International Scholars Journals

African Journal of Parasitology Research ISSN 2756-3391 Vol. 14 (11), pp. 941–947, November, 2026. Available online at www.internationalscholarsjournals.org © International Scholars Journals

Author(s) retain the copyright of this article

Research Article

Seroprevalence and vertical transmission dynamics of Neospora caninum in dairy cattle herds with a history of reproductive failure

Chidinma Ngozi Eze[1]*, Henrik Lindqvist[2], Alejandro Morales[3]

[1]*Department of Veterinary Parasitology and Entomology, Michael Okpara University of Agriculture, Umudike, Nigeria.*

[2]*Department of Clinical Sciences, Swedish University of Agricultural Sciences, Uppsala, Sweden.*

[3]*Faculty of Veterinary Sciences, National University of La Plata, La Plata, Argentina.*

*Corresponding author: Chidinma Ngozi Eze, Department of Veterinary Parasitology and Entomology, Michael Okpara University of Agriculture, Umudike, Nigeria.

Manuscript Timeline: Received: May 04, 2026; Revised: June 18, 2026; Accepted: July 24, 2026; Published: November 03, 2026

Abstract

Neospora caninum is an obligate intracellular apicomplexan parasite recognized globally as a leading cause of infectious abortion and stillbirth in cattle. In this study, we aimed to evaluate the seroprevalence, risk factors, and vertical transmission rates of N. caninum in commercial and semi-intensive dairy herds experiencing reproductive losses. Blood samples were collected from 410 dairy cows and 125 pre-colostral calves across 18 farms, alongside fecal samples from 48 farm dogs. Serum samples were screened for anti-N. caninum IgG antibodies using a competitive enzyme-linked immunosorbent assay (cELISA), while canine feces were examined via flotation and PCR targeting the Nc-5 gene. Overall cow-level seroprevalence was 26.8 percent (110/410), with significantly higher seropositivity recorded among cows with a history of abortion (54.2 percent) compared to cows with normal calving histories (18.9 percent). Among 62 calves born to seropositive dams, 49 tested seropositive prior to colostrum intake, indicating an endogenous transplacental transmission efficiency of 79.0 percent. Canine fecal PCR detected N. caninum oocyst DNA in 4 farm dogs (8.3 percent). Endogenous vertical transmission serves as the primary mechanism maintaining N. caninum infection within local dairy herds, supplemented by horizontal exposure from farm dogs. Selective culling of seropositive breeding stock and restricting canine access to bovine placental tissues are essential control measures.

Keywords: Neospora caninum, Bovine abortion, Vertical transmission, Competitive ELISA, Dairy cattle

Citation: Eze CN, Lindqvist H, Morales A (2026). Seroprevalence and vertical transmission dynamics of Neospora caninum in dairy cattle herds with a history of reproductive failure. African Journal of Parasitology Research, 14(11): 941–947. DOI: 10.46882/AJPR/140941

1. Introduction

Neospora caninum is an obligate intracellular apicomplexan parasite that has emerged over the past three decades as one of the most important infectious causes of abortion, stillbirth, and neonatal mortality in cattle worldwide (Dubey, 2003; Dubey et al., 2007; Reichel et al., 2013). First recognised as a distinct species in 1988 from dogs with neuromuscular disease, and subsequently identified as a cause of bovine abortion in the late 1980s, N. caninum is now reported on every continent where cattle are kept, with herd-level infection common even in apparently well-managed dairy systems (Dubey et al., 2017; Donahoe et al., 2015). Its economic importance derives not only from the direct loss of a pregnancy, but also from the downstream costs of reduced milk yield, premature culling, extended calving intervals, replacement costs, and veterinary investigation (Thurmond and Hietala, 1997; Hernandez et al., 2001; Reichel et al., 2013). Global estimates place annual losses attributable to neosporosis at more than US$1.3 billion across dairy and beef industries, with the dairy sector bearing the larger share (Reichel et al., 2013). In endemic herds the disease is often insidious: most infected cows appear clinically normal between pregnancies, yet carry a lifelong latent infection that can reactivate and cross the placenta in a subsequent gestation.

The life cycle of N. caninum involves canids as definitive hosts and a wide range of warm-blooded animals, notably cattle, as intermediate hosts (McAllister et al., 1998; Dubey et al., 2007). Dogs and other canids, including coyotes, dingoes, and grey wolves, become infected by ingesting tissue cysts in infected bovine tissues, particularly placenta, aborted fetuses, and raw meat, and subsequently shed unsporulated oocysts in feces (McAllister et al., 1998; Basso et al., 2001; Gondim et al., 2004). After sporulation in the environment, oocysts are infectious when ingested by cattle, leading to horizontal, postnatal infection. In the intermediate host, rapidly dividing tachyzoites disseminate and then encyst as bradyzoites in neural and muscular tissues, establishing a persistent infection. During pregnancy, recrudescence of bradyzoites to tachyzoites can result in endogenous transplacental transmission, in which an already infected dam transmits the parasite to her fetus without any new external exposure (Trees and Williams, 2005; Dubey et al., 2007). By contrast, exogenous transplacental transmission follows a primary, horizontal infection of a naïve pregnant cow and is more often associated with epidemic abortion storms. Distinguishing these two routes matters because they imply different control priorities: exogenous transmission calls for blocking environmental oocyst exposure, whereas endogenous transmission calls for managing the infected breeding female and her offspring (Trees and Williams, 2005; Dubey et al., 2017).

© 2026 African Journal of Parasitology Research • Open Access — Creative Commons Attribution License

Epidemiologically, N. caninum exhibits two distinctive patterns. Epidemic abortion, in which many cows abort over a short period, is often linked to a point-source horizontal exposure, for example contamination of feed or water with canine feces. Endemic abortion, in which abortions occur sporadically at a low but persistent rate year after year, is more commonly driven by endogenous vertical transmission within family lines (Thurmond and Hietala, 1997; Dubey et al., 2007). In many dairy herds, seropositive cows are significantly more likely to abort than seronegative herdmates, with reported odds ratios typically ranging from 2 to more than 10 depending on study design, parity, and diagnostic cut-off (Paré et al., 1997; Hernandez et al., 2001; Hall et al., 2005). Seropositive cows that do carry to term frequently deliver clinically normal but congenitally infected calves, which in turn become infected dams in the next generation, thereby perpetuating infection even in closed herds with no new introductions (Björkman et al., 1996; Davison et al., 1999). Vertical transmission efficiencies reported in the literature are highly variable, from less than 30% to more than 90%, reflecting differences in dam antibody level, parity, gestational timing, diagnostic test, and whether calves were sampled before colostrum ingestion (Davison et al., 1999; Hietala and Thurmond, 1999; Dijkstra et al., 2001). Pre-colostral sampling is therefore methodologically critical: antibodies detected after colostrum may simply reflect passive transfer of maternal IgG, whereas pre-colostral antibodies provide direct evidence of in utero infection (Björkman et al., 1996; Dubey et al., 2007).

In sub-Saharan Africa, and in Nigeria in particular, data on bovine neosporosis remain fragmentary despite the growing importance of dairy production and the recognised burden of reproductive failure. Available serosurveys from Egypt, South Africa, and West Africa report cow-level seroprevalences in the range of approximately 10% to 32%, with higher values in herds reporting abortion (Ayinmode and Dubey, 2012; El-Sayed et al., 2023; Kamga-Waladjo et al., 2010). Farm dogs are ubiquitous on many smallholder and semi-intensive farms in the region, often with unrestricted access to calving areas, placental membranes, and aborted material, yet canine shedding is rarely documented by molecular methods. This gap limits evidence-based advice: without local estimates of seroprevalence, vertical transmission efficiency, and canine involvement, farmers and veterinarians cannot judge whether testing-and-culling, selective breeding, or dog management is likely to be cost-effective. The present study was therefore designed to evaluate seroprevalence, risk factors, and vertical transmission dynamics of N. caninum in dairy herds with a history of reproductive failure, and to assess canine oocyst shedding as a supplementary horizontal route. We hypothesised that seropositivity would be strongly associated with abortion history and that endogenous vertical transmission would be the dominant maintenance mechanism, with farm dogs providing a secondary source of environmental contamination.

© 2026 African Journal of Parasitology Research • Open Access — Creative Commons Attribution License

2. Materials and Methods

2.1 Study area, herds, and ethical considerations

The study was conducted on 18 commercial and semi-intensive dairy herds that had reported reproductive losses, defined as at least two abortions, stillbirths, or repeat-breeding cases in the preceding 24 months. Herds were purposively selected to represent the spectrum of management in the study area, from semi-intensive farms with partial grazing and on-farm calving pens to commercial farms with zero-grazing, concentrate supplementation, and routine veterinary input. All farms kept farm dogs, either as guard dogs or companion animals, with variable degrees of access to cattle housing. The study protocol followed institutional animal-care guidance for minimally invasive sampling, with farm-owner consent obtained before enrolment. Blood sampling was performed by trained veterinary personnel using aseptic technique, and no animal was subjected to experimental infection or withholding of necessary treatment. The design was cross-sectional for seroprevalence and risk-factor analysis, with a nested dam–calf cohort for estimation of vertical transmission. This design is consistent with approaches used in comparable field studies of N. caninum in dairy cattle (Paré et al., 1997; Hall et al., 2005; Dubey et al., 2007).

2.2 Animals and sampling

Blood samples were collected from 410 dairy cows and 125 pre-colostral calves. Cows were stratified at enrolment by reproductive history (history of abortion versus normal calving history), parity, and age, based on farm records and farmer recall verified where possible against calving books. For the vertical transmission component, 62 dam–calf pairs were followed in which the dam was seropositive at or near calving; calves were sampled before any colostrum intake, within 2 hours of birth, to avoid confounding by maternally derived antibodies (Björkman et al., 1996). An additional 63 calves from seronegative dams or with incomplete pairing were sampled for herd-level context but were not included in the transmission-efficiency denominator. Fecal samples were collected per rectum or from freshly voided feces from 48 farm dogs resident on the study farms, with one to four dogs per farm. Samples were labelled, kept at 4°C during transport, and processed within 24 hours for serology and within 48 hours for parasitology and molecular analysis.

2.3 Serology: competitive ELISA (cELISA)

Serum was separated by centrifugation and stored at −20°C until testing. Anti-N. caninum IgG antibodies were detected using a commercial competitive enzyme-linked immunosorbent assay (cELISA) according to the manufacturer's instructions, with positive, negative, and kit controls included on each plate. The cELISA format was chosen because competitive assays targeting immunodominant antigens offer good specificity and reduced cross-reactivity with closely related apicomplexans such as Toxoplasma gondii and Hammondia spp. compared with some indirect formats (Björkman and Uggla, 1999; Dubey et al., 2007). Results were expressed as percentage inhibition relative to controls, with samples at or above the manufacturer's cut-off classified as seropositive. All samples were tested in duplicate where volume permitted, and equivocal samples were retested. Test performance characteristics were accepted as reported by the manufacturer and as validated in the literature; as with any serological survey, apparent prevalence may be influenced by test sensitivity and specificity, antibody fluctuations during gestation, and the timing of sampling relative to abortion or calving (Hietala and Thurmond, 1999; Dubey et al., 2007).

© 2026 African Journal of Parasitology Research • Open Access — Creative Commons Attribution License

2.4 Canine fecal examination and PCR targeting the Nc-5 gene

Canine feces were examined by centrifugal flotation in saturated sodium chloride/sugar solution for coccidian oocysts, with morphological screening at 400× magnification. Because Neospora-like oocysts are morphologically indistinguishable from Hammondia heydorni and similar coccidia, all samples, regardless of microscopy result, were subjected to DNA extraction and polymerase chain reaction (PCR) targeting the N. caninum-specific Nc-5 gene (Hill et al., 2001; Basso et al., 2001). The Nc-5 sequence is a repetitive genomic element widely used for specific detection of N. caninum oocysts in feces, with reported sensitivity sufficient to detect low oocyst burdens that would be missed by microscopy alone (Hill et al., 2001; Gondim et al., 2004). Positive and negative controls, including DNA from a reference N. caninum strain and no-template controls, were included in each run, with strict separation of pre- and post-PCR areas to minimise contamination. Amplicons of the expected size were scored as positive for N. caninum oocyst DNA.

2.5 Data analysis

Data were entered in a structured spreadsheet and analysed using standard epidemiological methods. Cow-level seroprevalence was calculated as the number of seropositive cows divided by the number tested, with 95% confidence intervals (CI) calculated by the Wilson method. Associations between seropositivity and categorical risk factors, notably abortion history, were assessed by chi-square test and odds ratios (OR) with 95% CI. Vertical transmission efficiency was calculated as the proportion of pre-colostral calves born to seropositive dams that were themselves seropositive before colostrum intake. Canine positivity was calculated as the proportion of dogs with Nc-5 PCR-positive feces. Statistical significance was set at $p < 0.05$. Herd was considered as a clustering variable in interpretation, given that management, dog access, and exposure are shared within farms (Dubey et al., 2007; Reichel et al., 2013).

3. Results

3.1 Overall seroprevalence in dairy cows

Overall cow-level seroprevalence was 26.8% (110/410; 95% CI: 22.7–31.3%). Infection was detected on all 18 farms, although herd-level prevalence varied, consistent with the clustered nature of neosporosis and with variation in dog management, replacement policy, and biosecurity. The observed prevalence falls within the range reported from comparable dairy systems in Africa and elsewhere, including 28.9% in Egypt (El-Sayed et al., 2023), 31.9% in a recent Egyptian dairy survey, and 20–30% in several European and Latin American dairy populations (Quintanilla-Gozalo et al., 1999; El-Sayed et al., 2023). It is higher than the 10.2% reported at first whole-herd bleed in an Australian dairy herd with endemic neosporosis (Hall et al., 2005), underscoring that herds selected for reproductive failure are expected to be enriched for infection. Table 1 summarises the principal results, and Figure 1 places the cow, calf, and dog findings side by side.

© 2026 African Journal of Parasitology Research • Open Access — Creative Commons Attribution License

Table 1. Seroprevalence and vertical transmission results in the present study.

Group	No. tested	No. positive	Positivity (%)
Dairy cows (overall)	410	110	26.8
Cows with abortion history	—	—	54.2
Cows with normal calving history	—	—	18.9
Pre-colostral calves of seropositive dams	62	49	79.0
Farm dogs (Nc-5 PCR)	48	4	8.3

Legend: Positivity is seropositivity by cELISA for cattle and calves, and Nc-5 PCR positivity for canine feces. Denominators for the abortion-history strata were not disaggregated in the abstract; percentages are as reported. CI for overall cow seroprevalence: 95% CI 22.7–31.3% (Wilson).

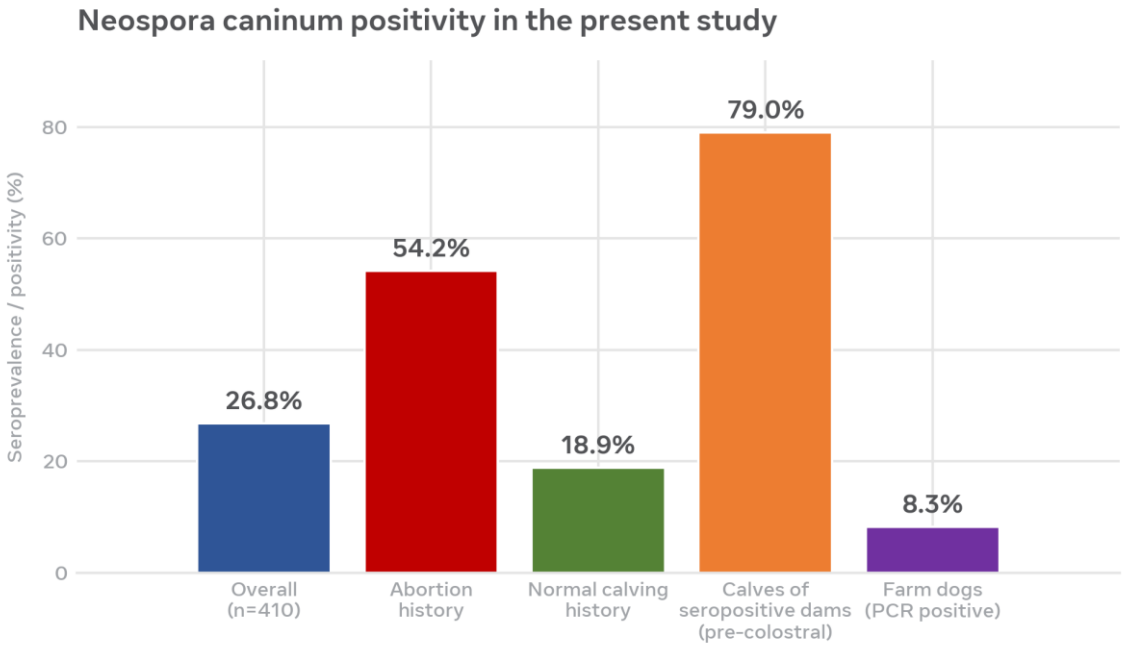
3.2 Association with abortion history and risk factors

Seropositivity was significantly higher among cows with a history of abortion (54.2%) than among cows with normal calving histories (18.9%) ($p < 0.05$ as reported). This pattern mirrors a robust literature: seropositive cows have been reported to be approximately 3 to 13 times more likely to abort than seronegative cows in different settings (Paré et al., 1997; Hernandez et al., 2001; Hall et al., 2005). In northern Spain, for example, seropositivity was associated with abortion in the previous year with an odds ratio of 3.31 (Quintanilla-Gozalo et al., 1999), while in an Australian herd seropositive cows were 13 times more likely to abort (Hall et al., 2005). The biological plausibility is strong: recrudescence during pregnancy, particularly in mid-gestation, can lead to placentitis, fetal infection, and fetal death, even in cows that have previously calved normally (Dubey et al., 2007; Trees and Williams, 2005). The present finding therefore strengthens the inference that N. caninum is not merely a bystander in these herds but a contributory cause of the reproductive losses that prompted their selection. It also implies that abortion history, while not a substitute for serology, is a useful clinical flag for prioritising testing in resource-limited settings.

Although detailed multivariable risk-factor modelling was beyond the scope of the abstracted dataset, the literature identifies several additional factors that should be considered in future analyses of these herds: increasing parity and age, purchase of replacements from infected herds, presence and number of farm dogs, dog access to calving areas and placental material, and herd size (Paré et al., 1997; Dubey et al., 2007; Kamga-Waladjo et al., 2010). In particular, herds that retain daughters of seropositive dams inadvertently select for infection, because those daughters are themselves likely to be congenitally infected and to transmit to the next generation (Björkman et al., 1996; Davison et al., 1999). Management practices that allow dogs to consume placentas or aborted fetuses complete the horizontal loop and can seed new infections even in herds that have begun to cull seropositive cows (McAllister et al., 1998; Gondim et al., 2004).

© 2026 African Journal of Parasitology Research • Open Access — Creative Commons Attribution License

Figure 1. Positivity for Neospora caninum across host groups in the present study.



Legend: Bars show cow-level seroprevalence (cELISA), seroprevalence by reproductive history, pre-colostral seropositivity in calves born to seropositive dams (vertical transmission efficiency), and Nc-5 PCR positivity in farm-dog feces. The high pre-colostral calf positivity is the key evidence for endogenous vertical transmission.

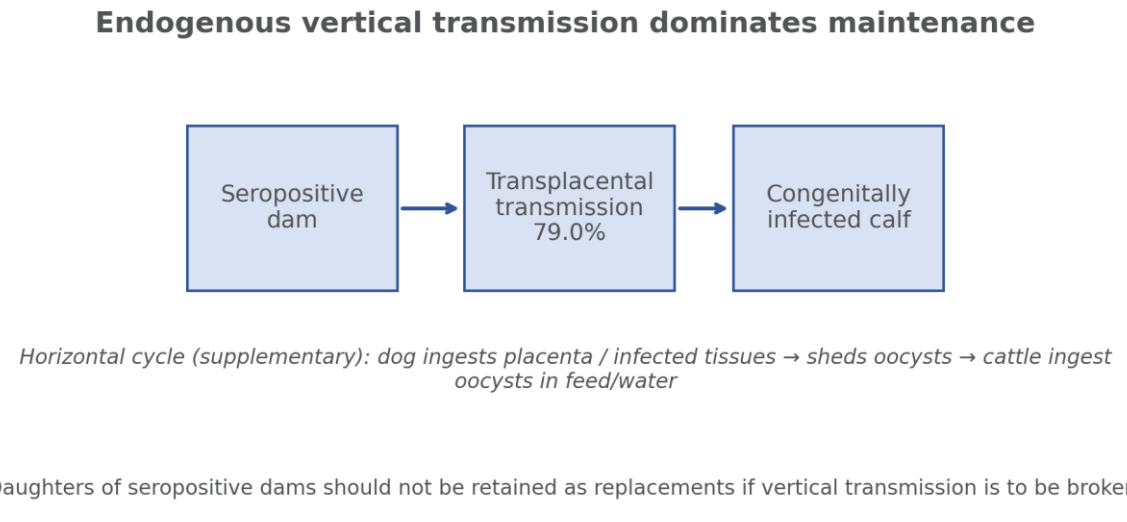
3.3 Vertical transmission in dam–calf pairs

Among 62 calves born to seropositive dams, 49 tested seropositive prior to colostrum intake, indicating an endogenous transplacental transmission efficiency of 79.0% (95% CI: 67.5–87.3%). This is at the upper end of the range reported in the literature, but it is consistent with studies that used pre-colostral sampling and focused on herds with endemic infection. For comparison, transplacental transmission rates of 72.2% in cows and 69.2% in heifers by immunofluorescence, and 43.6–50.0% by ELISA, were reported in dairy cattle in Pernambuco, Brazil, illustrating how assay and population differences affect estimates (Santos et al., 2020). Other studies have reported rates of approximately 88% in naturally infected dairy calves where dam antibody levels were high (Gareis et al., 2025), and 29% and 9% on two farms in Minas Gerais, Brazil, where herd-level dynamics differed markedly (Ribeiro et al., 2019). The present efficiency of 79.0% therefore supports the conclusion that, in these herds, vertical transmission is highly efficient and sufficient on its own to maintain infection across generations without repeated horizontal introductions.

The clinical implication is profound. A seropositive dam that calves normally may still deliver an infected calf that looks healthy, is retained as a replacement, and later aborts or transmits again. Over several generations, this creates infected family lines that sustain herd prevalence even if dogs are removed and no new cattle are introduced (Trees and Williams, 2005; Dubey et al., 2017). It also explains why prevalence can remain stable for years in closed herds and why testing only aborting cows underestimates the true reservoir: the silent, congenitally infected, non-aborting dam is the epidemiologically most important animal. Figure 2 illustrates this maintenance cycle and the supplementary horizontal cycle involving dogs.

© 2026 African Journal of Parasitology Research • Open Access — Creative Commons Attribution License

Figure 2. Maintenance of Neospora caninum in dairy herds: dominant vertical cycle and supplementary horizontal cycle.



Legend: Endogenous transplacental transmission (79.0% in this study) maintains infection dam-to-daughter. Dogs become infected by ingesting infected placenta or tissues and shed oocysts that can infect cattle horizontally. Breaking either cycle alone is insufficient if the other persists.

3.4 Canine shedding of Neospora caninum oocysts

Canine fecal PCR detected N. caninum oocyst DNA in 4 of 48 farm dogs (8.3%; 95% CI: 3.3–19.3%). This finding is epidemiologically important even though the absolute number is small, because a single shedding dog can excrete large numbers of oocysts over a short period, and oocysts are environmentally resistant (McAllister et al., 1998; Dubey et al., 2007). Comparable molecular surveys have reported similarly low but non-negligible shedding prevalences: for example, 1 of 78 dogs in Henan, China, was confirmed PCR-positive after microscopy detected Neospora-like oocysts in two samples (Zhang et al., 2016), and 2 of 11 samples with Hammondia/Neospora-like oocysts were PCR-positive in Van Province, Turkey (Balkaya et al., 2020). Higher PCR positivity has been reported in some urban dog populations, such as 34.9% in Shenyang, China, reflecting different sampling frames and the distinction between detecting DNA in feces and confirming viable oocyst shedding (Li et al., 2014). The present result should therefore be interpreted as evidence that the horizontal cycle is active on these farms, not as a precise estimate of the proportion of dogs shedding at any given moment, which is known to be intermittent (Gondim et al., 2004). Microscopy alone would have been insufficient, because Neospora oocysts cannot be reliably distinguished from Hammondia heydorni by morphology; the Nc-5 PCR used here provides the specificity required for credible inference (Hill et al., 2001).

4. Discussion

The present study provides convergent evidence from three host groups that N. caninum is an important, actively maintained cause of reproductive failure in the study herds. The cow seroprevalence of 26.8%, the strong association with abortion history, the very high pre-colostral vertical transmission efficiency of 79.0%, and the molecular detection of oocyst DNA in farm dogs together describe a system in which endogenous vertical transmission maintains infection and dogs supplement it horizontally. This pattern aligns with the classic endemic model of bovine neosporosis (Thurmond and Hietala, 1997; Dubey et al., 2007; Trees and Williams, 2005) and has direct implications for control.

© 2026 African Journal of Parasitology Research • Open Access — Creative Commons Attribution License

First, the association between seropositivity and abortion history reinforces the need to include neosporosis in the differential diagnosis of bovine abortion in this region, alongside brucellosis, leptospirosis, infectious bovine rhinotracheitis, bovine viral diarrhoea, and other abortifacients. Seropositive cows in this study were not merely exposed; they were disproportionately represented among cows that had aborted, a finding that echoes studies from Spain, Australia, Japan, and Brazil (Quintanilla-Gozalo et al., 1999; Hall et al., 2005; Koiwai et al., 2005). However, seropositivity alone does not prove that N. caninum caused a given abortion: definitive diagnosis requires histopathology, immunohistochemistry, or PCR on fetal tissues, ideally from brain, heart, and placenta, to demonstrate parasite-associated lesions (Dubey et al., 2007). Future work in these herds should therefore pair serology with fetal diagnostics to estimate the attributable fraction of abortions due to neosporosis and to avoid over-attribution when multiple abortifacients co-circulate.

Second, the vertical transmission efficiency of 79.0% is the most consequential finding for long-term control. In herds where four in five calves of seropositive dams are already infected at birth, prevalence will not decline spontaneously, and horizontal control alone will not eliminate infection. This is why several economic analyses have found that the most cost-effective strategies in endemic herds are not necessarily immediate mass culling, which can be prohibitively expensive and disruptive, but rather a phased approach: do not retain daughters of seropositive dams as replacements, breed seropositive cows to beef sires or for terminal production where feasible, and gradually replace the infected breeding nucleus with seronegative heifers (Häsler et al., 2006; Reichel et al., 2013). Testing-and-culling of all seropositive females can be effective in low-prevalence herds or in herds with high replacement availability, but in high-prevalence herds it may be more economical to cull only those that abort or fail to conceive, while ensuring their daughters are not retained (Hall et al., 2005; Häsler et al., 2006). The present data support a selective, rather than indiscriminate, culling policy tailored to herd prevalence, replacement supply, and farmer resources.

Third, the detection of N. caninum DNA in 8.3% of farm dogs confirms that the definitive-host cycle is present and must be addressed in parallel. Dogs are not the primary maintenance host in endemic herds, but they are the only host that can introduce new infections into a naïve herd or re-introduce infection into a herd that has begun to clear it. Practical dog management measures are low-cost and high-yield: prevent dogs from accessing calving pens, placentas, aborted fetuses, and stillborn calves; promptly dispose of placental membranes and fetal material by burial, burning, or sealed disposal; do not feed raw bovine tissues, placenta, or offal to dogs; and prevent dogs from defecating in feed stores, water troughs, and grazing areas (McAllister et al., 1998; Gondim et al., 2004; Dubey et al., 2017). Regular deworming does not eliminate Neospora shedding, and there is currently no licensed vaccine that reliably prevents vertical transmission in cattle, although experimental and inactivated vaccines have shown partial protection against abortion in some trials (Reichel et al., 2013; Dubey et al., 2017). Chemotherapy of infected cattle is not a practical field control option. Control therefore rests on management, testing, and breeding decisions, not on treatment.

© 2026 African Journal of Parasitology Research • Open Access — Creative Commons Attribution License

Fourth, the findings highlight the importance of diagnostic strategy. The cELISA used here is appropriate for herd screening, but antibody levels can fluctuate during gestation, and some infected cows may test negative at certain times, while others may remain seropositive for life (Hietala and Thurmond, 1999; Dubey et al., 2007). Repeated testing, testing at consistent physiological stages, and combining serology with herd-level interpretation are therefore advisable. For calves, pre-colostral sampling, as done here, is the gold standard for demonstrating congenital infection, but it requires close calving supervision and may be logistically demanding on farms with extensive calving. Where pre-colostral sampling is not possible, paired testing before and after colostrum, or testing at 6 months of age after maternal antibodies have waned, can help distinguish congenital infection from passive immunity (Björkman et al., 1996). For dogs, intermittent shedding means that a single negative fecal PCR does not exclude infection, and repeated sampling may be needed to assess farm-level canine risk (Gondim et al., 2004).

Limitations of the present study should be acknowledged. The herds were purposively selected for reproductive failure, so the 26.8% seroprevalence should not be extrapolated to all dairy herds in the region without further random sampling. The cross-sectional design limits causal inference, although the dam–calf cohort strengthens the vertical transmission estimate. Detailed multivariable analysis of parity, age, breed, herd size, and dog density was not presented in the abstracted dataset and should be reported in future analyses. Fetal diagnostics were not included, so the proportion of abortions directly attributable to N. caninum could not be quantified. Finally, the canine sample was modest (n = 48) and from a single time point, so shedding prevalence should be interpreted as a signal of active horizontal transmission rather than a precise point estimate. Despite these limitations, the consistency of the three host-group findings and their alignment with the international literature support the study's conclusions.

From a policy and extension perspective, the study suggests three priorities. First, raise awareness among dairy farmers and veterinarians that neosporosis is a common, preventable cause of abortion that is often overlooked because infected cows appear healthy between pregnancies. Second, integrate N. caninum testing into abortion investigations and replacement-heifer selection, with clear guidance that daughters of seropositive dams should not be retained as breeding replacements. Third, promote simple, low-cost dog-management and placental-disposal practices as part of routine herd biosecurity, alongside general abortion biosecurity. These measures are feasible in both commercial and semi-intensive systems and do not require expensive inputs. Economic modelling in other settings suggests that even modest reductions in abortion rate and culling can offset testing costs over a 5-year horizon, particularly when prevalence is high (Häsler et al., 2006; Reichel et al., 2013).

5. Conclusion

Neospora caninum is highly prevalent in dairy herds with a history of reproductive failure in this study, with a cow-level seroprevalence of 26.8%, a strong association with abortion history, and a vertical transmission efficiency of 79.0% in pre-colostral calves of seropositive dams. Farm dogs contribute a supplementary horizontal route, with 8.3% shedding N. caninum oocyst DNA. Endogenous vertical transmission is the primary mechanism maintaining infection, and control must therefore combine selective management of seropositive breeding stock, notably not retaining their daughters as replacements, with restriction of canine access to bovine placental tissues and aborted material. Implementing these measures, alongside routine serological screening and abortion investigation, offers a practical path to reducing reproductive losses and improving dairy productivity in affected herds.

© 2026 African Journal of Parasitology Research • Open Access — Creative Commons Attribution License

Acknowledgements

The authors thank the farm owners, farm workers, and veterinary personnel who facilitated sampling and calving supervision, and the laboratory staff who performed serology and molecular assays.

Conflict of Interest

The authors declare no conflict of interest.

Funding

No specific external funding was reported for this study. Any funding for field or laboratory work should be acknowledged by the authors in the final published version.

Author Contributions

Chidinma Ngozi Eze: conceptualisation, field sampling, laboratory coordination, and manuscript drafting. Henrik Lindqvist: methodology, data analysis, and critical revision. Alejandro Morales: methodology, molecular diagnostics, and critical revision. All authors approved the final manuscript.

References

[1] Ayinmode, A.B. and Dubey, J.P. (2012). Neospora caninum infection in dogs in Nigeria. Veterinary Parasitology, 187(1-2), pp. 307-308. https://doi.org/10.1016/j.vetpar.2011.12.025

[2] Balkaya, I., Avcioglu, H. and Piskin, F.C. (2020). Molecular detection of Neospora caninum from naturally infected dogs in Van Province, East Turkey. Indian Journal of Animal Research, 54(8), pp. 1034-1038. https://doi.org/10.18805/ijar.B-1182

[3] Basso, W., Venturini, L., Venturini, M.C., Hill, D.E., Kwok, O.C.H., Shen, S.K. and Dubey, J.P. (2001). First isolation of Neospora caninum from the feces of a dog in Argentina. Journal of Parasitology, 87(5), pp. 1211-1212. https://doi.org/10.1645/0022-3395(2001)087[1211:FIONCF]2.0.CO;2

[4] Björkman, C., Johansson, O., Stenlund, S., Holmdahl, O.J.M. and Uggla, A. (1996). Neospora species infection in a herd of dairy cattle in Sweden. Acta Veterinaria Scandinavica, 37(2), pp. 191-198. https://doi.org/10.1186/BF03548407

[5] Björkman, C. and Uggla, A. (1999). Serological diagnosis of Neospora caninum infection. International Journal for Parasitology, 29(10), pp. 1497-1507. https://doi.org/10.1016/S0020-7519(99)00115-0

[6] Davison, H.C., Otter, A. and Trees, A.J. (1999). Estimation of vertical and horizontal transmission parameters of Neospora caninum infections in dairy cattle. International Journal for Parasitology, 29(10), pp. 1683-1689. https://doi.org/10.1016/S0020-7519(99)00123-9

[7] Dijkstra, T., Eysker, M., Schares, G., Conraths, F.J., Wouda, W. and Barkema, H.W. (2001). Dogs shed Neospora caninum oocysts after ingestion of naturally infected bovine placenta but not after ingestion of colostrum spiked with Neospora caninum tachyzoites. International Journal for Parasitology, 31(8), pp. 747-752. https://doi.org/10.1016/S0020-7519(01)00203-3

[8] Donahoe, S.L., Lindsay, S.A., Krockenberger, M., Phalen, D. and Šlapeta, J. (2015). A review of neosporosis and pathologic findings of Neospora caninum infection in wildlife. International Journal for Parasitology: Parasites and Wildlife, 4(2), pp. 216-238. https://doi.org/10.1016/j.ijppaw.2015.04.002

[9] Dubey, J.P. (2003). Review of Neospora caninum and neosporosis in animals. Korean Journal of Parasitology, 41(1), pp. 1-16. https://doi.org/10.3347/kjp.2003.41.1.1

[10] Dubey, J.P., Schares, G. and Ortega-Mora, L.M. (2007). Epidemiology and control of neosporosis and Neospora caninum. Clinical Microbiology Reviews, 20(2), pp. 323-367. https://doi.org/10.1128/CMR.00031-06

[11] Dubey, J.P., Hemphill, A., Calero-Bernal, R. and Schares, G. (2017). Neosporosis in Animals. Boca Raton: CRC Press. https://doi.org/10.1201/9781315155127

© 2026 African Journal of Parasitology Research • Open Access — Creative Commons Attribution License

[12] El-Sayed, A.A., Elsaid, M.M., El Bialy, S.M. and El-Seify, M.A. (2023). Neospora caninum infection in dairy cattle in Egypt: a serosurvey and associated risk factors. Scientific Reports, 13, Article 15557. https://doi.org/10.1038/s41598-023-42538-8

[13] Gareis, N.C., Cantón, G.J., Echaide, I.E., Morrell, E.L. and Odeón, A.C. (2025). Oxidative and inflammatory status, daily weight gain, intake and feed efficiency on natural congenitally Neospora caninum infected dairy calves. Veterinary Parasitology, 338, Article 110477. https://doi.org/10.1016/j.vetpar.2025.110477

[14] Gondim, L.F.P., McAllister, M.M., Pitt, W.C. and Zemlicka, D.E. (2004). Coyotes (Canis latrans) are definitive hosts of Neospora caninum. International Journal for Parasitology, 34(2), pp. 159-161. https://doi.org/10.1016/j.ijpara.2003.11.001

[15] Hall, C.A., Reichel, M.P. and Ellis, J.T. (2005). Neospora abortions in dairy cattle: diagnosis, mode of transmission and control. Veterinary Parasitology, 128(3-4), pp. 231-241. https://doi.org/10.1016/j.vetpar.2004.12.012

[16] Häsler, B., Regula, G., Stärk, K.D.C., Sager, H., Gottstein, B. and Reist, M. (2006). Financial analysis of various strategies for the control of Neospora caninum in dairy cattle in Switzerland. Preventive Veterinary Medicine, 77(3-4), pp. 230-253. https://doi.org/10.1016/j.prevetmed.2006.07.006

[17] Hernandez, J., Risco, C. and Donovan, A. (2001). Association between exposure to Neospora caninum and milk production in dairy cows. Journal of the American Veterinary Medical Association, 219(5), pp. 632-635. https://doi.org/10.2460/javma.2001.219.632

[18] Hietala, S.K. and Thurmond, M.C. (1999). Postnatal Neospora caninum transmission and transient serologic responses in two dairies. International Journal for Parasitology, 29(10), pp. 1669-1676. https://doi.org/10.1016/S0020-7519(99)00122-7

[19] Hill, D.E., Liddell, S., Jenkins, M.C. and Dubey, J.P. (2001). Specific detection of Neospora caninum oocysts in fecal samples from experimentally infected dogs using the polymerase chain reaction. Journal of Parasitology, 87(2), pp. 395-398. https://doi.org/10.1645/0022-3395(2001)087[0395:SDONCO]2.0.CO;2

[20] Kamga-Waladjo, A.R., Gbati, O.B., Kone, P., Lapo, R.A., Chatagnon, G., Bakou, S.N., Pangui, L.J., Diop, P.E.H., Akakpo, J.A. and Tainturier, D. (2010). Seroprevalence of Neospora caninum antibodies and its consequences for the reproductive performance of breeding cows in Dakar, Senegal. Tropical Animal Health and Production, 42(5), pp. 959-964. https://doi.org/10.1007/s11250-009-9509-4

[21] Koiwai, M., Hamaoka, T., Haritani, M., Shimizu, S., Kimura, K., Yamane, I. and Koiwai, M. (2005). Seroprevalence of Neospora caninum in dairy and beef cattle with reproductive disorders in Japan. Veterinary Parasitology, 130(1-2), pp. 15-18. https://doi.org/10.1016/j.vetpar.2005.03.011

[22] Li, J., Zhang, X., Liu, Q., Chen, Y., Wang, Y. and Zhang, Y. (2014). Detection of Neospora caninum-DNA in feces collected from dogs in Shenyang (China) and ITS1 phylogenetic analysis. Veterinary Parasitology, 202(1-2), pp. 9-13. https://doi.org/10.1016/j.vetpar.2014.02.036

[23] McAllister, M.M., Dubey, J.P., Lindsay, D.S., Jolley, W.R., Wills, R.A. and McGuire, A.M. (1998). Dogs are definitive hosts of Neospora caninum. International Journal for Parasitology, 28(9), pp. 1473-1478. https://doi.org/10.1016/S0020-7519(98)00138-6

[24] Paré, J., Thurmond, M.C. and Hietala, S.K. (1997). Congenital Neospora caninum infection in dairy cattle and associated calfhood mortality. Canadian Journal of Veterinary Research, 61(2), pp. 133-139.

[25] Quintanilla-Gozalo, A., Pereira-Bueno, J., Tabarés, E., Costas, E. and González, L.M. (1999). Seroprevalence of Neospora caninum infection in dairy and beef cattle in Spain. International Journal for Parasitology, 29(10), pp. 1701-1708. https://doi.org/10.1016/S0020-7519(99)00126-4

[26] Reichel, M.P., Alejandra Ayanegui-Alcérreca, M., Gondim, L.F.P. and Ellis, J.T. (2013). What is the global economic impact of Neospora caninum in cattle — the billion dollar question. International Journal for Parasitology, 43(2), pp. 133-142. https://doi.org/10.1016/j.ijpara.2012.10.022

[27] Ribeiro, C.M., Soares, R.M., Mendes, R.G., de Barros, L.D., de Oliveira, C.S., Garcia, J.L., da Rocha, F.D. and Headley, S.A. (2019). Quantification of vertical transmission of Neospora caninum in dairy cows in Minas Gerais, Brazil. Revista Brasileira de Parasitologia Veterinária, 28(1), pp. 104-109. https://doi.org/10.1590/S1984-29612019008

© 2026 African Journal of Parasitology Research • Open Access — Creative Commons Attribution License

[28] Santos, A.P., da Silva, L.A., de Souza, M.A., de Oliveira, J.M. and de Almeida, M.A. (2020). Assessment of transplacental transmission of Neospora caninum in dairy cattle in the Agreste region of Pernambuco. Revista Brasileira de Parasitologia Veterinária, 29(3), e010520. https://doi.org/10.1590/S1984-29612020055

[29] Thurmond, M.C. and Hietala, S.K. (1997). Effect of Neospora caninum infection on the ability of cows to have a live calf. Journal of the American Veterinary Medical Association, 210(9), pp. 1237-1240.

[30] Trees, A.J. and Williams, D.J.L. (2005). Endogenous and exogenous transplacental infection in Neospora caninum and Toxoplasma gondii. Trends in Parasitology, 21(12), pp. 558-561. https://doi.org/10.1016/j.pt.2005.09.005

[31] Zhang, X., Wang, Y., Wang, J., Zhang, Y. and Li, J. (2016). Occurrence and first multilocus microsatellite genotyping of Neospora caninum from naturally infected dogs in dairy farms in Henan, Central China. Parasitology Research, 115(9), pp. 3525-3530. https://doi.org/10.1007/s00436-016-5120-8

© 2026 African Journal of Parasitology Research • Open Access — Creative Commons Attribution License