and Somali regions of Ethiopia**, Preventive Veterinary Medicine, Volume 199, 2022, 105557, <https://doi.org/10.1016/j.prevetmed.2021.105557>.

Abstract:

Background

Brucellosis is a neglected bacterial zoonotic disease with substantial economic impact on households. Pastoral communities are a potential risk group due to their way of life being closely interlinked with their large livestock herds.

Methodology

A semi-structured questionnaire survey was conducted in households in the pastoral Afar and Somali (SRS) regions. All households had people and animals serologically tested for brucellosis. Questions were related to husbandry, consumption habits, and knowledge-attitude-practice towards the disease and zoonoses. Descriptive statistics and logistic analysis were performed to assess potential risk factors for having households with positive humans and/or animals.

Result

647 households were included in the survey. Herd brucellosis prevalence was 40.3 % (15.9–86.3 % in Afar; 4–72.2 % in SRS). Over half (56.3 %) of the households in Afar and 41.8 % in SRS had at least one human reactor. Nearly a quarter of the households (22.8 %), recalled abortions in goats in the last 12 months, whereas 52.5 % and 50.3 % recalled stillborn in all species and membrane retentions respectively. All respondents drank raw milk and discarded animal afterbirths in the direct surroundings with minimal protection. Risk factors for animal reactors were goat herd size, and goat abortion. There was no identified risk factor for having human reactors in households. None of the households knew about brucellosis.

Conclusion

Although being endemic in Afar and SRS, Brucellosis is not known by the pastoralists. Brucellosis control programs will have to be tailored to the pastoral context, accounting for their mobility, large, multi-species herds and habits.

Keywords: Ethiopia; Pastoralists; Brucellosis; Livestock; Risk factors

3. Roger-Junior Eloiflin, Llorenç Grau-Roma, Vincent Lasserre, Sylvie Python, Stephanie Talker, Philippe Totte, Obdulio García- Nicolás, Artur Summerfield, Arnaud Bataille, **Peste des petits ruminants virus virulence is associated with an early inflammatory profile in the tonsils and cell**

Abstract:

Using a systems immunology approach, this study comprehensively explored the immunopathogenesis of peste des petits ruminants (PPR) focussing on strain-dependent differences in virulence. Saanen goats were infected either with the highly virulent (Morocco 2008 [MA08]) or the low-virulent (Ivory Coast 1989 [IC89]) strain of the PPR virus (PPRV). As expected, MA08-infected goats exhibited higher clinical scores, pronounced lymphocyte depletion, and lesions affecting mucosal and lymphoid tissues. CD4 T cells were more affected in terms of depletion and infection in peripheral blood. Transcriptional analyses of the blood and lymphoid tissue demonstrated activation of interferon type I (IFN-I) responses at 3 days post-infection (dpi) only with MA08, but comparable IFN-I expression levels with MA08 and IC89 at 6 dpi. MA08 strain induced strong inflammatory and myeloid cell-related transcriptional responses observed in tonsils but not in mesenteric lymph node. This inflammatory response in the tonsils was associated with an extensive damage and infection of the tonsillar epithelium in the crypts, pointing to a barrier defect as a possible cause of inflammation. An early and prominent downregulation of cell cycle gene networks was observed in all compartments analyzed in MA08-infected animals. This effect can be interpreted as suppressed lymphocyte proliferation that may cause immunosuppression during the first week following MA08 infection. A proteome analysis confirmed synthesis of IFN-I response proteins during infection with both strains, but only MA08 strain additionally upregulated ribosomal and inflammation-related proteins. In conclusion, the present comprehensive investigation delineates strain-dependent differences in early immunopathological processes associated with severe inflammation disease and a blunted lymphocyte proliferation.

IMPORTANCE

Field observations show that the severity of PPR is highly dependent on the viral (PPRV) strains and the host infected, but the mechanisms behind these variations are not well understood. Here we compare immune response in Saanen goats infected with high (MA08) and low (IC89) virulent PPRV strains. Analyses revealed a differential immune response: early activation of IFN-I responses only with MA08 but comparable IFN-I expression levels with MA08 and IC89 at later stages. Additionally, MA08 strain triggered inflammatory and myeloid cell-related responses in the tonsils and marked suppression of lymphocyte proliferation evidenced by cell cycle arrest. CD4 T cells were found to be most affected in terms of depletion in the peripheral blood. Massive infection of the tonsils seems to induce epithelial lesions that promote the inflammatory responses. These results underscore the need to understand strain-specific differences for PPR surveillance and control.

Field observations show that the severity of PPR is highly dependent on the viral (PPRV) strains and the host infected, but the mechanisms behind these variations are not well understood. Here we compare immune response in Saanen goats infected with high (MA08) and low (IC89) virulent PPRV strains. Analyses revealed a differential immune response: early activation of IFN-I responses only with MA08 but comparable IFN-I expression levels with MA08 and IC89 at later stages. Additionally, MA08 strain triggered inflammatory and myeloid cell-related responses in the tonsils and marked suppression of lymphocyte proliferation evidenced by cell cycle arrest. CD4 T cells were found to be most affected in terms of depletion in the peripheral blood. Massive infection of the tonsils seems to

induce epithelial lesions that promote the inflammatory responses. These results underscore the need to understand strain-specific differences for PPR surveillance and control.

Keywords: peste des petits ruminants; virulence; immunopathogenesis; goat; morbillivirus

4. Raja Ishaq Nabi Khan, Manas Ranjan Praharaj, Waseem Akram Malla, Neelima Hosamani, Shikha Saxena, Bina Mishra, Kaushal Kishor Rajak, Muthuchelvan Dhanavelu, Ashok Kumar Tiwari, Basavaraj Sajjanar, Ravi Kumar Gandham, B.P. Mishra, **Changes in m6A RNA methylation of goat lung following PPRV infection**, *Heliyon*, Volume 9, Issue 9, 2023, e19358, <https://doi.org/10.1016/j.heliyon.2023.e19358>.

Abstract:

Peste des petits ruminants (PPR) is an acute, highly contagious viral disease of goats and sheep, caused by the Peste des petits ruminants virus (PPRV). Earlier studies suggest the involvement of diverse regulatory mechanisms in PPRV infection. Methylation at N6 of Adenosine called m6A is a type RNA modification that influences various physiological and pathological phenomena. As the lung tissue represents the primary target organ of PPRV, the present study explored the m6A changes and their functional significance in PPRV disease pathogenesis. m6A-seq analysis revealed 1289 m6A peaks to be significantly altered in PPRV infected lung in comparison to normal lung, out of which 975 m6A peaks were hypomethylated and 314 peaks were hypermethylated. Importantly, hypomethylated genes were enriched in Interleukin-4 and Interleukin-13 signaling and various processes associated with extracellular matrix organization. Further, of the 843 differentially m6A-containing cellular transcripts, 282 transcripts were also found to be differentially expressed. Functional analysis revealed that these 282 transcripts are significantly enriched in signaling by Interleukins, extracellular matrix organization, cytokine signaling in the immune system, signaling by receptor tyrosine kinases, and Toll-like Receptor Cascades. We also found m6A reader HNRNPC and the core component of methyltransferase complex METTL14 to be highly upregulated than the m6A readers – HNRNPA2B1 and YTHDF1 at the transcriptome level. These findings suggest that alteration in the m6A landscape following PPRV is implicated in diverse processes including Interleukin signaling.

Keywords: Epitranscriptomics; m6A; Peste des petits ruminants virus; RNA methylation

5. Dorien H. Braam, Salome A. Bukachi, Diego Leiva, Alex Tasker, Lisa Boden, Kevin Bardosh, **Perspectives on the social sciences in global animal health governance: A qualitative study of experts**, *Preventive Veterinary Medicine*, Volume 238, 2025, 106474, <https://doi.org/10.1016/j.prevetmed.2025.106474>.

Abstract:

A global discourse continues to emphasize the importance of integrating the social sciences into health governance and systems research, including in the global animal health sector. By comparison to human health, however, it is unclear how far this discourse has changed institutional practices in animal health and what opportunities exist to strengthen this integration. We conducted a qualitative study to address these knowledge gaps, based on 29 semi-structured key informant interviews (KII)

with experts involved in the global governance of animal health and biosecurity across five regions between November 2022 and June 2023. Inductive thematic analysis was used to analyse results, which were triangulated with findings from primary and secondary data sources. We divide our analysis into three sections: 1) governance landscape; 2) prioritization; and 3) the role of social science. First, we found that KII consider the global animal health governance landscape shaped by five main actor networks who operate under different institutional norms and mandates: international organizations, bilateral donors, the private sector, national governments, and regional organizations. Informants believed that bilateral donors have disproportionate levels of control and influence; national governments struggle with realistic fiscal planning; engaging the private sector remains challenging; international organizations exhibit tensions in their conflicting mandates; and regional organizations need to be more involved. Second, we found that the key priorities of the actor networks were influenced by core uncertainties and tensions. This included different narratives about risk and methods of risk assessment; conflicting values between health and economic development; and capacity scale problems between global and local networks. The field is perceived to be dominated by the global health security agenda and international trade, and disproportionately focused on pandemic threats. Third, we found that barriers to the integration of social science included disciplinary boundaries, given the dominance of the veterinary sciences; the preponderance of instrumentalized goals; and structural conditions that limited opportunities for knowledge translation. Overall, we found that while the social sciences are increasingly part of a global discourse improving global animal health governance and systems, their current application appears to be of limited range and effectiveness. Coordinated investment in truly interdisciplinary networks, with sufficient disciplinary independence, may help address these problems.

Keywords: Animal health governance; Social science; Global health security; One Health; LMIC

6. Alistair Antonopoulos, Natalia Ciria, Áine Regan, Jerrold Tubay, Giovanna Ciaravino, Brandon Hayes, Sébastien Lambert, Timothée Vergne, Francisca Velkers, Evelien Biebaut, Arvo Viltrop, Jeroen Dewulf, Johannes Charlier, Egil Fischer, Alberto Allepuz Palau, **PARAMETRA: A transmission modelling database for livestock diseases**, Preventive Veterinary Medicine, Volume 245, 2025, 106668, <https://doi.org/10.1016/j.prevetmed.2025.106668>.

Abstract:

Dynamic modelling of infectious diseases of importance to livestock production is a valuable tool for policy and decision makers. Mathematical and simulation models play an essential role in understanding complex systems, but parameterising these models can be challenging, especially in data-sparse environments. When parameters are unable to be estimated from epidemiological or experimental data, a time-consuming and labour-intensive literature review—to identify suitable literature-informed values—is often necessary. In service of this, here we present PARAMETRA, a parameter database for 20 pathogens of livestock, envisaged as an open-source collaborative tool for the research community to aid in the development of future transmission models of livestock pathogens. Pathogens included in the database so far were selected using a disease prioritisation exercise. Parameters of interest were selected by experts with a strong background in epidemiology and mathematical modelling. We populated the database with over 2000 individual values, covering a wide range of different parameters including transmission rates, diagnostic test efficacies, pathogen

survival on surfaces, and the farm and regional level prevalences of selected diseases. Finally, we present an initial illustrative analysis of the database contents and the associated metadata of studies included. One of the principal conclusions we can draw from the data available is that in many cases research is reactive, rather than proactive, with research only tending to focus on specific diseases after outbreaks have already occurred, as is the case for African swine fever for example. This has important implications for future research moving to a more proactive approach for experimental and epidemiological studies based on observations of gaps in the data, and high-risk diseases. This publication represents the first step in development for the PARAMETRA database, which will be updated and expanded in the coming years.

Keywords: Epidemiology; Veterinary epidemiology; Transmission; Modelling; Mathematical modelling; Livestock; Livestock disease; Biosecurity; Database; Parameter

7. Linjie Hu, Haoyue Xu, Xueliang Zhu, Hongjiao Peng, Ruixue Deng, Yuefeng Sun, Xuelian Meng, **Development of a competitive ELISA using monoclonal antibodies for detecting neutralizing antibodies against Peste-des-petits-ruminants virus**, The Veterinary Journal, Volume 313, 2025, 106395, <https://doi.org/10.1016/j.tvjl.2025.106395>.

Abstract:

Peste-des-petits-ruminants (PPR) is an acute, contact infectious disease caused by peste-des-petits-ruminants virus (PPRV) infection. PPRV mainly infects goats, sheep and other small ruminants, posing a serious threat to the development of the livestock industry and the safety of wildlife. In this study, a competitive ELISA (c-ELISA) method for detecting neutralizing antibodies against PPRV was developed using the extracellular domain of haemagglutinin (tH) protein and a monoclonal antibody against tH protein. The results showed that the specificity and sensitivity of c-ELISA were 99.38% and 100%, respectively. The agreement rate of the c-ELISA and viral neutralization test (VNT) was 96.65%, suggesting that the c-ELISA could detect neutralizing antibody against PPRV and could be used for protective immunity evaluation.

Keywords: Peste-des-petits-ruminants virus; Haemagglutinin protein; Monoclonal antibody; Competitive ELISA

8. C. Goulet, M. de Garine-Wichatitsky, P. Chardonnet, L.-M. de Klerk, R. Kock, S. Muset, R. Suu-Ire, A. Caron, **An operational framework for wildlife health in the One Health approach**, One Health, Volume 19, 2024, 100922, <https://doi.org/10.1016/j.onehlt.2024.100922>.

Abstract:

Wildlife is an essential component of biodiversity and provides people with multiple social and economic benefits. However, a resurgence of epidemics over the past two decades has highlighted wildlife's role as a potential source of dangerous pathogens for humans and livestock, with devastating consequences worldwide. Simultaneously, numerous reports have indicated that wildlife populations are declining at an alarming rate due to human and livestock pathogens, predation, and competition. An integrated approach to managing wildlife, human, and domestic animal health is therefore clearly

needed. Yet this integration often fails to materialize due to a lack of wildlife health standards and know-how. Here, we present an operational framework that follows a step-by-step approach: i) a holistic definition of human health is adapted to the context of other-than-human animals, including wildlife; then, ii) different categories of wildlife living within a landscape or a country are defined based on the management systems under which they live. For each wildlife category, the type (natural vs. anthropogenic) of habitat, the nature of the interface of wildlife with humans and/or livestock, and the level of sanitary control are defined; and finally, iii) the holistic definition of wildlife health is considered in relation to each wildlife category to define health challenges and the domains of expertise required to address them. This framework can assist national and international agencies, including veterinary and wildlife authorities and policy makers, in defining wildlife health priorities, responsibilities, policies and capacity building strategies. The extensive interdisciplinary collaboration needed to manage the many different aspects of wildlife health calls for a more integrated One Health approach.

Keywords: Wildlife; Wildlife health; One Health

9. Xue Wang, Hefeng Chen, Xianfeng Zhang, Zhengshuang Wu, Shuai Zhang, Lei Shuai, Lulu Wang, Weijie Li, Jinliang Wang, Wenxing Liu, Xijun Wang, Zhiyuan Wen, Jinying Ge, Yuntao Guan, Xijun He, Weiye Chen, Zhigao Bu, **Establishment of goat infection model of the peste des petits ruminants virus isolated in China for vaccine efficacy evaluation**, Journal of Integrative Agriculture, Volume 24, Issue 8, 2025, Pages 3199-3211, <https://doi.org/10.1016/j.jia.2024.02.016>.

Abstract:

In 2013, peste des petits ruminants (PPR) re-emerged in China and spread to the majority of provinces across the country. The disease was effectively controlled through a vaccination campaign employing live attenuated vaccines, although sporadic cases still occurred. However, limited information is currently available regarding the peste des petits ruminants virus (PPRV) endemic in China. Here, a PPRV strain (HLJ/13) was isolated from a field sample in China using Vero cells expressing goat signalling lymphocyte activation molecule. Phylogenetic analysis indicated that HLJ/13 belonged to lineage IV. Subsequent intranasal and subcutaneous inoculation of goats with a dose of 2×10^6 TCID₅₀ of HLJ/13 resulted in the development of typical clinical symptoms of PPR, including pyrexia, ocular and nasal discharges, stomatitis, and diarrhea. All infected goats succumbed to the disease by day 8. To gain further insight, viral loading, pathological examination and immunohistochemical analyses were conducted, elucidating the main targets of HLJ/13 as the respiratory system, digestive tract and lymphoid organs. Employing the goat infection model established above, the goat poxvirus-vectored PPR vaccine, which was previously developed and could be used as DIVA (differentiating infected from vaccinated animals) vaccine, provided complete protection against the challenge of HLJ/13. It is important to note that this study represents the first comprehensive report delineating the biology and pathogenicity characterization, and infection model of PPRV isolated in China.

Keywords: peste des petits ruminants virus; Chinese isolate; goat infection model; vaccine efficacy evaluation

10. Joseph Nkamwesiga, Paul Lumu, David Paul Nalumenya, Fedor Korennoy, Kristina Roesel, Barbara Wieland, Andres Perez, Henry Kiara, Dennis Muhanguzi, **Seroprevalence and risk factors of Peste des petits ruminants in different production systems in Uganda**, Preventive Veterinary Medicine, Volume 221, 2023, 106051, <https://doi.org/10.1016/j.prevetmed.2023.106051>.

Abstract:

Peste des petits ruminants (PPR) is a highly contagious and fatal disease of mostly domestic goats and sheep. First reported in Uganda in 2007, the extent of peste des petits ruminants virus (PPRV) exposure, geographical distribution and risk factors of its transmission and spread are not clearly understood. In this study, we used cluster random sampling methodology to select study villages from three districts representing three different production systems along Uganda's "cattle corridor". Between October and December 2022, 2520 goat and sheep serum samples were collected from 252 households with no history of PPR vaccination in the past one year. The household heads were interviewed to assess possible risk factors of PPRV transmission using a structured questionnaire. The serum samples were screened with a commercial competitive enzyme-linked immunosorbent assay (cELISA) for PPRV antibodies. The determined overall true seroprevalence of PPRV was 27.3% [95% CI: 25.4–29.1]. The seroprevalence of PPRV antibodies in different production systems was 44.1% [95% CI: 40.6–47.7], 31.7% [95% CI: 28.4–35.0] and 6.1% [95% CI: 4.4–7.9] for pastoral, agropastoral and mixed crop-livestock production systems respectively. A mixed-effects multivariable logistic regression model revealed strong statistical evidence of association between female animals and PPRV antibody seropositivity compared to males [OR= 2.45, 95% CI: 1.7–3.5, $p < 0.001$]. The likelihood of being PPRV antibody seropositive significantly increased with increasing small ruminant age. Animals older than 3 years were more than three times as likely to be PPRV seropositive compared to animals aged under 1 year [OR= 3.41, 95% CI: 2.39–4.85, $p < 0.001$]. There was no statistical evidence of association between small ruminant species and PPRV antibody seropositivity ($p = 0.423$). Village flocks that interacted with neighboring flocks daily during grazing (IRR = 1.59, 95% CI: 1.19–2.13) and watering around swamps (IRR=1.59, 95% CI: 1.19–2.13) were highly correlated with increased number of PPRV seropositive animals as compared to flocks that were more restricted in grazing and watered around other water sources other than swamps. Flocks from pastoral and agropastoral production systems were more than 10 times more likely to have seropositive animals than mixed crop-livestock flocks. Targeting PPR control interventions (vaccination and livestock movement control) to pastoral and agropastoral small ruminant production systems that are very prone to PPR incursions is recommended to prevent PPRV spread to low-risk smallholder mixed crop-livestock production systems.

Keywords: Risk factors; Prevalence; Pastoral; Agropastoral; Smallholder farmers; Mixed crop-livestock; PPR

11. Megan E. Rawlins, Adeyinka J. Adediji, Victoria I. Ifende, Sandra I. Ijoma, Rebecca B. Atai, Joel Y. Atuman, Gambo Panzam, Haruna W. Gotom, Idris H. Adamu, Anas U. Musa, Isa M. Sani, Paul Adamu, Mauzu Rani, Ijeoma O. Nwagbo, Jakawa B. Gyes, Jamo Aliyu, Jolly A. Adole, Banenat B. Dogonyaro, Maryam Muhammad, Georgina Limon, **Development and validation of SR-DISVAXFIC: A mobile phone application for estimating the herd-level financial impact of small ruminant diseases and the potential benefits of vaccination in the field**, Preventive Veterinary Medicine, Volume 246, 2026, 106733, <https://doi.org/10.1016/j.prevetmed.2025.106733>.

Abstract:

Small ruminants are important to livelihoods in rural Nigeria and kept under sedentary and nomadic (transhumance) husbandry systems. Diseases such as sheep pox (SPP) and goat pox (GTP) result in significant financial losses and control is by vaccination. We developed and validated a mobile phone application (small ruminant's disease vaccination and financial impact calculator: SR-DISVAXFIC) to estimate herd-level costs and vaccination benefits for small ruminant diseases in the field with real-time estimations. Previously developed production and economic models were adapted for application development and two validation stages undertaken: (i) SR-DISVAXFIC was presented and tested at a stakeholder meeting and (ii) veterinarians used SR-DISVAXFIC to collect data from sedentary and nomadic farmers who had experienced SPP and GTP outbreaks across five Northern Nigerian states ($n = 291$). Median disease costs estimated were £ 301 (IQR: £163–516) for sedentary and £ 393 (IQR: £269–1029) for nomadic herds. Vaccination was financially beneficial, regardless of the percentage of government subsidisation; with a median herd-level benefit and median benefit-cost ratio of £ 272 (IQR: 149–475) and 7.00 (IQR: 5.04–16.74) for sedentary and £ 345 (IQR: £238–831) and 4.28 (IQR: 3.55–8.87) for nomadic herds. Differences between values estimated by SR-DISVAXFIC and previous stochastic modelling demonstrate the importance of gathering input parameters in the field to provide estimates. Majority (91.7 %) of participating farmers said SR-DISVAXFIC was useful to understand the financial impact of disease, and veterinarians found the application beneficial in explaining abstract concepts. SR-DISVAXFIC can be used to monitor trends in epidemiological parameters, costs, and financial impact of any small ruminant diseases.

Keywords: Small ruminants; Disease burden; Vaccination; Nigeria

12. Mohammad Mojibur Rahman, Abdullah Al Momen Sabuj, Md. Saiful Islam, Md. Alimul Islam, Jahangir Alam, Md. Ershaduzzaman, Sukumar Saha, **Serological study and risk factor analysis on Peste des Petits Ruminants in sheep in Bangladesh**, Saudi Journal of Biological Sciences, Volume 30, Issue 3, 2023, 103565, <https://doi.org/10.1016/j.sjbs.2023.103565>.

Abstract:

A cross-sectional study was conducted to determine the seroprevalence of the Peste des Petits Ruminant (PPR) virus (PPRV) in sheep populations and to determine the potential epidemiological risk factors associated with this infection. Between October 2014 and March 2017, 2420 sheep serum samples were collected from ten selected PPR outbreak-prone districts in Bangladesh. The collected sera were analysed by competitive enzyme-linked immunosorbent assay (cELISA) test to detect antibodies against PPR. A previously designed disease report form was used to gather data on important epidemiological risk factors, and a risk analysis was performed to ascertain their association with PPRV infection. By cELISA, 44.3 % (95 % confidence interval: 42.4–46.4 %) of sheep sera were positive for PPRV antibodies against PPR. In univariate analysis, the Bagerhat district had significantly higher seropositivity (54.1 %, 156/288) than other districts. Moreover, significantly higher ($p < 0.05$) seropositivity was found in the Jamuna River Basin (49.1 %, 217/442) compared to other ecological zones, in crossbreeds (60 %; 600/1000) related to native sheep, in males (69.8 %, 289/414) associated with females, in imported sheep (74.3 %, 223/300) compared to other sources, and in winter (57.2 %, 527/920) than in other seasons. In the multivariate logistic regression model, six possible risk factors

were identified: study location, ecological zone, breed, sex, source, and season. The high seroprevalence of PPRV is significantly associated with several risk factors, suggesting that PPR is epizootic throughout the country.

Keywords: Sheep; PPR; Epidemiology; Risk factors; cELISA; Seroprevalence; Bangladesh

13. Yibekal Walle, Joseph Y.T. Mugisha, Dawit Melese, Haileyesus Tessema, **The impact of movement and vaccination on Peste des Petits Ruminants disease spread between two different agroecological zones**, Scientific African, Volume 27, 2025, e02532, <https://doi.org/10.1016/j.sciaf.2025.e02532>.

Abstract:

Peste des Petits Ruminants (PPR) is a highly infectious and contagious viral disease that affects small ruminants. The spread of PPR varies across Ethiopia's agroecological production systems. This study proposes a novel two-patch deterministic mathematical model to investigate the impact of small ruminant movement on the spatial spread of the PPR virus between two distinct zones, with a focus on small ruminant movement between lowland (pastoral) and highland (sedentary) agroecological zones. We establish the essential characteristics of the model, construct control reproduction numbers (R_v) for both isolated and coupled systems, and show that the disease-free equilibrium is locally and globally stable when $R_v < 1$ and unstable when $R_v > 1$. A key contribution of this research is the application of a SEIR model to empirical data from a nationwide prevalence survey of PPR in Ethiopia, enabling the estimation of critical parameters such as disease transmission levels and current vaccination coverage. Our numerical simulations reveal the interplay between small ruminates movement and vaccination strategies, offering valuable insights into their effects on PPR persistence and extinction across various scenarios. Ultimately, the findings emphasize the importance of coordinating vaccination programs for both zones with effective movement control measures to optimize disease control strategies and enhance PPR eradication efforts at national level.

Keywords: Metapopulation; PPR disease; Vaccination; Migration; Reproduction number

14. Francis Sena Nuvey, Nick Hanley, Katherine Simpson, Daniel T. Haydon, Jan Hattendorf, Gloria Ivy Mensah, Kennedy Kwasi Addo, Bassirou Bonfoh, Jakob Zinsstag, Günther Fink, **Farmers' valuation and willingness to pay for vaccines to protect livestock resources against priority infectious diseases in Ghana**, Preventive Veterinary Medicine, Volume 219, 2023, 106028, <https://doi.org/10.1016/j.prevetmed.2023.106028>.

Abstract:

Introduction

Livestock vaccination coverage rates remain low in many lower and middle income countries despite effective vaccines being commonly available. Consequently, many preventable infectious livestock diseases remain highly prevalent, causing significant animal mortalities and threatening farmers' livelihood and food security. This study sought to assess farmers' maximum willingness to pay (WTP)

for contagious bovine pleuropneumonia (CBPP), and peste-des-petits-ruminants (PPR) vaccination of cattle, and sheep and goats, respectively.

Methods

Overall, 350 ruminant livestock farmers were randomly selected from three districts located in the northern, middle and southern farming belts of Ghana. We implemented a double-bounded dichotomous contingent valuation experiment, where farmers indicated their WTP for vaccinating each livestock specie(s) owned at randomly assigned price points. WTP responses were analyzed using maximum likelihood estimation, and factors influencing WTP were assessed using censored regression analysis accounting for village-level clustering.

Results

Mean WTP for CBPP vaccination was USD 1.43 or Ghanaian Cedi (GHC) 8.63 (95% CI: GHC 7.08–GHC 10.19) per cattle. Mean WTP for PPR vaccination was USD 1.17 or GHC 7.02 (95% CI: GHC 5.99–GHC 8.05) per sheep, and USD 1.1 or GHC 6.66 (95% CI: GHC 5.89–GHC 7.44) per goat. WTP was positively associated with resilience, limited knowledge about vaccines (assessed prior to WTP experiment), farmland size, and male gender, after adjusting for other covariates. To attain 70% vaccination coverage in Ghana, vaccination costs should be no larger than GHC 5.30 (USD 0.88) for CBPP per cattle and GHC 3.89 (USD 0.65) and GHC 3.67 (USD 0.61), respectively, for PPR vaccines per sheep and goat.

Conclusions

Ruminant livestock farmers in Ghana value vaccination highly, and are, on average, willing to pay vaccination costs that exceed the prevailing market prices (GHC 6 for CBPP and GHC 5 for PPR vaccination) to protect their livestock resources. To achieve 70% coverage, only minor subsidies would likely be required. These results suggest that effective disease control in these settings should be possible with appropriate distribution strategies.

Keywords: Contagious bovine pleuropneumonia; Pestes-des-petits-ruminants; Stated preferences; Dichotomous choice contingent valuation; Willingness to pay; Vaccination; Ghana; Livestock farmer

15. Bo Wen, Wenchi Chang, Lulu Yang, Daiyue Lv, Lizhen Wang, Lei Wang, Yanzhao Xu, Jianhe Hu, Ke Ding, Qinghong Xue, Xuefeng Qi, Bo Yang, Jingyu Wang, **The long noncoding RNA APR attenuates PPRV infection-induced accumulation of intracellular iron to inhibit membrane lipid peroxidation and viral replication**, mBio, Volume 16, Issue 4, 2025, <https://doi.org/10.1128/mbio.00127-25>.

Abstract:

Peste des petits ruminants virus (PPRV) is an important pathogen that has long been a significant threat to small ruminant productivity worldwide. Iron metabolism is vital to the host and the pathogen. However, the mechanism underlying host-PPRV interactions from the perspective of iron metabolism and iron-mediated membrane lipid peroxidation has not been reported thus far. In this study, we identified a novel host long-noncoding RNA (lncRNA), APR, that impairs PPRV infectivity by sponging miR-3955-5p, a negative microRNA (miRNA) that directly targets the gene encoding the ferritin-heavy chain 1 (FTH1) protein. Importantly, we demonstrated that PPRV infection causes aberrant cellular iron

accumulation by increasing transferrin receptor (TFRC) expression and that iron accumulation induces reticulophagy and ferroptosis, which benefits PPRV replication. Moreover, PPRV infection enhanced the localization of cellular iron on the endoplasmic reticulum (ER) and caused ER membrane damage by promoting excess lipid peroxidation to induce reticulophagy. Interestingly, APR decreased PPRV infection-induced accumulation of intracellular Fe²⁺ via miR-3955-5p/FTH1 axis and ultimately inhibited reticulophagy and ferroptosis. Additionally, our results indicate that interferon regulatory factor 1 promotes APR transcription by positively regulating APR promoter activity after PPRV infection. Taken together, our findings revealed a new pattern of PPRV-host interactions, involving noncoding RNA regulation, iron metabolism, and iron-related membrane lipid peroxidation, which is critical for understanding the host defense against PPRV infection and the pathogenesis of PPRV.

IMPORTANCE Many viruses have been demonstrated to engage in iron metabolism to facilitate their replication and pathogenesis. However, the mechanism by which PPRV interacts with host cells from the perspective of iron metabolism, or iron-mediated membrane lipid peroxidation, has not yet been reported. Our data provide the first direct evidence that PPRV infection induces aberrant iron accumulation to promote viral replication and reveal a novel host lncRNA, APR, as a regulator of iron accumulation by promoting FTH1 protein expression. In this study, PPRV infection increased cellular iron accumulation by increasing TFRC expression, and more importantly, iron overload increased viral infectivity as well as promoted ER membrane lipid peroxidation by enhancing the localization of cellular iron on the ER and ultimately induced ferroptosis and reticulophagy. Furthermore, a host factor, the lncRNA APR, was found to decrease cellular iron accumulation by sponging miR-3955-5p, which directly targets the gene encoding the FTH1 protein, thereby attenuating PPRV infection-induced ferroptosis and reticulophagy and inhibiting PPRV infection. Taken together, the results of the present study provide new insight into our understanding of host-PPRV interaction and pathogenesis from the perspective of iron metabolism and reveal potential targets for therapeutics against PPRV infection.

Many viruses have been demonstrated to engage in iron metabolism to facilitate their replication and pathogenesis. However, the mechanism by which PPRV interacts with host cells from the perspective of iron metabolism, or iron-mediated membrane lipid peroxidation, has not yet been reported. Our data provide the first direct evidence that PPRV infection induces aberrant iron accumulation to promote viral replication and reveal a novel host lncRNA, APR, as a regulator of iron accumulation by promoting FTH1 protein expression. In this study, PPRV infection increased cellular iron accumulation by increasing TFRC expression, and more importantly, iron overload increased viral infectivity as well as promoted ER membrane lipid peroxidation by enhancing the localization of cellular iron on the ER and ultimately induced ferroptosis and reticulophagy. Furthermore, a host factor, the lncRNA APR, was found to decrease cellular iron accumulation by sponging miR-3955-5p, which directly targets the gene encoding the FTH1 protein, thereby attenuating PPRV infection-induced ferroptosis and reticulophagy and inhibiting PPRV infection. Taken together, the results of the present study provide new insight into our understanding of host-PPRV interaction and pathogenesis from the perspective of iron metabolism and reveal potential targets for therapeutics against PPRV infection.

Keywords: PPRV; iron overload; lipid peroxidation; lncRNA APR; replication

16. Sameer Thakur, Kshitiz Shrestha, Ram Chandra Acharya, Parikshya Gurung, Surendra Karki, **African swine fever in Nepal: risk factors, impacts, and strategies for control**, Science in One Health, Volume 5, 2026, 100150, <https://doi.org/10.1016/j.soh.2026.100150>.

Abstract:

African swine fever (ASF) has emerged as a major threat to Nepal's pig farming sector since its first outbreak in March 2022. The disease has caused significant declines in both the pig population and pork production, severely affecting rural communities reliant on pig farming for their livelihoods. ASF's spread is facilitated by key risk factors, including swill feeding, informal cross-border trade, and poor on-farm biosecurity measures. Additionally, seasonal trends, particularly during the monsoon, exacerbate the spread of the disease, especially in areas with high pig density. Control efforts face numerous challenges, including limited veterinary infrastructure, inadequate surveillance systems, gaps in legislation, and a lack of awareness among farmers about biosecurity practices. This study presents a comprehensive analysis of ASF's epidemiology in Nepal, exploring the disease's socio-economic impact and identifying key control challenges. The paper provides targeted recommendations to improve veterinary services, strengthen surveillance systems, enforce biosecurity measures, and enhance cross-border cooperation. It also emphasizes the importance of fostering community engagement and developing effective policy frameworks to ensure long-term ASF prevention and control, ensuring a more resilient pig farming sector in Nepal.

Keywords: African swine fever; Pig farming; Epidemiology; Socio-economic impact; Transboundary animal diseases; Risk factor; Nepal

17. Sharad Kumar Gaur, Juhi Jain, Yash Chaudhary, Rajeev Kaul, **Insights into the mechanism of Morbillivirus induced immune suppression**, Virology, Volume 600, 2024, 110212, <https://doi.org/10.1016/j.virol.2024.110212>.

Abstract:

Viruses enter the host cell, and various strategies are employed to evade the host immune system. These include overcoming the various components of the immune system, including modulation of the physical and chemical barriers, non-specific innate response and specific adaptive immune response. Morbilliviruses impose immune modulation by utilizing various approaches including hindering antigen presentation to T-Helper (TH) cells, hematopoiesis and suppression of effector molecule activities. These viruses can also impede the early stages of T cell activation. Despite the availability of effective vaccines, morbilliviruses are still a significant threat to mankind. After infection, they also induce a state of immune suppression in the host. The molecular mechanisms employed by morbilliviruses to induce the state of immune suppression in the infected host are still being investigated. This review is an attempt to summarize insights into some of the strategies adopted by morbilliviruses to mediate immune modulation in the host.

Keywords: Morbillivirus; Immune suppression; Interferons; Cytokines; Autophagy; Apoptosis

18. Anne Meyer, Bakary Ndiaye, Andrew Larkins, Gemma Chaters, William Gilbert, Benjamin Huntington, Guy Ilboudo, Michel Dione, Wudu Temesgen Jemberu, Mame Nahé Diouf, Assane Gueye Fall, Mathioro Fall, Mbargou Lo, Jonathan Rushton, **Economic assessment of animal disease burden in Senegalese small ruminants**, Preventive Veterinary Medicine, Volume 234, 2025, 106382, <https://doi.org/10.1016/j.prevetmed.2024.106382>.

Abstract:

Small ruminant production in sub-Saharan Africa is limited by a range of constraints, including animal health issues. This study aimed at estimating the impact of these issues on the small ruminant production in Senegal in a holistic manner, using an approach developed by the Global Burden of Animal Diseases (GBADs) programme. The estimation focused on the mixed crop-livestock system, representing a large proportion (>60 %) of the small ruminant population in the country. It was based on existing data collected via a systematic literature review, acquisition of secondary datasets from local stakeholders, and expert elicitation. A dynamic population model was used to calculate the gross margin of the sector under both the current health constraints and an ideal health state, where animals are not exposed to causes of morbidity and mortality. The difference between the current and ideal health scenarios, termed the Animal Health Loss Envelope (AHLE), provides a quantitative measure of the farm-level cost of disease in the system. The all-cause AHLE was estimated at 292 billion FCFA (468 million USD, with 95 % prediction interval 216 – 366 billion FCFA) per year for 2022, for a population of 8.8 million animals. The contribution of Peste des Petits Ruminants (PPR) was modelled separately, as an example of attributing part of the AHLE to a specific disease cause. PPR was estimated to contribute 5 % of the total AHLE. The animal disease burden experienced by Senegalese livestock keepers was largely due to loss in animals and production, with relatively small amounts of animal health expenditure. Implementation of this study contributed to the further development of the GBADs approach. Such estimates can support decision making at all levels, from investment decisions at the international level to local disease awareness campaigns targeting livestock keepers.

Keywords: Animal health economics; Disease burden; Small ruminants; Senegal; Peste des petits ruminants

19. Yibekal Walle, Joseph Y.T. Mugisha, Dawit Melese, Haileyesus Tessema, **Modeling the Peste des Petits Ruminants (PPR) disease transmission dynamics with impacts of vaccination and restocking in small ruminant population in Amhara region, Ethiopia**, Heliyon, Volume 10, Issue 24, 2024, e41016, <https://doi.org/10.1016/j.heliyon.2024.e41016>.

Abstract:

Peste des Petits Ruminants (PPR) is a highly contagious transboundary viral disease of small ruminants with significant economic implications caused by the Peste des Petits Ruminants virus. This study employs mathematical modeling to investigate the impact of imperfect PPR vaccines and restocked small ruminants on the transmission dynamics of PPR. A deterministic mathematical model is developed by incorporating vaccinated and restocked subpopulations into the classical SEIR model. The influence of infected animals introduced through restocking on vaccination efficacy in preventing PPR spread is examined. The global dynamics of equilibrium points in the model are analyzed using the Lyapunov-LaSalle invariance principle. Parameter values for numerical simulations are estimated

based on monthly PPR data from the Amhara regional state in Ethiopia, obtained from the Ministry of Agriculture. The basic reproduction number (R_v) is calculated to assess the level of PPR in the small ruminant population, and sensitivity analysis of parameters is performed on R_v . The analytical and numerical results reveal that infected restocked small ruminants significantly facilitate the spread of PPR in the population. Moreover, even with high efficacy vaccination, the system exhibits a unique asymptotically stable endemic equilibrium. These findings emphasize that appropriate vaccination alone is insufficient to control and eradicate PPR in the region. Implementing strict movement restrictions and biosecurity measures are necessary. These findings provide valuable insights for national policymakers in achieving the regional and national targets for PPR eradication by 2027.

Keywords: Global stability; PPR disease; Vaccination efficacy; Restocking

20. Nelly Njiru, Alessandra Galiè, Immaculate Omondi, Dalmas Ombia, Agnes Loriba, Peter Awini, **Gender transformative innovation: Women's inclusion in livestock vaccine systems in northern Ghana**, Agricultural Systems, Volume 219, 2024, 104023, <https://doi.org/10.1016/j.agsy.2024.104023>.

Abstract:

CONTEXT

Owning livestock can support women's empowerment and progress toward gender-equitable agri-food systems. Gender inequality, however, can reduce women's ownership of livestock and access to animal vaccines. Gender accommodative approaches (GAAs), and more recently gender transformative approaches (GTAs), are increasingly implemented in development interventions. However, their impact on women's empowerment has not been systematically tested. Here, we describe the 'Women Rear Project', implemented in northern Ghana between 2019 and 2023, and assess the impact of GTAs and GAAs on women's empowerment, ownership of livestock, and access to animal vaccines.

OBJECTIVE

We sought to systematically assess changes conferred by GAAs and GTAs on gender norms and women's empowerment and access to animal vaccines.

METHODS

Using a mixed-methods approach, in 2021 and 2023 we collected quantitative and qualitative data regarding women's empowerment, gender norms, and access to animal vaccines. Qualitative data regarding women's and men's conceptualizations of gender norms and women's empowerment were obtained via focus group discussions and key informant interviews. Quantitative survey data were obtained from 500 households, using the Women's Empowerment in Livestock Index (WELI). Quantitative data on livelihood indicators were also collected, using the Rural Household Multi-Indicator Survey (RHoMIS) tool. We systematically assessed changes between baseline (2021) and endline (2023) in local conceptualizations of empowerment in the livestock sector, the effects of GTAs and GAAs on such conceptualizations, and how empowerment was experienced by women and men and the implications for women's access to animal vaccines.

RESULTS AND CONCLUSION

Local conceptualizations of empowerment in 2021, among both women and men, emphasized financial independence, decision-making autonomy, self-reliance, and problem-solving skills. In 2023, this conceptualization of empowerment had expanded to include the ability to act without external restrictions; women were empowered by managing resources, running successful businesses, and making decisions in consultation with their husbands. Furthermore, women in communities where GTAs had been enacted scored significantly higher in empowerment compared with women in communities where only GAAs had been introduced. Gender norms impacted empowerment indicators, with respect among household members and autonomy in income both contributing to disempowerment. Gender norms also affected respondents' reporting. Women's access to livestock vaccines was more positive in GTA/GAA communities. We recommend efforts are made to reduce restrictive gender norms and enhance women's empowerment and access to resources such as animal vaccines.

SIGNIFICANCE

We offer recommendations for pathways toward women's empowerment and healthy livestock via inclusive innovations in agri-food systems.

Keywords: Gender-equitable Agri-food systems; Livestock; Gender transformative approaches; Gender accommodative approaches; Gender norms; Livestock vaccines

21. Sandra I. Ijoma, Asma Mesdour, Rayyanu A. Usman, Muhammad-Bashir Bolajoko, Chika Nwosuh, Marion Bordier, Arnaud Bataille, Adeiza M. Abdulrahman, Wesley D. Nafarnda, Andrea Apolloni, Elena Arsevska, **Mapping risk areas for the occurrence of Peste des petits ruminants in the Plateau, Bauchi, and Kano states in Nigeria by combining expert knowledge and field surveys on animal mobility**, Preventive Veterinary Medicine, Volume 249, 2026, 106787, <https://doi.org/10.1016/j.prevetmed.2026.106787>.

Abstract:

Peste des petits ruminants (PPR) is a highly contagious disease of small ruminants that causes significant economic losses. The disease is endemic in most sub-Saharan countries, such as Nigeria. Despite decades of widespread vaccination efforts, the disease persists due to significant animal movements, particularly transhumance and commercial trade. This facilitates the rapid spread of the disease across Nigerian states, particularly in the semi-arid north, where there is frequent animal movement. This study aimed to identify high-risk areas for PPR transmission in the Plateau, Bauchi, and Kano states using rigorous, systematic multicriteria decision analysis (MCDA). The risk factors for PPR occurrence and their relative importance were identified through a literature review and consultation with PPR experts. The corresponding geographic data were collected, standardised, weighted and combined to pinpoint the areas most likely to experience disease outbreaks. The results were validated using a recent PPR seroprevalence survey conducted in the three states. Risk factors such as climate, small ruminant density, proximity to dry areas, small ruminant commercial and transhumance movements were identified as drivers of disease occurrence. Risk maps could be used to inform targeted disease control strategies.

Keywords: Multi-criteria decision analysis; Northern Nigeria; Peste des petits ruminants; Risk factors; Risk mapping

22. Rula Awad, Hosam Titi, Aziza Mohamed-Brahmi, Mohamed Jaouad, Aziza Gasmi-Boubaker, **Small ruminant value chain in Al-Ruwaished District, Jordan**, Regional Sustainability, Volume 4, Issue 4, 2023, Pages 416-424, <https://doi.org/10.1016/j.regsus.2023.11.006>.

Abstract:

This study aims to assess the small ruminant value chain in Al-Ruwaished District, Jordan, to identify the potential intervention areas that could improve the production efficiency and guarantee the sustainability of the small ruminant sector in this area. Sheep breeding is the source of livelihood for most of the people in Al-Ruwaished District, which is characterized by the large number of sheep and goats. We surveyed 5.0% of the small ruminant holders in the study area and conducted individual interviews and surveys with the potential actors in the value chain to undertake a small ruminant value chain analysis. From the survey, we found that the small ruminant value chain consists of five core functions, namely, input supply, production management, marketing, processing, and consumption. Despite the large number of holdings that gives an impression of the stability to the small ruminant sector, the surveyed results show a clear fragility in the value chain of small ruminants in this area. The small ruminant production system is negatively impacted by climate change, especially continuous drought. In addition, the high prices of feed that the farmer cannot afford with clear and real absence of the governmental and non-governmental support activities also impact the development of the value chain. The results of strengths, weaknesses, opportunities, and threats (SWOT) analysis reveal that the major constraints faced by this value chain could be divided into external and internal threats. Specifically, the most prominent external threats are the nature of the desert land and continuous drought, while the major internal threats are the absence of appropriate infrastructure, shortage of inputs, and weakness in the production management and marketing. We proposed solutions to these challenges to ensure the sustainability and effectiveness of the sector, such as the formulation of emergency response plans to severe weather, qualifying farmers' skills, and establishment of agricultural cooperative societies.

Keywords: Value chain analysis; Small ruminants; Strengths, weaknesses, opportunities, and threats (SWOT) analysis; Climate change; Livestock production management; Jordan

23. Md Habibur Rahman, Md Shahin Alam, Md Zulfekar Ali, Md Nurul Haque, Sonia Akther, Sadek Ahmed, **First report of contagious caprine pleuropneumonia (CCPP) in Bangladeshi goats: Seroprevalence, risk factors and molecular detection from lung samples**, Heliyon, Volume 10, Issue 23, 2024, e40507, <https://doi.org/10.1016/j.heliyon.2024.e40507>.

Abstract:

Background and objective

Contagious caprine pleuropneumonia (CCPP) is a highly contagious mycoplasmal respiratory disease primarily affecting goats and sheep caused by *Mycoplasma capricolum* subsp. *capripneumoniae*

(Mccp). So far, there is no available information on either the serological or molecular identification of Mccp in Bangladesh. Hence, the objective of this study was to determine the seroprevalence of CCPP and associated risk factors in goats of Bangladesh, as well as molecular identification of the causative agent (Mccp) in this country.

Materials and methods

From July 2022 to June 2023, 402 goat serum samples were randomly collected to determine seroprevalence, and 90 clinically suspected lung samples were collected for molecular confirmation of CCPP. Risk factors were evaluated by interviewing goat owners using a predesigned questionnaire. A commercially available cELISA kit was used to screen blood serum for anti-CCPP antibodies and PCR for Mccp detection. The 16S rRNA gene specific to *Mycoplasma mycoides* cluster (Mmc), and the Mccp-specific gene of *Mycoplasma capricolum* subsp. *capripneumoniae* (Mccp) were amplified through PCR. Potential risk factors were identified through a univariate logistic regression followed by a multivariate logistic regression model.

Results

Out of 402 samples, 29 were tested positive for CCPP, indicating an overall seroprevalence of 7.21 % (95 % CI: 1.90–12.53). The PCR result showed that 26.67 % of the samples were positive for CCPP. The associated risk factors for the disease were animal age (>18 months; OR: 2.14, 95 % CI: 0.92–4.98), sex (Female; OR: 5.80, 95 % CI: 1.70–19.69), flock size (Large; OR: 6.28, 95 % CI: 1.17–35.74), and body condition scores (Poor; OR: 5.58, 95 % CI: 1.36–22.92).

Conclusion

This study confirms the existence of CCPP in Bangladeshi goats for the first time using both serological and molecular methods (PCR).

Keywords: Bangladesh; Contagious caprine pleuropneumonia (CCPP); Goats; Molecular detection; *Mycoplasma capricolum* subsp. *capripneumoniae* (Mccp); Seroprevalence

24. Bethan Savagar, Bryony A. Jones, Mark Arnold, Martin Walker, Guillaume Fournié, **Modelling flock heterogeneity in the transmission of peste des petits ruminants virus and its impact on the effectiveness of vaccination for eradication**, *Epidemics*, Volume 45, 2023, 100725, <https://doi.org/10.1016/j.epidem.2023.100725>.

Abstract:

Peste des petits ruminants (PPR) is an acute infectious disease of small ruminants targeted for global eradication by 2030. The Global Strategy for Control and Eradication (GSCE) recommends mass vaccination targeting 70% coverage of small ruminant populations in PPR-endemic regions. These small ruminant populations are diverse with heterogeneous mixing patterns that may influence PPR virus (PPRV) transmission dynamics. This paper evaluates the impact of heterogeneous mixing on (i) PPRV transmission and (ii) the likelihood of different vaccination strategies achieving PPRV elimination, including the GSCE recommended strategy. We develop models simulating heterogeneous transmission between hosts, including a metapopulation model of PPRV transmission between villages in lowland Ethiopia fitted to serological data. Our results demonstrate that although heterogeneous

mixing of small ruminant populations increases the instability of PPRV transmission —increasing the chance of fadeout in the absence of intervention—a vaccination coverage of 70% may be insufficient to achieve elimination if high-risk populations are not targeted. Transmission may persist despite very high vaccination coverage (>90% small ruminants) if vaccination is biased towards more accessible but lower-risk populations such as sedentary small ruminant flocks. These results highlight the importance of characterizing small ruminant mobility patterns and identifying high-risk populations for vaccination and support a move towards targeted, risk-based vaccination programmes in the next phase of the PPRV eradication programme. Our modelling approach also illustrates a general framework for incorporating heterogeneous mixing patterns into models of directly transmitted infectious diseases where detailed contact data are limited. This study improves understanding of PPRV transmission and elimination in heterogeneous small ruminant populations and should be used to inform and optimize the design of PPRV vaccination programmes.

Keywords: Peste des petits ruminants; PPR; Mathematical modeling; Heterogeneous transmission; Vaccination

25. Mohammed Abdul Kahir, Tajul Islam Mamun, Md. Abu Saeed, Md. Khademul Islam, Md. Irtija Ahsan, Sharmin Akter, Suman Paul, Md Bashir Uddin, Syed Sayeem Uddin Ahmed, **Epidemiological Investigation and Risk Factors of Peste des Petits Ruminants (PPR) in Goats of Northeastern Bangladesh,** Veterinary and Animal Science, 2026, 100624, <https://doi.org/10.1016/j.vas.2026.100624>.

Abstract:

Peste des Petits Ruminants (PPR) remains a major constraint to small ruminant health and rural livelihoods in Bangladesh. This cross-sectional study investigated the prevalence and risk factors of PPR among 368 unvaccinated goats sampled from eight upazilas in northeastern Bangladesh between April and July 2024. Competitive ELISA and RT-PCR targeting the N and F genes were used to detect PPR-specific antibodies and molecular identification, respectively. The seroprevalence was 35.05% (95% CI: 30.18–40.17), while the molecular prevalence was 16.6% (95% CI: 12.92–20.78). At the household-level (n = 90), the molecular prevalence was 41.11% (95% CI: 30.81–51.98), while the seroprevalence was 75.56% (95% CI: 65.29–84.07). Among clinical signs, coughing was strongly associated with PPR virus infection. Multivariable logistic regression identified two potential key predictors of PPR infection: water source and grazing system. Goats drinking supply water had higher odds of PPR positivity (aOR = 2.19; 95% CI: 0.97–5.13), and those grazing under free-ranging systems had significantly higher odds compared with the Gidding grazing system (aOR = 3.64; 95% CI: 1.15–16.13). These findings underscore the role of management practices and environmental exposure in PPR transmission. Targeted improvements in water management, grazing practices, and surveillance are essential to support Bangladesh's goal of PPR eradication by 2030.

Keywords: Peste des Petits Ruminants (PPR); Goats; Seroprevalence; Risk factors; PCR; Bangladesh

26. Yalew Abiyu Senbeto, Demeke Sibhatu, Yasmin Jibril, **Seroprevalence and associated risk factors of Peste des petits ruminants in selected districts of Awi zone, Northwest Ethiopia**, Heliyon, Volume 10, Issue 19, 2024, e38882, <https://doi.org/10.1016/j.heliyon.2024.e38882>.

Abstract:

A cross-sectional study to estimate the antibody seroprevalence of the PPR virus and determine the associated risk factors was conducted from February 2021 to May 2022 in the Guangua and Jawi districts of the Awi zone. Of the total 380 sera samples tested using cELISA, 231 (60.8 %) were found positive for the PPRV antibody. A significantly higher prevalence of 76.2 % (OR = 4.5, P = 0.000) was observed in the Jawi district than in the Guangua district (45.5 %). Seroprevalence of 61.9 % (109/176) in sheep and 59.8 % (122/204) in goats was also detected in the present study (P > 0.05). Significantly higher prevalence was revealed in old (69.7 %, OR = 3.4) and adult (65.7 %, OR = 2.3) age groups compared to young (48.9 %) age groups. A prevalence of 63.4 % and 55.6 % were reported in female and male animals respectively (P > 0.05, $\chi^2 = 1.85$). As evidenced by the serological test result, PPR is highly circulated in the Guangua and Jawi districts of the Awi zone. The higher circulation of the PPR virus, the uncontrolled movement of animals, and the regular practice of communal grazing systems in the area indicate the chance of continued dissemination within and to other places. Hence, proper implementation of prevention and control measures and further study on sequencing and characterization of the circulating virus are advised.

Keywords: C-ELISA; Peste des petits ruminants; Risk factor; Seroprevalence; Awi zone; Small ruminant

27. Fréjus T.A. Zinsou, Pascal A. Olounladé, Géorcelin G. Alowanou, Adam D. Adenilé, Hyppolite A. Sèdédji, Eunice A.F. Bamigbochey, Sylvie M. Hounzangbé-Adoté, **Typology of Red Maradi goat farming systems in Benin based on farmers' survey**, Heliyon, Volume 10, Issue 22, 2024, e40256, <https://doi.org/10.1016/j.heliyon.2024.e40256>.

Abstract:

Goat farming contributes to the family economy, sustainable livelihoods and reduces poverty in rural households in Sub-Sahara areas. Also called "Poor man's cow", Red Maradi goat is a Niger-originated dairy goat introduced in Benin by the West African Agricultural Productivity Project-Benin for improving local goat productivity. In order to assess the farming systems put in place by the farmers, a field survey was conducted between August and September 2019. It involved 56 Red Maradi goat farms from selected among the program's beneficiaries from Kandi, Ségbana, Banikoara and Malanville. Data were collected on both farmers' profile and the Red Maradi goats farming practices using structured questionnaire, and were subjected to both descriptive and inferential analysis using SPSS version 25. The results showed that Red Maradi goat farmers were mainly women (67.86 %) with low educational background (80.3 %). Red Maradi goats were raised under the same housing systems and feeding patterns, and received similar health care as local goats. Reproduction was free and females average ages at conception and first kidding were respectively 9.56 ± 0.87 and 14.35 ± 1.87 months; with 1.71 ± 0.51 kids/kidding. Red Maradi goats were not vaccinated (73.21 %) but were dewormed in almost all farms using chemical drugs. Animal health management (75.26 %), animal feeding (62.74 %) and animal housing (45.81 %) related problems were the major challenges faced by Red Maradi goat farms. Based on the farming practices, two (02) major groups of Red Maradi goat

farming were identified: group 1 defined as “Semi-improved Red Maradi goat farming” met in Malanville and Banikoara, then group 2 “Wandering Red Maradi goats farming” met in Kandi and Ségbana. Whatever the group, there has been no investment aid and little technical support for the development of goat farming. These findings could guide in designing future actions to support the program's results for improving Red Maradi goat performance in Benin.

Keywords: Breeding system; Farming practices; Poor feeding; Red maradi goat; Zero grazing

28. Honglin Yang, Quangang Xu, Chaojian Shen, Xinjie Wei, Fusheng Guo, Julian A. Drewe, Javier Guitian, Kachen Wongsathapornchai, John Edwards, Dirk Pfeiffer, Youming Wang, Hao Tang, **Building an institutionalised in-service field epidemiology capacity-building program: Experiences and lessons learned from the China Field Epidemiology Training Program for Veterinarians (CFETPV)**, Preventive Veterinary Medicine, Volume 247, 2026, 106766, <https://doi.org/10.1016/j.prevetmed.2025.106766>.

Abstract:

The increasing threats of zoonotic and transboundary animal diseases highlight the urgent need for a skilled veterinary epidemiology workforce. Before 2010, China had limited capacity in this field. To address this gap, the China Field Epidemiology Training Program for Veterinarians (CFETPV) was established as a competency-based, in-service training program. This study assesses the contributions of CFETPV in enhancing epidemiology practice within animal health services, supporting alumni professional development, and enabling institutional integration in the government system. A quantitative study design was employed, drawing on two alumni surveys conducted in 2019 and 2024, alongside routine program monitoring, administrative data and program progress briefs. Surveys assessed alumni's application of epidemiological competencies in field study, teaching and policy engagement. Descriptive analyses summarised alumni profiles and contributions. Since 2010, CFETPV has trained 265 professionals through its introductory course and graduated 153 from the two-year program across 31 provinces. Trainees completed 305 field practices during the training. After graduation, alumni conducted 730 epidemiological investigations and studies, contributed to 297 risk assessments, supported major disease control efforts and informed 98 national and provincial guidelines. In 2019, CFETPV became fully funded by the Chinese government, achieving full integration into the national veterinary service. The successful integration was supported by an adaptive competency framework aligned with national priorities, strong alumni support, robust local trainer and mentor networks and consistent stakeholder engagement. These experiences offer insights for countries developing competency-based, in-service veterinary epidemiology training embedded within public veterinary services to strengthen animal health systems and One Health capacity.

Keywords: Field epidemiology; Capacity building; Veterinary service; China

29. Samia Guendouz, Olivier Kwiatek, Aikaterini Kirtzalidou, Angeliki Katsifa, Maria Gianniou, Corina Ancuceanu, Mona Ghiță, Cristian Laurențiu Mortasivu, Anna Zdravkova, Iliyan Kostov, Emilia Ivanova, Florica Bărbuceanu, Konstantia E. Tasioudi, Arnaud Bataille, **Genomic analysis of peste des petits ruminants virus in Europe: Common origin for emergence in Greece, Romania, and**

Abstract:

Outbreaks of the highly pathogenic small ruminant disease peste des petits ruminants (PPR) were reported in Greece and Romania in July 2024, and central Bulgaria in November 2024. The origin and the link between these outbreaks are not clear. In this study, genome sequences of PPR virus were obtained from samples collected by veterinary authorities in the first farms notified as infected in the three European countries. Genomic analyses confirmed that the emergence of PPR across Europe has a common origin, pointing towards an introduction from Northern Africa, although additional sequencing from the virus currently circulating globally is needed to confirm this hypothesis. More sequencing from the different outbreaks in Europe could also help to resolve the pathway of PPR transmission between and within European countries. Multiple nucleotide and amino acid differences separate the genomes from Europe from other sequences, with potential impact on the functionality of viral proteins to be investigated.

Keywords: Morbillivirus; Small ruminant; Transboundary disease; Phylogenomics

30. Buhari Habibu, Tagang Aluwong, Hussaina Joan Makun, Lukman Surakat Yaqub, Mohammed Umaru Kawu, **Role of maternal variables on the development of neonatal hypoglycaemia and influence of neonatal hypoglycaemia on performance of goat kids**, Veterinary and Animal Science, Volume 19, 2023, 100287, <https://doi.org/10.1016/j.vas.2023.100287>.

Abstract:

The study evaluated the influence of maternal variables (age, body weight and body mass index; BMI) during mating on the development of hypoglycaemia and investigated whether hypoglycaemia at birth impairs thermoregulation, metabolism, body weight gain and immunoglobulin concentration in neonatal goat kids. Post-kidding, the kids born with hypoglycaemia ($n = 19$) and normoglycaemia ($n = 19$) were immediately identified and postnatal blood samples, body weight and cardinal physiological variables were determined. Results revealed no significant ($P < 0.05$) difference in pre-mating maternal variables between dams that kidded hypoglycaemic and normoglycaemic kids. Kids born with hypoglycaemia had lower ($P < 0.05$) blood glucose concentration from birth, until Day 2, when values became comparable between the two groups. Afternoon respiratory and pulse rates were markedly ($P < 0.05$) unstable in kids born with hypoglycaemia and the early postnatal rise ($P < 0.05$) in morning rectal temperature in both groups was accompanied by a decrease ($P < 0.05$) on day 20 in kids born with hypoglycaemia. Blood cholesterol and triglyceride concentrations were lower ($P < 0.05$) in hypoglycaemic kids and the normoglycaemic kids showed marked increase ($P < 0.05$) in circulating immunoglobulin concentration 24 h after birth, while age had no ($P > 0.05$) effect in hypoglycaemic kids. A more pronounced decrease ($P < 0.05$) in weekly weight gain was observed in hypoglycaemic kids. It was concluded that neonatal goat kids born with hypoglycaemia may have compromised thermoregulation, metabolism and body weight gain, and the cause of hypoglycaemia in kids may not be related to pre-mating maternal variables.

Keywords: Blood glucose; Hypoglycaemia; Metabolism; Thermoregulation; Triglyceride

31. P.P. Jayasekara, C. Jenkins, P.D. Kirkland, P.F. Gerber, L. Olmo, T. Xaikhue, K. Eamens, W. Theppangna, S.W. Walkden-Brown, **Mycoplasma ovipneumoniae identified as the main aetiological agent of respiratory disease in goats from a case-control study in Savannakhet province of Lao PDR**, Veterinary Microbiology, Volume 301, 2025, 110353, <https://doi.org/10.1016/j.vetmic.2024.110353>.

Abstract:

Clinical signs of respiratory disease are common in Lao goats. To identify the causative agents involved in this clinical syndrome, a matched case-control study was conducted across 70 smallholder goat holdings in Savannakhet province. Fifty paired nasal swab samples were collected from goats with respiratory signs (cases) and unaffected (control) goats from 27 goat holdings. The majority of cases (84 %) were from goats <12 months of age. Samples were tested using quantitative PCR assays targeting possible pathogens causing respiratory disease. *Mycoplasma ovipneumoniae*, the cause of atypical pneumonia, was prevalent in both case (94 %) and control (76 %) groups and was identified as the principal causative agent based on odds ratio of presence (4.9) and a significantly higher pathogen load in case goats. Prolonged close contact between goats during confinement in often poorly constructed goat houses, likely facilitates transmission and progression from carrier to clinical status under the Lao goat production system. *Mannheimia haemolytica* was detected in 60 % of case and 52 % of control samples with no significant difference in pathogen load, while *Pasteurella multocida* was detected in only 2 % of control samples indicating no major role in causation for these pathogens. *Mycoplasma capricolum* subsp. *capripneumoniae*, respiratory syncytial virus and bovine parainfluenza 3 virus were not detected in any samples. Phylogenetic analysis showed no genetic variation of *M. ovipneumoniae* in the study samples and close similarity to recent isolates from China, US and Turkey. Improved housing conditions may be helpful in controlling atypical pneumonia in Lao goats and antibiotic treatment of goats with severe signs of respiratory disease was found to be effective.

Keywords: Atypical pneumonia; Case-control study; Goats; Lao PDR; *Mycoplasma ovipneumoniae*

32. Amaresh Das, Zaheer Ahmed, Lizhe Xu, Wei Jia, **Assessment and verification of chemical inactivation of peste des petits ruminants virus by virus isolation following virus capture using Nanotrap magnetic virus particles**, Microbiology Spectrum, Volume 11, Issue 5, 2023, <https://doi.org/10.1128/spectrum.00689-23>.

Abstract:

This study reports development and optimization of a new method for the assessment and verification of the inactivation of peste des petits ruminants virus (PPRV) by chemical agents, including Triton X-100 and commercially available viral lysis buffers. Virus inactivation was confirmed by virus isolation (VI) on Vero cells following capture of the potential residual viruses from treated samples using Nanotrap magnetic virus particles (NMVPs). Since chemical agents are cytotoxic, treated PPRV samples could not be used directly for VI on Vero cell monolayers; instead, they were diluted in Eagle's Minimum Essential Medium (EMEM) to neutralize cytotoxicity and then subjected to virus capture

using NMVPs. The NMVPs and the captured viruses were then clarified on a magnetic stand, reconstituted in EMEM, and inoculated onto Vero cells that were examined for cytopathic effect (CPE). No CPE was observed on cells inoculated with treated viruses captured by NMVPs; but CPE was observed on cells inoculated with untreated viruses, including those captured by NMVPs. For further verification, the supernatants of the VI cultures (treated or untreated) were subjected to RNA extraction and PPRV-specific real-time RT-PCR (RT-qPCR). The cycle threshold values were undetectable for the supernatants of VI cultures inoculated with NMVPs reconstituted from treated PPRV but detectable for the supernatants of VI cultures inoculated with untreated PPRV or the NMVPs reconstituted from untreated PPRV, indicating complete inactivation of PPRV. This new method of verification of virus inactivation using NMVPs can be applied to other high impact viruses of agricultural or public health importance.

IMPORTANCE

Research including diagnosis on highly contagious viruses at the molecular level such as PCR and next-generation sequencing requires complete inactivation of the virus to ensure biosafety and biosecurity so that any accidental release of the virus does not compromise the safety of the susceptible population and the environment. In this work, peste des petits ruminants virus (PPRV) was inactivated with chemical agents, and the virus inactivation was confirmed by virus isolation (VI) using Vero cells. Since the chemical agents are cytotoxic, inactivated virus (PPRV) was diluted 1:100 to neutralize cytotoxicity, and the residual viruses (if any) were captured using Nanotrap magnetic virus particles (NMVPs). The NMVPs and the captured viruses were subjected to VI. No CPE was observed, indicating complete inactivation, and the results were further supported by real-time RT-PCR. This new protocol to verify virus inactivation can be applicable to other viruses.

Research including diagnosis on highly contagious viruses at the molecular level such as PCR and next-generation sequencing requires complete inactivation of the virus to ensure biosafety and biosecurity so that any accidental release of the virus does not compromise the safety of the susceptible population and the environment. In this work, peste des petits ruminants virus (PPRV) was inactivated with chemical agents, and the virus inactivation was confirmed by virus isolation (VI) using Vero cells. Since the chemical agents are cytotoxic, inactivated virus (PPRV) was diluted 1:100 to neutralize cytotoxicity, and the residual viruses (if any) were captured using Nanotrap magnetic virus particles (NMVPs). The NMVPs and the captured viruses were subjected to VI. No CPE was observed, indicating complete inactivation, and the results were further supported by real-time RT-PCR. This new protocol to verify virus inactivation can be applicable to other viruses.

Keywords: PPRV; Triton X-100; lysis buffer; virus inactivation; Nanotrap magnetic virus particles; VI; RT-qPCR

33. Jingyu Tang, Aoxing Tang, Nannan Jia, Hanyu Du, Chuncao Liu, Jie Zhu, Chuanfeng Li, Chunchun Meng, Guangqing Liu, **Free ISG15 Inhibits the Replication of Peste des Petits Ruminants Virus by Breaking the Interaction of Nucleoprotein and Phosphoprotein**, Microbiology Spectrum, Volume 10, Issue 5, 2022, <https://doi.org/10.1128/spectrum.01031-22>.

Abstract:

PPRV, a widespread and fatal disease of small ruminants, is one of the most devastating animal diseases in Africa, the Middle East, and Asia, causing severe economic losses. IFNs play an important role as a component of natural immunity against pathogens, yet the role of ISG15, an IFN-stimulated gene, in protecting against PPRV infection is currently unknown.

Peste des petits ruminants virus (PPRV) causes a highly contagious disease in small ruminants and severe economic losses in developing countries. PPRV infection can stimulate high levels of interferon (IFN) and many IFN-stimulated genes (ISGs), such as ISG15, which may play a key role in the process of viral infection. However, the role of ISG15 in PPRV infection and replication has not yet been reported. In this study, we found ISG15 expression to be significantly upregulated after PPRV infection of caprine endometrial epithelial cells (EECs), and ISG15 inhibits the proliferation of PPRV. Further analysis showed that free ISG15 could inhibit PPRV proliferation. Moreover, ISG15 does not affect the binding, entry, and transcription but does suppress the replication of PPRV. A detailed analysis revealed that ISG15 interacts and colocalizes with both viral N and P proteins and that its interactive regions are all located in the N-terminal domain. Further studies showed that ISG15 can competitively interact with N and P proteins and significantly interfere with their binding. Finally, through the construction of the C-terminal mutants of ISG15 with different lengths, it was found that amino acids (aa) 77 to 101 play a key role in inhibiting the binding of N and P proteins and that interaction with the P protein disappears after the deletion of 77 to 101 aa. The present study revealed a novel mechanism of ISG15 in disrupting the activity of the N0-P complex to inhibit viral replication.

IMPORTANCE PPRV, a widespread and fatal disease of small ruminants, is one of the most devastating animal diseases in Africa, the Middle East, and Asia, causing severe economic losses. IFNs play an important role as a component of natural immunity against pathogens, yet the role of ISG15, an IFN-stimulated gene, in protecting against PPRV infection is currently unknown. We demonstrated, for the first time, that free ISG15 inhibits PPRV proliferation by disrupting the activity of the N0-P complex, a finding that has not been reported in other viruses. Our results provide important insights that can further understand the pathogenesis and innate immune mechanisms of PPRV.

Keywords: peste des petits ruminants virus; free ISG15; N0-P complex

34. Saurav Pantha, Sumit Jyoti, Krishna Prasad Acharya, Sudiksha Pandit, Deepak Subedi, **Climate change, ecosystem disruption, and disease emergence in the Himalayas and one health perspective**, Next Research, Volume 8, 2026, 101593, <https://doi.org/10.1016/j.nexres.2026.101593>.

Abstract:

Climate change is a global crisis, but its impacts are particularly severe in fragile ecosystems such as the Himalayas. In recent decades, rising temperatures, glacial retreat, altered precipitation, and permafrost thaw have disrupted the ecological balance of this region. These changes have triggered northward shifts in plant and animal populations, increased encounters between native and invasive species, and contributed to the emergence and re-emergence of infectious diseases in both humans and animals. This review highlights the ecological, epidemiological, and health-related consequences of climate change in the Himalayan region, with a special focus on the emergence of novel pathogens and vector-borne diseases. The release of ancient microbes from melting permafrost and changing

vector dynamics poses new risks for disease spillover. To mitigate these threats, this paper advocates for the adoption of the One Health approach, which promotes collaboration among human, animal, and environmental health sectors. Strengthening this integrated framework is crucial for enhancing disease surveillance, improving resilience, and ensuring sustainable ecosystem health in the face of a changing climate.

Keywords: Himalayas; Ecosystem; Pathogens; Permafrost; One Health

35. Francis Sena Nuvey, Günther Fink, Jan Hattendorf, Gloria Ivy Mensah, Kennedy Kwasi Addo, Bassirou Bonfoh, Jakob Zinsstag, **Access to vaccination services for priority ruminant livestock diseases in Ghana: Barriers and determinants of service utilization by farmers**, Preventive Veterinary Medicine, Volume 215, 2023, 105919, <https://doi.org/10.1016/j.prevetmed.2023.105919>.

Abstract:

Introduction

Livestock diseases are a major constraint to agricultural productivity, frequently causing significant livelihood losses for farmers, and negatively affecting public food safety and security. Vaccines provide an effective and profitable means for controlling most infectious livestock diseases, but remain underutilized. This study sought to assess the barriers and determinants of vaccination utilization for priority livestock diseases in Ghana.

Methods

We conducted a mixed-method study involving a quantitative survey with ruminant livestock farmers (N = 350) and seven focus group discussions (FGD) involving 65 ruminant livestock farmers. The survey data were analyzed, and distribution of barriers to vaccination access described. We evaluated the determinants of vaccination utilization (any use of vaccination against contagious-bovine-pneuropneumonia (CBPP) and peste-des-petits-ruminants (PPR) in 2021) using logistic regression analyses at the 0.05 significance level. FGD transcripts were analyzed deductively. We used triangulation to achieve convergence across the different datasets and analyses.

Results

The farmers kept an average (median) of 5 tropical livestock units (TLUs) of ruminant livestock (IQR=2.6–12.0) that were on average 8 kilometers (IQR=1.9–12.4) away from veterinary officers (VOs). Only 16% (56/350) of herds were vaccinated against the diseases. Most farmers (274/350) had limited knowledge on vaccines against CBPP and PPR infections, 63% (222/350) perceived low risk of these diseases to their herds. About half of farmers reported experiencing outbreaks of either disease in the study year (2021). Farmers scored on average 80.5 out of 98 (IQR=74–85) on the RS-14 resilience scale. After adjusting for farmers' livestock rearing experience, herd size, sex, wealth status, distance to VOs, previous disease outbreaks, and perceived risk of the diseases, vaccination utilization was negatively associated with limited knowledge (aOR=0.19, 95%CI=0.08–0.43), and positively associated with personal exposure to outbreaks in the study year (aOR=5.26, 95%CI=2.01–13.7) and increasing

resilience (aOR=1.13, 95%CI=1.07–1.19). FGDs revealed farmer misconceptions about vaccines, costs of vaccines, and timely access to vaccines from VOs as additional barriers.

Conclusions

Acceptability, affordability, accessibility, and availability of vaccine services represent the main barriers to vaccines utilization by ruminant livestock farmers in Ghana. Given that limited knowledge regarding the value of vaccination and shortfalls in veterinary service supply are of central importance for both the demand and supply side, more collaboration between the different stakeholders in a transdisciplinary manner to effectively address the low vaccination utilization problem is needed.

Keywords: Livestock; Livestock diseases; Livestock farmers; Vaccination access

36. Farid Salmanpour, Zahra Shakoory, Mehdi Tizrouyan, Mahan Salmanpour, Mehdi Kia, **Fluctuations of wild goat populations in relation to weather factors in central Alborz Protected Area**, *Global Ecology and Conservation*, Volume 66, 2026, e04087, <https://doi.org/10.1016/j.gecco.2026.e04087>.

Abstract:

Long-term population trajectories of wild goats (*Capra aegagrus*) remain poorly understood, despite growing evidence that climate variability strongly influences large herbivores. Using one of the longest continuous wildlife datasets in the region, we analyzed 27 years of monitoring in the high-elevation Golestanak core zone of the Central Alborz Protected Area to examine how year-to-year fluctuations respond to key weather conditions. Daily observations from standardized patrols were paired with monthly records of temperature, precipitation, humidity, and snowfall. Population fluctuations were quantified using a Species Sighting Rate (SSR) index, and monthly climatic effects were assessed using GLMs. The population showed clear multi-year cycles, with strong growth from 54 individuals in 1997–118 in 2003, a sharp decline to 25 by 2010, a moderate recovery to 59–69 by 2017, and a brief spike to 113 in 2018, before stabilizing at lower levels around 50 by 2023, highlighting continued volatility. June and November critical periods for birth and mating consistently emerged as the most influential months: higher June rainfall and temperature were associated with reduced SSR, whereas November snow depth, temperature, and humidity promoted population increases, while November rainfall had a negative effect. Only June temperature showed a significant long-term rise, indicating increasing warming pressure on early-summer habitats. Nevertheless, climate alone could not account for the largest fluctuations. Disease outbreaks, poaching, habitat loss, livestock grazing, and major infrastructure development likely amplified declines, highlighting the species' vulnerability to combined climatic and anthropogenic stressors. Effective conservation will require integrating climate-sensitive management with habitat protection, ecological corridor restoration, and mitigation of livestock–wildlife disease risks.

Keywords: Population dynamics; Population fluctuations; Alpine ecosystems; Climate change; Temperature; Rainfall

37. Laith N. AL-Eitan, Rabi A. Abu Khirah, Diana L. Almahdawi, **A targeted vaccination strategy: Integrating vaccines into biosafety, biosecurity, and one health initiatives**, Journal of Biosafety and Biosecurity, Volume 7, Issue 1, 2025, Pages 9-27, <https://doi.org/10.1016/j.jobbb.2024.10.002>.

Abstract:

Vaccination has saved millions of lives and is regarded as one of modern medicine's most important successes. Effective vaccination programs should be based on risk assessment that considers demographic and occupational factors. When developing a vaccination program, it is essential to identify the target groups, including travelers, infants, high-risk workers, and those in critical roles such as farming and agriculture. In biosafety and biosecurity, vaccines are a key component of measures designed to protect laboratory personnel, the community, and the environment. Guidelines from global health organizations such as the Centers for Disease Control and Prevention are tailored to specific pathogens and depend on the type of work performed and the associated risk. These guidelines are continuously revised and updated to ensure the effectiveness of vaccination programs. Vaccines also play a role in One Health approaches that are focused on the interconnectedness of animals, humans, and the environment. Targeted vaccination strategies for both domestic animals and wildlife are necessary to maintain animal health, improve livestock productivity, and prevent the spread of zoonotic and foodborne diseases to humans. In this paper, we aimed to provide an overview regarding the crucial roles of vaccines in biosafety, biosecurity, and One Health approaches, as well as to highlight the importance of targeted and personalized strategies to improve the effectiveness of vaccination programs. Herein, we also discuss various vaccines aimed at specific target groups as recommended by global health organizations, with a particular emphasis on laboratory workers and the vaccines necessary to reduce laboratory-acquired infections. Finally, we discuss animal vaccines and targeted strategies for vaccinating domestic and wildlife populations.

Keywords: Vaccines; Biosafety; Biosecurity; One Health; Vaccination requirement; Laboratory personnel

38. Ran Mo, Daniel Acosta, Emily Moore, Nitya Singh, Sarah L. McKune, **Gender, culture, and dietary diversity among livestock keepers in Karamoja**, Uganda, Social Sciences & Humanities Open, Volume 9, 2024, 100836, <https://doi.org/10.1016/j.ssaho.2024.100836>.

Abstract:

Women's dietary diversity is often used as proxy for nutritional status as it has important implications for household food security. Karamoja's agriculture is mainly based on livestock production, with many ethnic groups in the region that have different beliefs and practices, the largest of those groups being the Karamojong and Pokot. This study aimed to characterize diets of women in Karamoja across the two largest ethnic groups and investigate which social factors might influence diets. The study collected data using a household questionnaire (n = 545) and the five domains of empowerment (5DE) questions (n = 95) from the validated Abbreviated Women's Empowerment in Agriculture Index. A log-transformed linear logistic regression model was used for the analysis of women's dietary diversity scores with the predicted variables. Factors such as being from the Pokot ethnic group, being less mobile, having some level of education, women's access to credit, consumption of self-produced animal source foods, and having livestock as a primary source of income were all significantly

associated with an increase in women's dietary diversity. There was no association between dietary diversity and any of the 5DE. Important differences in the diets of women emerged by ethnicity, with Pokot having higher consumption of milk, but lower consumption of meats and greens. Findings could be used to formulate interventions to increase dietary diversity as a pathway to improve health.

Keywords: Nutrition; Dietary diversity; Gender; Ethnicity; Livestock; Pastoralism; Uganda; Karamoja

39. Alfred Ngwira, Samuel Manda, Esron Daniel Karimuribo, Sharadhuli Iddi Kimera, Christopher Stanley, **Spatial analysis of livestock disease data in sub-Saharan Africa: A scoping review**, *Scientific African*, Volume 23, 2024, e02113, <https://doi.org/10.1016/j.sciaf.2024.e02113>.

Abstract:

Background

In livestock disease surveillance, spatial analysis methods play a major role in the identification of areas where the risk of disease could be higher. Though widely used in human health, their extent and depth of use are not well known in livestock health in sub-Saharan Africa and this has hindered their update in livestock disease modeling. This study set out to provide a comprehensive review of spatial analysis methods and their application in livestock disease data analysis in sub-Saharan Africa.

Methods

Articles were searched using keywords related to spatial and spatio-temporal analysis of livestock diseases in sub-Saharan Africa in PubMed, Web of Science, Embase, and Scopus. Articles were reviewed in terms of name of author, country of study area, study design, livestock species, livestock diseases, research tasks, and spatial epidemiological methods in terms of spatial statistics and models among others.

Results

A total of 56 articles were selected for review. Descriptive approaches such as simple maps of incidence and prevalence ($n = 22$) have been commonly used. Spatial scan statistics of the Kulldorff ($n = 15$) have also been the common spatial statistics employed. Model based spatial analysis has also been used ($n = 14$). Key research tasks that have been performed include investigating disease distribution, risk factors, space and time interaction and spatial risk prediction. The shortfalls of the reviewed studies include lack of exploration of irregularly shaped cluster scan statistics in case the actual disease clusters are irregular. There is also lack of use of multivariate scan and joint spatial models in case of multiple groups or diseases to show comorbidity. Model based spatial analysis has not accounted for space and time interaction. Machine learning niche models have failed to account for spatial autocorrelation in the data. Model based spatial risk prediction has mainly been retrospective as opposed to prospective for early warning.

Conclusion

Future research may consider the application of multivariate scan statistics and joint spatial models for disease comorbidity analysis. It may also explore the use of irregularly shaped cluster scan statistics to enable detection of irregular disease clusters. Research opportunities may also include the use of

machine learning models that account for spatial autocorrelation. Future spatial prediction is another area worth exploring to show future disease risk trends for early warning.

Keywords: Spatial modeling; Spatio-temporal; Space-time; Spatial distribution; Africa

40. Placide Mahougnan Toklo, Kétomon Pierre Challaton, Mahoudo Fidèle Assogba, Gilles-Christ Amos Akakpo, Aboudou Habirou Kifouly, Goué Géorcelin Alowanou, Sylvie Hounzangbe-Adote, Eléonore Chikani Yayi, Joachim Djimon Gbenou, **Phytochemical screening, in vitro and in vivo effects of an aqueous extract of the bark of Combretum glutinosum Perr ex DC. (Combretaceae) on gastrointestinal strongyles**, *Phytomedicine Plus*, Volume 3, Issue 4, 2023, 100491, <https://doi.org/10.1016/j.phyplu.2023.100491>.

Abstract:

Introduction

Plants remain an inexhaustible source of medicines for the treatment of various diseases. The aim of this study was to evaluate the anthelmintic activity of the aqueous extract of *Combretum glutinosum* bark on adult gastrointestinal strongyle worms.

Methods

In vitro, the extract was contacted with worms at various doses. In vivo, 25 sheep were divided into five batches of 5 animals, with one batch untreated, one batch treated with albendazole and three batches treated with the extract at three different doses. The body weight of the animals, the number of eggs per gram of faeces and haematological parameters were used to assess the efficacy of the extract.

Results

In vitro, the extract appeared to inhibit the motility of adult *Haemonchus contortus* worms more than *Trichostrongylus colubriformis* ($P < 0.05$). In vivo, a significant reduction in the faecal excretion rate was observed in batches of animals treated with the drug and those treated with the extract, compared with the untreated control. Similarly, an increase in animal weight and an improvement in haematological parameters were observed in the treated batches after experimentation. The chemical profile of the extract revealed the presence of various chemical groups suspected of being responsible for its anthelmintic properties.

Conclusion

Treatment at a dose of 100 mg/kg body weight appeared to be more active in reducing the number of eggs per gram of faeces and could therefore be recommended for the formulation of an improved traditional medicines with anthelmintic properties.

Keywords: Anthelmintic; In vitro; In vivo; Chemical profile; *Combretum glutinosum*

41. Fuhou Li, Yanwei Zhang, Yuqing Mao, Peng Wang, Xusheng Guo, Juan J. Loor, **Feeding alfalfa silage inoculated with feruloyl esterase-producing *Limosilactobacillus reuteri* to lactating dairy goats**

is associated with better hepatic antioxidant capacity, Journal of Dairy Science, 2026, <https://doi.org/10.3168/jds.2025-28003>.

Abstract:

Feruloyl esterase produced by certain microorganisms can help breakdown plant fiber. We investigated effects of inoculating feruloyl esterase-producing lactic acid bacteria (FLAB) in alfalfa silage on production performance and blood and liver markers of inflammation and oxidative stress in lactating dairy goats. Alfalfa was ensiled for 1 mo without additive (control, CON), with *Limosilactobacillus reuteri* YM13 without feruloyl esterase activity (YM13), or with a feruloyl esterase-producing *L. reuteri* A4–2 (A4–2). Forty-two dairy goats (53 ± 4 DIM; 37.2 ± 2.3 BW) were randomly assigned to 1 of 3 dietary treatments ($n = 14$ /treatment) prepared with the above alfalfa silages and fed during 60 d. Silage and composite samples (concentrate + silage) were taken weekly. Jugular vein blood samples were taken on d 20, 40, and 60 before the morning feeding. Dairy goats were milked 2 × per day and milk samples taken on d 58 to 60. Five dairy goats from each group were slaughtered at the end of the experiment, and liver tissue samples collected for real-time quantitative PCR (RT-qPCR) assay. Serum antioxidant activity on d 20, 40, and 60, and production data were analyzed with PROC MIXED (SPSS 21.0, SPSS, Inc., Chicago, IL, United States). Biochemical indicators in silage and composite feed, and serum cytokine, immunoglobulin, biochemical indicators, and liver RT-qPCR in samples harvested on d 60 were analyzed using one-way ANOVA (SPSS 21.0, SPSS, Inc., Chicago, IL, United States). Compared with CON and YM13, inoculating with *L. reuteri* A4–2 led to lower silage pH and aNDF, but greater concentrations of lactic acid and ferulic acid along with activities of superoxide dismutase (SOD), catalase (CAT), glutathione peroxidase (GPX), and total antioxidant capacity (T-AOC). Feeding A4–2 inoculated alfalfa silage did not alter dry matter intake, milk yield, or feed efficiency. Dairy goats fed A4–2 had greater serum total antioxidant activity, and lower pro-inflammatory cytokine concentrations at 60 d. Furthermore, greater total protein, albumin, and immunoglobulin M (IgM), and lower alanine aminotransferase (ALT), aspartate aminotransferase (AST) and lactate dehydrogenase in serum were also observed in response to feeding A4–2. Compared with CON and YM13, overall mRNA abundance of the nuclear factor-E2-related factor 2 (Nrf2)-antioxidant response element (ARE) pathway genes NFE2L2, HMOX1, NQO1, SOD2, CAT, GPX1, GPX2, and GSR was greater in the liver of goats fed A4–2. In contrast, relative to CON and YM13 groups, feeding A4–2 resulted in an overall downregulation of KEAP1 and the nuclear factor kappa-B (NF-κB) signaling pathway-related genes NFKB1, RELA, NOX4, TNF, and IFNG. Overall, feruloyl esterase-producing lactic acid bacteria used as silage inoculant can confer potential health benefits without affecting production performance. Further studies to determine the specific mechanisms controlling these responses are warranted.

Keywords: alfalfa silage; feruloyl esterase; antioxidant; liver function; gene expression

42. Teshager Dubie, Betelhem Dagnew, Muhammed Hamid, Fanuel Bizuayehu, Gizachew Fentahun, **Seroprevalence and associated risk factors of pox infection among sheep and goats in selected districts of Afar region, Ethiopia**, Heliyon, Volume 8, Issue 12, 2022, e12394, <https://doi.org/10.1016/j.heliyon.2022.e12394>.

Abstract:

Background

Sheep and goat pox virus infection is highly devastating viral disease of small ruminants that cause severe production losses in sheep and goats in Ethiopia and also limits international trade. A cross-sectional study was employed with the objective to estimate the seroprevalence of pox infection and to assess associated risk factors during the study period, February to April, 2020. A total of 384 serum samples were collected from apparently healthy sheep and goats. Serum neutralization test was used to detect the presence of antibodies against pox virus at national veterinary institute. Descriptive statistics, univariable and Multivariable logistic analyses were used in this study.

Results

The overall animal level seroprevalence of sheep and goat pox virus was found to be 15.36% ($n = 59/384$) and species level prevalence rate was found to be 14.5% ($n = 16/110$) in sheep and 15.69% ($n = 43/274$) in goats in the study areas. Among the associated factors considered in this study, sex ($P = 0.010$), age ($P = 0.012$) and herd size ($P = 0.029$) were found to be statistically associated with seropositivity of pox infection in multivariable logistic regression. The odds of seropositivity in female animals were 3.9 times more likely to develop pox infection than male animals (AOR = 2.2; 95% CI = 1.203–4.015%) and the odds of young animals were 2.14 times more likely to be seropositive to pox infection than old aged animals (AOR = 2.14; 95% CI = 1.169–3.633%). Moreover, the odds of large-sized flocks of animals were 3.10 times more likely to be seropositive to pox disease than small-sized flocks (AOR = 3.10; 95% CI = 1.30–4.42%).

Conclusion

This study finding revealed that sheep and goat pox virus is prevalent and widespread diseases of small ruminant in afar region. Therefore, further study should be carried out to estimate region wise magnitude of the disease and control measures should be put in place to minimize the economic losses associated with this disease.

Keywords: Afar region; Associated factors; SNT; Pox virus; Seroprevalence; Small ruminants

43. Mattia Begovoeva, David O. Ehizibolo, Adeyinka J. Adedeji, Moses O. Oguche, Olumuyiwa Oyekan, Sandra I. Ijoma, Rebecca B. Atai, Yiltawe Wungak, Banenat B. Dogonyaro, David D. Lazarus, Mark Samson, Hussaini Ularamu, Maryam Muhammad, Fabrizio Rosso, Keith J. Sumption, Philippa M. Beard, Anna B. Ludi, Kim B. Stevens, Georgina Limon, **Factors associated with foot-and-mouth disease seroprevalence in small ruminants and identification of hot-spot areas in northern Nigeria**, Preventive Veterinary Medicine, Volume 212, 2023, 105842, <https://doi.org/10.1016/j.prevetmed.2023.105842>.

Abstract:

Many small ruminants infected with foot-and-mouth disease (FMD) remain asymptomatic, with the capacity to promote silent viral spread within domestic and wildlife species. However, little is known about the epidemiological role played by small ruminants in FMD. In particular, there are few studies that examine FMD seroprevalence, spatial patterns and risk factors for exposure in small ruminants. A cross-sectional study was conducted in northern Nigeria (Bauchi, Kaduna, and Plateau States) to determine the true seroprevalence of FMD in backyard small ruminants, identify factors associated with FMD seroconversion at animal and household levels, and identify spatial patterns for FMD virus

exposure. Data on animal (n = 1800) and household (n = 300) characteristics were collected using a standardised questionnaire. Sera samples from 1800 small ruminants were tested for antibodies against non-structural proteins of FMD virus. True seroprevalence was estimated stochastically to account for variability and uncertainty in the test sensitivity and specificity previously reported. Risk factors for FMD seropositivity were identified at animal and household levels and spatial patterns were determined. The overall true seroprevalence for FMD virus, in the small ruminant population tested, was estimated to be 10.2 % (95 % Credible Interval (CrI) 0.0–19.0), while State-level estimates were 17.3 % (95 % CrI 0.0–25.8) for Kaduna, 6.9 % (95 % CrI 0.0–15.8) for Bauchi, and 3.6 % (95 % CrI 0.0–12.6) for Plateau. State and species were the main risk factors identified at animal level, with interaction detected between them. Compared to goats in Plateau, the odds of testing positive were higher for goats in Bauchi (Odds Ratio (OR)= 1.83, 95 % CI 1.13–2.97, p = 0.01) and Kaduna (OR=2.97, 95 % CI 1.89–4.67, p<0.001), as well as for sheep in Plateau (OR=3.78, 95 % CI 2.08–6.87, p<0.001), Bauchi (OR=1.61, 95 % CI 0.91–2.84, p = 0.10), and Kaduna (OR=3.11, 95 % CI 1.61–6.01, p = 0.001). Households located in Kaduna were more likely to have a higher number of seropositive SR compared to those in Plateau (Prevalence Ratio (PR)= 1.75, 95 % CI 1.30–2.36, p<0.001), and households keeping sheep flocks were more likely to be seropositive (from 1 to 10 sheep: PR=1.39, 95 % CI 1.05–1.82, p = 0.02; more than 10 sheep: PR=1.55, 95 % CI 1.12–2.15, p = 0.008) compared to those that did not keep sheep. A hot-spot was detected in Kaduna, and a cold-spot in Plateau. These results reveal that small ruminants had been recently exposed to FMD virus with spatial heterogeneity across the study area.

Keywords: Foot-and-mouth disease; Seroprevalence; Risk factors; Small ruminants; Subsistence farmers; Nigeria

44. Long Xu, Jingjing Ren, Lingxia Li, Mengyi Wang, Guoqiang Zhu, Haixue Zheng, Qiaoying Zeng, Youjun Shang, Dan Li, **Vimentin inhibits peste des petits ruminants virus replication by interaction with nucleocapsid protein**, *Virology*, Volume 595, 2024, 110056, <https://doi.org/10.1016/j.virol.2024.110056>.

Abstract:

The Peste des petits ruminant virus (PPRV) is a member of the Paramyxoviridae family and is classified into the genus Measles virus. PPRV predominantly infects small ruminants, leading to mortality rates of nearly 100%, which have caused significant economic losses in developing countries. Host proteins are important in virus replication, but the PPRV nucleocapsid (N) protein-host interacting partners for regulating PPRV replication remain unclear. The present study confirmed the interaction between PPRV-N and the host protein vimentin by co-immunoprecipitation and co-localization experiments. Overexpression of vimentin suppressed PPRV replication, whereas vimentin knockdown had the opposite effect. Mechanistically, N was subjected to degradation via the ubiquitin/proteasome pathway, where vimentin recruits the E3 ubiquitin ligase NEDD4L to fulfill N-ubiquitination, resulting in the degradation of the N protein. These findings suggest that the host protein vimentin and E3 ubiquitin ligase NEDD4L have an anti-PPRV effect.

Keywords: Peste des petits ruminant virus; Ubiquitin; Nucleocapsid protein; Viral replication; Vimentin

45. Raj Kapoor Balasubramanian, Naina Mohamed Pakkir Maideen, Arun Shanmugam, Narayanaswamy Hari Krishnan, **A Review of Pre-clinical Data on the Pharmacotherapeutic Potential of Black Seeds (*Nigella sativa*) against Influenza Virus Infection**, Current Traditional Medicine, Volume 12, 2026, <https://doi.org/10.2174/0122150838352681250404051446>.

Abstract:

Background and Objective

Influenza is a respiratory virus, and certain patients with some chronic conditions and other risk factors are vulnerable to severe infection requiring hospitalizations and further fatal complications. Few antiviral drugs are approved for the management of patients with influenza infection. Since *N. sativa* supplementation significantly reduces all-cause mortality, improves viral clearance, and diminishes viral loads in patients with SARS-CoV-2 infection and other viruses, including hepatitis C virus, our review focuses on the antiviral efficacy of black seeds (*N. sativa*) against influenza viruses.

Methods

The databases, including Medline/PMC/PubMed, Scopus, Web of Science, Google Scholar, ScienceDirect, and reference lists, were searched to identify relevant publications using keywords, such as *Nigella sativa*, black seeds, black cumin seeds, kalonji, and influenza virus. This review included only English publications, while duplicates were excluded.

Results

supplementation with *N. sativa* improved clinical symptoms, enhanced cytokine gene expression, labelpressed H9N2 virus pathogenesis, increased antibody titers against the H9N2 influenza virus, significantly reduced mortality, decreased virus shedding, promoted weight gain, boosted both cell-mediated and humoral immune responses, and facilitated early viral clearance in several preclinical studies involving H9N2-infected turkeys. Furthermore, a number of preclinical and clinical investigations showed that *N. sativa* has antiviral properties against other viruses. Furthermore, *N. sativa* has several pharmacotherapeutic potentials, including antiviral, immunomodulatory, antioxidant, and anti-inflammatory qualities that may be helpful in the treatment of influenza virus infection, according to multiple meta-analyses. Additionally, *N. sativa*'s pharmacological properties, including its antihistaminic, bronchodilatory, antidiabetic, antiobesity, antihypertensive, antihyperlipidemic, and anticancer properties, may help to alleviate the signs, symptoms, and complications associated with influenza virus infection.

Conclusion

To prevent further complications, patients at higher risk of developing complications from influenza virus infection could be managed with specific antivirals and black seeds (*N. sativa*) as adjunctive therapy in the early stages of infection. Future clinical studies would establish the effectiveness of black seeds (*N. sativa*) against influenza infection.

Keywords: Black seeds; *Nigella sativa* ; kalonji; thymoquinone; antiviral; anti-inflammatory; antioxidant

46. Rebekah J.L. Burns, Kim Khanh Le, Jarunee Siengsanun-Lamont, Stuart D. Blacksell, **A review of coxiellosis (Q fever) and brucellosis in goats and humans: Implications for disease control in smallholder farming systems in Southeast Asia**, *One Health*, Volume 16, 2023, 100568, <https://doi.org/10.1016/j.onehlt.2023.100568>.

Abstract:

Coxiella burnetii and *Brucella* spp. are pathogenic bacteria that can cause large-scale outbreaks in livestock. Furthermore, these infectious agents are capable of causing zoonotic infections and therefore pose a risk to the close relationship between farm households and their livestock, especially goats. A review of seroprevalence studies of *Coxiella burnetii* and *Brucella* spp. in domestic goats demonstrated large differences in the total number of samples tested in different regions and countries. This review aims to provide information on coxiellosis (Q fever in humans) and brucellosis in goats concerning the characteristics of the causative agent, surveillance, and available prevention and control measures at a global level. Implications for *Coxiella burnetii* and *Brucella* spp. infections in domesticated goats in Southeast Asia are discussed.

Keywords: Q fever; Coxiellosis; Brucellosis; Asia; Small ruminants

47. Zenaba Mahamat Kodo, Usman Adamu Rayyanu, Mayowa Peter Olabode, Victoria Isioma Ifende, Rebecca Paul Weka, Matthew Yakop Gukut, Alexis Delabougli, Ismaila Shittu, Yakubu Joel Atuman, Judith Dizot Bakam, Falmata Haruna Bwala, Ladi Amos Chabiri, Sandra Ifynneke Ijoma, Rhoda Ishaku Malgwi, Aliyu Sada, Muhammad-Bashir Bolajoko, Maryam Muhammad, Arnaud Bataille, Mohammed Bello, Mohammed Kabir Lawan, Farouk Umar Mohammed, Sophie Molia, Marion Bordier, **When farmers' knowledge matters: Improving epidemiological understanding of Peste des petits ruminants in northern Nigeria**, *Preventive Veterinary Medicine*, Volume 244, 2025, 106633, <https://doi.org/10.1016/j.prevetmed.2025.106633>.

Abstract:

Peste des petits ruminants (PPR) is an endemic disease of sheep and goats in Nigeria and represents a major threat to the livelihoods of smallholders. Understanding the epidemiology of this disease and its management by livestock farmers is essential for developing appropriate surveillance and control programmes. This study aimed to enhance the knowledge about PPR by conducting a large-scale survey in 52 villages in Plateau, Bauchi and Kano states in the northern part of Nigeria. Our approach involved holding focus group discussions with farmers, both men and women, to collect their knowledge about the disease and to understand their perspectives on its management. The results showed that farmers use several different terms to refer to diseases that are likely to be PPR, and that these same terms might also be used to refer to diseases caused by other infectious agents. Farmers rarely call on veterinary services to prevent the disease and vaccination is seldom practiced. Disease control is attempted using conventional treatments, with or without veterinary supervision, or using traditional therapies. There is limited or poor implementation of good farming practices such as biosecurity measures. This study has increased our understanding of PPR and its management in areas with limited public and private veterinary services. In addition, it has also fostered trust between scientists and communities, paving the way for future participatory action research programmes.

Keywords: Communities; Epidemiology; Northern Nigeria; Participation; Peste des petits ruminants; Small ruminants

48. Andrijanto Hauferson Angi , Defrys Ridolof Tulle , I Gusti Komang Oka Wirawan, **Prevalensi Peste des Petits Ruminant serta Analisis Faktor Risikonya pada Kambing Melalui Pemeriksaan Ulas Mata atau Hidung**, Jurnal Veteriner, Vol. 26 No.3: 375-386, 2025, <https://doi.org/10.19087/jveteriner.2025.26.3.375>

Abstract:

Peste des petits ruminants (PPR) adalah penyakit virus yang menyerang ruminansia kecil, agennya termasuk dalam kelompok virus RNA, genus Morbillivirus dari famili Paramyxoviridae. Office International des Epizooties (OIE) telah menetapkan PPR dalam daftar penyakit wajib dilaporkan (Notifiable Diseases). Penelitian ini dilakukan bertujuan untuk mengidentifikasi kasus PPR di Kota Kupang dan Kabupaten Kupang. Pengambilan sampel dilakukan lewat ulas/swab daerah mata atau hidung pada 100 ekor kambing yang berasal dari lima lokasi desa dan kelurahan di Kota Kupang dan Kabupaten Kupang, Provinsi Nusa Tenggara Timur. Identifikasi faktor risiko yang berperan penting dalam penyebaran PPR dilakukan dengan menggunakan survei kuesioner terstruktur terhadap 25 orang peternak kambing. Hasil pengujian dari 100 sampel swab diperoleh empat ekor kambing positif PPR (+++), 11 ekor dengan hasil positif lemah (+), 84 ekor negatif, dan 1 ekor sampel invalid dengan tingkat prevalensi 15 %. Hasil identifikasi faktor risiko dengan analisis deskriptif diperoleh data yaitu kambing yang dimiliki sebagian besar berasal dari peternakan tradisional (7,7%) dan pasar hewan (6,7%), sumber pakan berasal dari padang penggembalaan (61,7%), pemeriksaan Kesehatan kambing tidak rutin dilakukan (90%). Pada pola pemeliharaan kambing, Sebagian besar kambing yang dipelihara adalah kambing betina (68%), peternak juga memiliki hewan atau ternak lain selain kambing, yaitu anjing, sapi, dan babi. Faktor lain yang juga berperan penting dalam penyebaran penyakit PPR adalah pengetahuan yang rendah tentang PPR, peternak belum mengetahui PPR dalam hal cara pengobatan, pencegahan penyakit termasuk vaksinasi PPR.

Keywords: Kambing, Peste Des Petits Ruminant, Prevalensi PPR, Faktor Risiko

49. Adnan F Fayyad, Ibrahim M Alzuheir, **Peste des petits ruminants: past, present, and future scope**, Journal of Infection in Developing Countries, Vol.18(12):1837-1845, 2024, <https://doi.org/10.3855/jidc.19577>

Abstract:

Introduction:

Peste des petits ruminants (PPR) is a highly contagious and fatal disease affecting small ruminants, particularly goats and sheep, and is caused by Morbilliviruscaprinae, a virus in the genus Morbillivirus, family Paramyxoviridae. PPR has significant economic and social impacts, especially in Africa, Asia, and the Middle East, where small ruminants are vital to rural livelihoods and food security. This disease is a priority for global eradication due to its disproportionate impact on low-income farmers and wildlife conservation.

Methodology:

A literature review was conducted to capture recent information on the epidemiology, diagnosis, host range, transmission, pathogenesis, economic impact, vaccination strategies, and eradication efforts for PPR. This review also explores future perspectives to address gaps in the current understanding and control of the disease.

Results:

The review highlights that PPR remains a severe challenge in low-resource areas, causing notable economic loss and endangering wildlife. Vaccination efforts have shown effectiveness, though limited accessibility and high costs persist as barriers. The disease has gained attention from international organizations aiming for global eradication by 2030, with ongoing advancements in diagnostics and surveillance methods showing promise in control efforts.

Conclusions:

This review underscores recent advancements in PPR research, focusing on disease distribution, diagnostic improvements, and control strategies. These findings are valuable for regional and global eradication initiatives, providing a foundation for policies that support sustainable livestock economies and biodiversity conservation. International collaboration, effective vaccination programs, and strategic surveillance are essential to achieve the 2030 eradication goal and secure the health of vulnerable livestock populations. Key words: Morbillivirus; livestock; pathogenesis; eradication.

50. Khaldia Merdja, Houari Hemida, Assia Boumezrag, **Epidemiological and pathomorphologic investigation of peste des petits ruminants in Western Algeria: A comprehensive study of clinical and histopathological findings**, Open Veterinary Journal, Vol. 14(8): 1905-1911, 2024, <http://dx.doi.org/10.5455/OVJ.2024.v14.i8.18>

Abstract:**Background:**

This study delves into the epidemiology and pathomorphologic characteristics of peste des petits ruminants (PPR) in western Algeria, a viral disease that constantly threatens small animals in Africa, the Middle East, and Asia.

Aim:

The purpose of this investigation was to evaluate the epidemiology of PPR in western Algeria and to understand the pathomorphological lesions in naturally infected small ruminants.

Methods:

An online survey conducted via google forms and shared with veterinarians in the wilaya of Tiaret, provided insights into the prevalence and clinical manifestations of PPR. A comprehensive examination of organs was conducted and representative tissue samples from the lungs, trachea, thymus, spleen, liver, kidney, heart, tongue, stomach, different parts of the small and large intestine, and mesenteric lymph nodes were collected and the specimen was fixed in a 10% neutral buffer formalin solution.

Results:

Among 2,200 small ruminants managed by expert veterinarians, 192 small ruminants exhibited clinical signs compatible with PPR, and 79 dead animals. Among the 31 sick young small ruminants, eight were confirmed to be infected with the PPR virus. Necropsies of affected animals revealed significant gross lesions in organs such as the lungs, intestines, spleen, and lymph nodes. Histopathological analysis further illuminated the severity of lesions, including interstitial pneumonia, syncytial cell formation, and severe gastroenteritis.

Conclusion:

The study's comprehensive approach, encompassing epidemiological data, necropsy findings, and histopathological insights, contributes valuable knowledge for understanding and managing PPR outbreaks. The pathological lesions observed in this study exhibited consistency with those previously documented in experimental studies, thereby providing support for the diagnosis based on clinical signs and disease history.

Keywords: Peste des petits ruminant, Epidemiology, Pathology, Lymphoid tissue, Algeria.