



Prevalence of endoparasite of pigs in Kafanchan area of Kaduna State: a comparative study between wet and dry season

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Abstract. *This study investigated the prevalence of endoparasitic infections of pigs in Kafanchan area of Kaduna State, Nigeria, across wet and dry seasons. A repeated cross-sectional design was employed, with a total of 162 pigs sampled (81 pigs evenly selected across the two seasons) using a two-stage cluster sampling method. Fresh faecal samples were collected from the faecal droppings using a spatula. Qualitative coprological exams were conducted on the faecal samples collected using flotation and sedimentation techniques to identify parasite eggs, larvae and cysts. Data collected were analyzed using descriptive and chi-square analysis. The result revealed a prevalence rate of 54.3% and 40.7% in the wet and dry seasons, respectively, indicating year-round infection with a higher burden in the wet season. Strongyle and Ascaris species were the dominant parasites detected in both the wet and dry seasons. Strongyle had a prevalence rate of 36% in wet season and 39% in dry season, while Ascaris spp. had 25% in wet season and 21% in the dry season. Monoparasitic infections were more common than polyparasitism, occurring in 41% (wet) and 32% (dry) of pigs, whereas co-infections were less frequent. The study found no statistically significant difference ($P>0.05$) in parasite prevalence based on age or sex. The findings highlight the need for farmers to implement daily manure removal, raised slatted-floor housing, quarantine of new pigs, clean feed/water provision, and hygiene training via extension services to reduce Strongyle and Ascaris transmission and improve pig health and productivity in Kafanchan.*

Keywords: endoparasites, pigs, infection, season, Kafanchan

Introduction

Endoparasitic infections in pigs pose significant economic and public health concerns that warrant further investigation, particularly in Nigeria, because these parasites can lead to substantial economic losses for pig farmers through reduced growth rates, lower feed efficiency and lower meat quality, as well as increased morbidity and mortality rates in pig farms leading to higher treatment cost and overall cost of production (Adesehinwa et al., 2024). Koto et al. (2025) stated that younger

animals are more susceptible to infections and observed that young cattle (under 2 years of age) exhibited the highest prevalence at 50.49%, followed by adults (2-8 years of age) at 47.42%, and older cattle (>8 years of age) at 46.00%. Many endoparasites of pigs such as *Ascaris suum*, and *Taenia solium*, are zoonotic, meaning they can be transmitted to humans. Infections in humans can cause a range of health problems, from mild gastrointestinal symptoms to severe neurological complications and even death. The global burden of foodborne parasitic diseases is estimated to

be over 400,000 Disability-Adjusted Life Years (DALYs) annually (Ayinmode et al., 2017). These parasitic infections are influenced by several risk factors such as age, sex, management system, and seasonal variations (Ayinmode et al., 2017).

Notably, the Kafanchan area in Kaduna State, having the largest pig market in West Africa, is characterized by distinct wet and dry seasons, which may significantly influence the prevalence and transmission dynamics of endoparasites in pigs. Seasonal changes affect environmental conditions such as temperature, humidity, and soil moisture, which in turn impact the survival and infectivity of parasitic eggs and larvae (Bautista-Garfias et al., 2022). Despite the importance of these factors, no study has yet compared the prevalence of pig endoparasites between the wet and dry seasons in Kaduna State or Kafanchan specifically. Most available research in Nigeria, such as in Enugu State, has shown seasonal variation but research has not been conducted in this key pig-producing region (Bernard et al., 2021). Existing studies have also focused on other regions or on external parasites in wild animals rather than endoparasites in domestic pigs. By comparing the prevalence of endoparasites in pigs during both dry and wet seasons in Kafanchan area, this study aims to fill a critical gap in the literature to provide valuable insights for pig farmers, veterinarians, and public health authorities.

Materials and methods

Study area and period

The study was conducted in the Kafanchan area of Kaduna State, Nigeria. Kafanchan is situated in the southern region of Kaduna State, Nigeria, under the Jema'a Local Government Area. The geographic coordinates of Kafanchan are around 9.58330°N latitude and 8.28330°E longitude (Google Map, 2025). It is characterized by a tropical climate with distinct wet and dry seasons. The area's average annual rainfall is approximately 1225 mm, with the heaviest rains from July to September, during which monthly rainfall averages range from 220 to 288 mm. Conversely, the driest months January, November, and December receive minimal to

no rainfall (NiMet, 2023). The mean monthly temperature of Kafanchan generally ranges from about 22°C to 31°C throughout the year. The hottest months are typically March to May, with average temperatures peaking around 30-31°C, while the coolest months are December to January, averaging around 22-23°C.

The study commenced during the wet season of 2024 and was completed in the dry season of 2025, allowing for a comparative analysis of endoparasite prevalence between these two seasons.

Study population and sample size

The study population comprised pigs managed under semi-intensive and intensive production systems within the Kafanchan area of Kaduna State. To effectively capture the diversity and distribution of pigs in this region, a two-stage cluster sampling technique was employed. Initially, the study area was divided into distinct clusters based on geographic zones and land use categories, specifically farms, residential areas, and other relevant zones. This initial clustering facilitated targeted sampling by grouping pigs according to their primary rearing environments.

Subsequent to cluster formation, random sampling of pig farms within the farm clusters was conducted to select specific sampling units. Within these farms, individual pigs were then randomly selected for sampling to ensure representativeness at the animal level. Sample size was estimated using the following formula adapted from Naing et al., (2022):

$$n = \frac{Z^2 P (1-P)}{d^2} ,$$

where **n**=Sample size, **Z**=Z statistic for a level of confidence (1.96 for 95% confidence level, which is the level adopted for this study), **P**=Expected prevalence or proportion, and **d**=Precision. Using previous studies conducted in various regions in Nigeria which had an average prevalence rate of endoparasites to be 30% (0.3), a 1.96 confidence level, and an experimental precision level of 10% (0.1), our calculated sample was:

$$n = \frac{1.96^2 \times 0.3 (1-0.3)}{0.12}$$

=80.67~81 samples. Therefore, a total sample size of 162 pigs (81 pigs from each season) were used for the study.

Study design

A repeated cross-sectional study was used in this study and samples were collected from 81 pigs each from both season (wet and dry). The data were collected with respect to season, age and sex. For age classification, pigs were grouped into two categories: young pigs (1-6 months old) and adult pigs (>6months). The age determination employed the dentition eruption technique, which is a reliable and widely used method in swine studies, where the pattern and timing of tooth eruption serve as indicators of animal age (Tucker et al., 2009). The age of pigs sampled were confirmed using the information provided by each pig owner.

Faecal samples were collected from pigs reared under semi-intensive and intensive management systems within the study area. In the semi-intensive system, pigs were housed in pens with concrete or earthen floors and allowed limited outdoor access during the day; in the intensive system, pigs were permanently confined in enclosed concrete-floored pens with no outdoor access. In both systems, pigs were fed commercial concentrates supplemented with household food scraps. Manure removal was conducted by farm workers, ranging from daily to every 2 – 3 days depending on the farm. Regarding anthelmintic use, approximately 68% of farms reported routine deworming with ivermectin or albendazole-based products, administered once or twice per year, predominantly at the onset of the dry season. The remaining 32% of farms reported no routine deworming program (Lora, 2019).

Sample collection

A total of 81 faecal samples were collected during the wet season of 2024. Subsequently, an equal number of 81 samples were collected during the dry season of 2025 from the same sampling area, resulting in a total of 162 samples for the study. Pigs were randomly selected from various farms across Kafanchan, ensuring representation

across different age groups and sexes.

The faecal samples of pigs were collected early in the morning by random sampling. Spatula was used to collect the samples from the faecal droppings of the animals and dropped into sterilized sample bottles which were then transported to the National Veterinary Research Institute (NVRI) laboratory Vom, Plateau State for parasitological examination. Each sample was properly labeled, noting the age and sex.

Laboratory analysis

Faecal samples underwent qualitative parasitological examinations to detect and identify endoparasite eggs, larvae, and cysts. Flotation and sedimentation techniques, as described by Hansen and Perry (1994), were used to concentrate parasite eggs and cysts for microscopic examination.

Parasite species were identified based on morphological characteristics under light microscopy at 10x and 40x magnifications.

Data analysis

Data collected were analyzed using descriptive statistics to determine the prevalence of each parasite species. Chi-square test was applied to compare prevalence rates between wet and dry seasons and to assess associations with pig age and sex. A significance level of $p<0.05$ was considered statistically significant. Data analysis was carried out using Statistical Package of Social Sciences (SPSS).

Result and discussion

The prevalence of endoparasites in pigs during the wet and dry seasons in Kafanchan is presented in Figure 1. Out of 81 pigs sampled in each season, 40.70% of pigs in the dry season were infected with one or more endoparasites, while a higher prevalence of 54.30% was recorded in the wet season. This result indicates that parasitic infections are present throughout the year in the pig population, differences in prevalence were observed, however not statistically significant ($p>0.05$), with a higher infestation rate observed

during the wet season. These findings are consistent with some studies conducted within Nigeria and other tropical regions. Abonyi and Njoga (2019) reported a 74.5% prevalence of gastrointestinal worm infections in pigs during the wet season and 62% during the dry season in Enugu State, Nigeria, corroborating the presence of year-round infestations with a wet season peak. The slightly lower parasitic prevalence found in the dry season of Kafanchan aligns with this pattern, supporting the influence of seasonal rainfall and humidity on parasite transmission.

Amaechi et al. (2022) found an overall prevalence of 64.6% in two pig farms in Umudike, Nigeria, with significant parasitic challenges year-round but higher burdens during the rainy season. These comparable findings highlight the widespread problem of endoparasitism in Nigerian pig production under semi-intensive and traditional systems.

A study by Nwokoye et al. (2019) in Kaduna State observed an overall helminth prevalence of 71.9%, with seasonality affecting specific parasite species differently, emphasizing the complex dynamics of parasite epidemiology in tropical climates. Their findings suggest that year-round control efforts are necessary to mitigate economic losses associated with endoparasite infections, such as poor weight gain and increased mortality. A study in Ghana by Addy et al. (2023) revealed similar seasonal variations where the rainy season sees elevated parasite prevalence due to favorable conditions for larvae development, aligning with the wet season increase observed in this study.

Environmental factors can promote the infestation by endoparasites. In Kafanchan, some environmental factors that promote endoparasite infestations include its tropical climate characterized by high humidity, warm temperatures, and significant rainfall which create ideal conditions for parasite egg and larval survival in soil and pig pens. Also, poor management practices such as delayed manure removal, co-rearing of pigs of varying ages, lack of routine deworming, and poor sanitation contribute to high parasite transmission rates. These factors are amplified during the rainy season when moisture and temperature rise, facilitating

parasite survival and increasing infestation rates in pigs (Adebayo et al., 2018; Oladipo and Adeyemi, 2021).

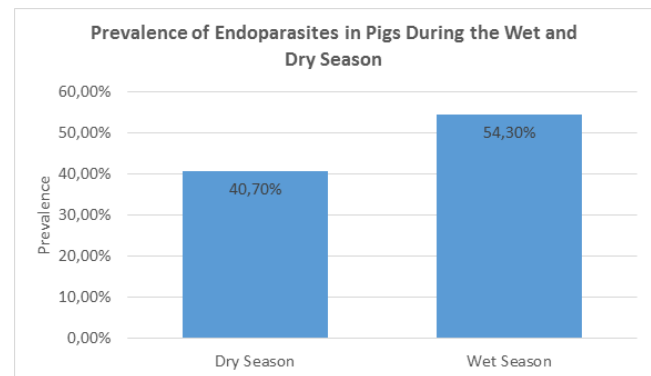


Figure 1. Prevalence of Endoparasites in Pigs During the Wet and Dry Seasons in Kafanchan

Figure 2 presents the frequency of endoparasite species identified in pigs during the wet and dry seasons in Kafanchan. As shown, *Strongyle* spp. was the most frequently detected parasite in both seasons, with a prevalence of 36% in the wet season and 39% in the dry season. Next is *Ascaris* with 25% in the wet season and 21% in the dry season. Other notable parasites include *Oesophagostomum* (7% wet, 9% dry), *Blastocyst* (5% wet, 3% dry), *Eimeria* (10% wet, 9% dry), and *Balantidium* (2% wet, 3% dry). These results indicate that *Strongyle* and *Ascaris* spp. are the most dominant endoparasites in pigs across both seasons, with varying but generally stable frequencies.

This finding concurs with that of Abonyi and Njoga (2019) who reported 28.6% prevalence of gastrointestinal nematodes primarily *Strongyles* in Nsukka, southeastern Nigeria. Their study emphasized that environmental factors like soil moisture and temperature, combined with poor hygiene, support the life cycle of *Strongyles* and their persistence year-round. Similarly, Idika et al. (2021) found *Strongyle* prevalence of 25.7% in southeastern Nigeria, reinforcing the parasite's dominance due to its adaptation to tropical climates where infective larvae survive well in shaded, moist soil and contaminated pens.

The continuous presence of *Strongyles* in both seasons in Kafanchan can be attributed to the tropical climate having sufficient rainfall and humidity that maintain larva/cyst survival, as well as common pig management practices such as

semi-intensive rearing, poor sanitation, and free-range scavenging. These practices increase pigs’ exposure to infective cyst. Delayed removal of feces and mixing of pigs of different ages without routine deworming potentiates parasite transmission and re-infection cycles. Similar socio-environmental drivers were evidenced in a study by Bernard et al. (2021), who documented nematode persistence linked with hygiene deficiencies and lack of deworming in Enugu State.

Ascaris species followed *Strongyles* in prevalence (25% wet season, 21% dry season) in Kafanchan. This aligns with findings from Nwokoye et al. (2019) who reported 23% prevalence of *Ascaris* in Kaduna State pigs. *Ascaris* eggs are highly resistant to environmental extremes due to their hardy shell, enabling survival in a range of farm settings. This resilience means that even during the dry season, *Ascaris* eggs remain viable and infective, explaining the relatively stable prevalence across seasons. Unanam and Lekko (2023) likewise reported 30.6% prevalence of *Ascaris suum* in pigs in Abakaliki, confirming its epidemiological importance in Nigerian pig farms.

Protozoan parasites such as *Blastocyst*, *Eimeria*, and *Balantidium* were also detected at lower but consistent frequencies in both seasons. This is consistent with Thanasuwan et al. (2024), who found protozoan infections at relatively low levels but significant due to their involvement in diarrheal diseases and poor weight gain in pigs. Their prevalence, while lower than nematodes, indicates ongoing transmission possibly encouraged by poor sanitation and water quality.

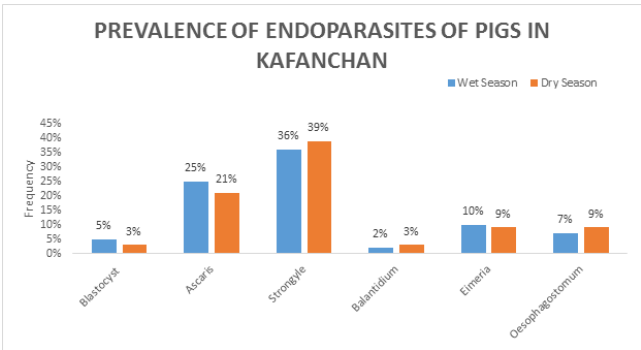


Figure 2. Frequency of endoparasites identified in pigs during the wet and dry season

Monoparasitism refers to an infection where a pig is infected with a single species of parasite, while

polyparasitism describes infections involving two or more different parasite species simultaneously. Understanding these infection types helps in estimating the complexity and severity of parasite burdens in pig populations. Figure 3 depicts the prevalence of endoparasite infections in pigs from Kafanchan based on monoparasitism and polyparasitism during the wet and dry seasons. In the wet season, 46% of the pigs showed No Parasite Seen (NPS), 41% were infected with a single parasite species, and 13% had infections involving two parasites. During the dry season, 59% of the pigs were parasite-free, 32% had a single parasite (monoparasitism) infection, and 9% had double infections (polyparasitism). These results showed that more pigs were free from endoparasites during the dry season compared to the wet season, whereas monoparasitism was higher in the wet season. This distribution indicates that single parasite infections constitute the majority of cases in both seasons, with a lower incidence of co-infections.

In contrast to this finding, Addy et al. (2023) in northern Ghana found that 72.55% of infected pigs had polyparasitic infections involving two to five parasite species, while 27.45% had infections with a single parasite species. This higher rate of polyparasitism compared to Kafanchan was attributed to poorer environmental hygiene and more extensive free-range farming practices, which increase pigs’ exposure to diverse infectious stages (Addy et al., 2023). Their results emphasize that relaxed farm management often leads to complex mixed infections that can worsen pig health.

The lower polyparasitism prevalence in Kafanchan suggests marginally better farm management compared to these systems but still indicates substantial ongoing parasite transmission. Seasonal variation showing increased parasite-free pigs in the dry season can be explained by environmental conditions unfavorable for parasite survival, such as reduced moisture limiting parasite egg viability and larval development (Addy et al., 2023). However, the persistence of monoparasitic infections year-round reflects the resilience of certain parasites like *Ascaris* with hard eggs that survive harsh conditions and *Strongyle* larvae adapted to seasonal fluctuations.

Clinically, monoparasitism may cause less severe disease but still affects pig growth and feed efficiency. Polyparasitism often intensifies clinical signs and complicates control measures by increasing parasite load diversity and contributing to immunosuppression.

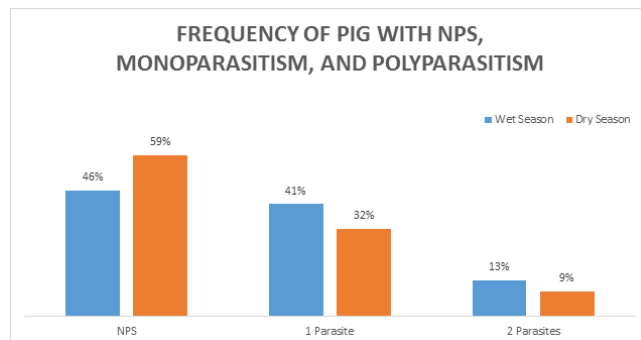


Figure 3. Prevalence of endoparasite of pig based on monoparasitism or polyparasitism NPS=No parasite seen

Table 1 presents the effect of age on the prevalence of endoparasites in pigs sampled in Kafanchan. The Chi-square test value was 2.815 with a p-value of 0.093, indicating that the difference in prevalence between adult and young pigs was not statistically significant. Among adult pigs (n=105), 52.4% were found to be infected, while 47.6% had no infection. In young pigs (n=57), 38.6% were infected and 61.4% were uninfected. This result shows that both adult and young pigs in Kafanchan can be infected with endoparasites, with adults exhibiting a higher numerical prevalence, though the age difference is not statistically significant ($p>0.05$). This non-significant difference aligns with findings from Daka et al. (2019), who reported an overall higher prevalence in adult pigs (63.9%) compared to piglets (56.8%) in Ethiopia, explaining that older pigs may accumulate infections over time due to

prolonged exposure to parasite-contaminated environments. However, the difference was not statistically significant, reflecting that infections can be acquired at all ages based on environmental exposure and management practices.

On the contrary, other studies have found significant age-related differences. Okita et al. (2021) in Nigerian pig farms reported a statistically significant higher prevalence of endoparasites in young pigs compared to adults, attributing this to immature immune systems in younger animals, making them more susceptible to infections. Similarly, Jufare et al. (2015) in Ethiopia observed higher parasitic burdens in piglets due to lower immunity and increased vulnerability to environmental contamination.

The higher numerical prevalence among adult pigs in Kafanchan may be explained by their longer life span, which corresponds to cumulative exposure to parasite infective stages over time. Adult pigs' continuous contact with contaminated pens, soil, and infected faeces may increase infection likelihood. In addition, adults may harbour chronic infections that persist due to inadequate or irregular deworming.

Young pigs, despite showing lower prevalence, are also at risk since their naive immune systems make them vulnerable during early exposure periods. The absence of a statistical significance difference in Kafanchan suggests that parasite transmission occurs broadly across age groups, reinforced by environmental contamination and farm practices such as unrestricted pig movement, mixed-age housing, and poor hygiene.

Table 1. Effect of age on the prevalence of endoparasites of pigs in Kafanchan.

Age	Total No. Animal sample	Absent	Present	Chi-square	Cramer's value	p-value
Adult	105	50(47.6)	55(52.4)	2.815 ^{NS}	0.132 ^{NS}	0.093
Young	57	35(61.4)	22(38.6)			
Total	162	85(52.5%)	77(47.5%)			

Figures in parentheses are in percent, NS=Not significant

Table 2 presents the prevalence of endoparasites based on sex among pigs sampled in Kafanchan. Of the 162 pigs examined, 70 were females and 92

were males. The infection prevalence in females was 48.6% (34 out of 70), while in males it was 40.2% (37 out of 92). The result indicated no significant

difference in the prevalence of endoparasites between sexes (Chi-square=1.127, p=0.288).

This result suggests that sex does not have a significant influence on the prevalence of endoparasites in the pig population studied in Kafanchan. From this study, both males and females are equally susceptible to endoparasitic infections in this area. This finding agrees with the observations of Omoruyi and Agbinone (2020) in Edo State, Nigeria, who reported no significant association between pig sex and prevalence of gastrointestinal parasites. Similarly, Amoke and Nwosu (2025) in Umuahia South, Abia State, found that male pigs (75.0%) and female pigs (72.4%) had comparable levels of infection, with no significant sex effect. Maganga et al. (2019) also reported a similar trend in Gabon, Central Africa, where male and female pigs had nearly equal prevalence of gastrointestinal parasites, indicating that exposure risk is largely determined by environmental and husbandry factors rather than sex.

Studies have documented higher prevalence in female pigs, particularly in reproductive or

lactating sows. Bernard et al. (2021) in Enugu State observed that female pigs had higher parasite loads compared to males, a pattern attributed to hormonal and physiological stressors associated with pregnancy and lactation, which may reduce immune competence. Likewise, Wesołowska et al. (2022) noted that sex-related immune differences in animals can sometimes predispose females to higher infection burdens.

Findings from Nwokoye et al. (2021) and Bernard et al. (2021) studies suggest that factors such as hormonal variations potentially influencing immunity, reproductive status, and behavior have been proposed in some species to modulate parasitic infections; however, these effects seem minimal in domestic pig populations under the semi-intensive and intensive systems common in Kafanchan. The consistent husbandry practices and environmental exposures in these settings expose pigs of both sexes equally to infective parasite stages, thereby reducing any sex-related differences in susceptibility.

Table 2. Effect of sex on the prevalence of endoparasites of pigs in Kafanchan.

Sex	Total No. Animal sample	Absent	Present	Chi-square	Cramer's value	p-value
Female	70	36(51.4)	34(48.6)	1.127 ^{NS}	0.083 ^{NS}	0.288
Male	92	55(59.8)	37(40.2)			
Total	162	85(52.5%)	77(47.5%)			

Figures in parentheses are in percent, NS=Not significant

Table 3 presents the effect of season on the prevalence of endoparasites in pigs in Kafanchan. During the dry season, 40.7% of the pigs were infected, while 59.3% showed no parasite infection. In the wet season, prevalence was higher at 54.3%, with 45.7% uninfected. The p-value of 0.084, indicating that the difference in infection rates between seasons was not statistically significant.

The higher prevalence during the wet season is expected and has been commonly observed in tropical environments such as Kafanchan. This is because wet conditions create an ideal environment for the development and survival of parasite eggs and larvae in the soil and pig pens, facilitating transmission. Warm temperatures combined with moisture favor the survival of infective stages of

parasites like Strongyles and Ascaris, increasing the risk of infection when animals graze or scavenge in contaminated areas (Addy et al., 2023). Therefore, the wet season provides optimal conditions for parasite stages to complete their life cycles and infect hosts.

Similar seasonal trends are documented across tropical regions. A study in Nsukka, Nigeria by Abonyi and Njoga (2019) found significantly higher prevalence of gastrointestinal parasites during the rainy season compared to the dry season, attributed to increased larval survival and host exposure during humid months. However, the lack of significant seasonal effect (p>0.05) on endoparasite prevalence in pigs in Kafanchan may be attributed to environmental and management

factors that allow parasite transmission year-round.

Kafanchan lies within the Guinea savannah zone, characterized by higher vegetation density and wetter climatic conditions compared to the drier Sudan and Sahel savannah zones further north, creating an environment favorable for parasite survival. Constant exposure of pigs to contaminated feed, water, and inadequately cleaned housing in imperfectly managed piggeries maintains transmission throughout the year. Parasites such as *Ascaris suum* produce highly resilient eggs capable of surviving dry conditions

and extreme environments for weeks to months, allowing infection cycles to persist despite seasonal fluctuations in moisture (Lora, 2019). This persistence of infection across seasons indicates that continuous control measures are needed year-round rather than focusing solely on the wet season. Studies in other tropical areas report similar mixed seasonal effects with ongoing infections during dry periods, underscoring the importance of husbandry and biosecurity over seasonality alone (Addy et al., 2023; Liaw et al., 2022).

Table 3. Effect of season on the prevalence of endoparasites of pigs in Kafanchan

Season	Total No. Animal sample	Absent	Present	Chi-square	Cramer's value	p-value
Dry	81	48(59.3)	33(40.7)	2.995 ^{NS}	0.136 ^{NS}	0.084
Wet	81	37(45.7)	44(54.3)			
Total	162	85(52.5)	77(47.5)			

Figures in parentheses are in percent, NS=Not significant

Conclusion

The study revealed that endoparasitic infections are common in pigs in Kafanchan, with parasites present throughout both wet and dry seasons. Although a higher prevalence was observed during the wet season, this difference was not statistically significant ($p>0.05$), indicating that parasites persist year-round, supported by environmental conditions such as favorable moisture and temperature in the guinea savannah zone and prevailing farm management practices. Also, age and sex did not significantly influence ($p>0.05$) infection rates, suggesting universal susceptibility among pigs. The dominant parasites identified were *Strongyle* and *Ascaris* species, which maintained stable frequencies across seasons due to their adaptability and resilience. The year-round persistence of endoparasites underscores the necessity for continuous, integrated control programs rather than seasonal efforts alone. Regular deworming protocols, enhanced sanitation, improved housing conditions, and strict biosecurity measures must be prioritized to break the transmission cycle and minimize economic losses due to reduced growth performance and increased mortality. The resilience of parasites like *Ascaris suum*, which

produce hardy eggs capable of surviving harsh environmental conditions, demands comprehensive strategies combining chemical, environmental, and management interventions.

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