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Gastrointestinal parasites of Japanese quails (*Coturnix japonica*): A comparative study between an improved farm and a traditional farm

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Abstract

This study was carried out in 2025 on two different Japanese quail farms in the south of Abidjan (Côte d'Ivoire). Its aim was to improve animal health by identifying gastrointestinal parasites for more effective control. To this end, 720 digestive tracts were collected, of which 360 came from an improved farm at Nangui Abrogoua University (Abidjan, Côte d'Ivoire) and 360 from a traditional farm in Akandjé village (Abidjan, Côte d'Ivoire). The digestive tracts were collected during the slaughter period at 35 days of age for human consumption. The crop, gizzard, small intestine and caecum were isolated, eviscerated, and their contents transferred into boxes. These were numbered according to the sample and collection site, then transported to the Laboratory of Animal Biology and Cytology of Nangui Abrogoua University. At the laboratory, the contents were pooled into homogeneous batches of 15 samples per organ. The contents underwent helminthological examination, then 3 g of each batch were weighed, diluted and analysed using the flotation and McMaster techniques to detect parasite eggs. Eggs of *Capillaria sp.* and coccidia, as well as adult ascarids, were observed. Akandjé showed a slightly higher overall prevalence than Nangui Abrogoua (29.2% versus 25%), along with greater parasitic diversity (*Ascaridia sp.* and *Capillaria sp.* in addition to *Eimeria sp.*).

Keywords: Quails; Parasites; Gastrointestinal; Faeces; Flotation; McMaster

1. Introduction

The population of Côte d'Ivoire is estimated at 31.9 million inhabitants and is constantly growing at an average annual rate of 2.5% [2]. According to a report published in 2023 by the United States Department of Agriculture (USDA), poultry meat consumption in Côte d'Ivoire stands at around 2.65 kg per person per year [16]. In order to meet the growing demand for animal protein, the government has put in place structures to support stakeholders and facilitate access to inputs [11]. In this context, short-cycle farming such as quail rearing is attracting interest. Recent studies conducted in Côte d'Ivoire highlight encouraging performance results [12]. However, these farms face health challenges such as gastrointestinal parasites, which often lead to considerable economic losses [14]. The present study aims to identify the digestive tract parasites of quails in order to contribute to better health management and the sustainable promotion of this growing sector. Specifically, the study aims to identify the different digestive tract parasites of quails, to assess prevalence in both farms, and to compare mean parasite burdens.

1.1. Study area

This study was conducted in two localities within the Autonomous District of Abidjan. The first site is the experimental poultry farm of Nangui Abrogoua University (Figure 1), located in the municipality of Abobo-Adjamé, in the north of

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Abidjan [5], at geographical coordinates 5.38922° N latitude and 4.01909° W longitude. The second site is a farm located in the village of Akandjé (Figure 2), in the municipality of Bingerville, also within the Autonomous District of Abidjan [7]. This village is located approximately 20 km east of downtown Abidjan, at approximate geographical coordinates 5°21′ (≈ 5.3558°) N latitude and 3°54′ (≈ −3.8854°) W longitude. The main difference between the two sites is that the Akandjé farm uses floor-based rearing, while the Nangui Abrogoua University farm uses off-ground (cage) rearing.

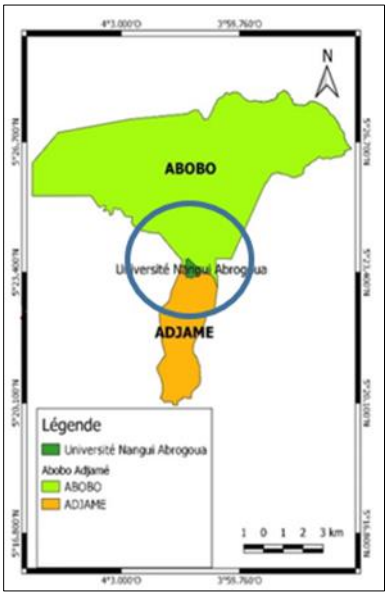

Figure 1 First study area (Nangui Abrogoua University)

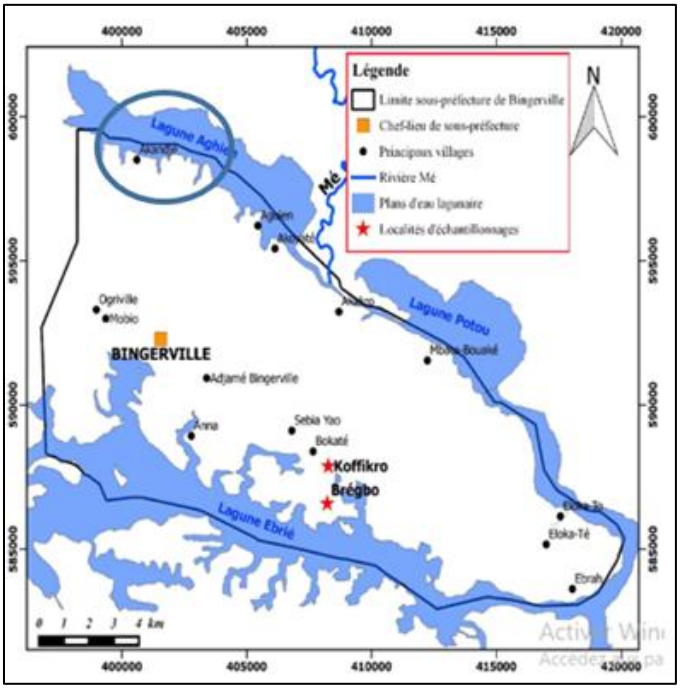

Figure 2 Second study area (Akandjé)

2. Material and methods

The sample consisted of 720 Japanese quails (*Coturnix japonica*), of which 360 came from an improved farm at Nangui Abrogoua University (Abidjan, Côte d'Ivoire) and 360 from a traditional farm in Akandjé village (Abidjan, Côte d'Ivoire). Selection was made randomly according to the number of animals available on each farm. The experiments were therefore conducted on adult male (180) and female (180) quails aged 35 days per farm. All slaughtered quails were

intended for consumption. The digestive tracts were removed and placed in plastic bags labelled by sex, then stored in a cool box with ice and transported to the Laboratory of Animal Biology and Cytology of Nangui Abrogoua University. Those not analysed on the same day were kept at 4°C and analysed the following day.

Given the small amount of digestive material available in each organ, batches were formed according to the number of samples (45) per organ. Thus, 3 batches of 15 samples were formed per organ, giving 12 batches per sex and 24 batches per farm. The organs (gizzard, crop, small intestine, caecum) were cut open with scissors and forceps, and the contents of each were poured into plastic Petri dishes to form a homogeneous batch. Adult parasites are sought with the naked eye or with the aid of a magnifying glass, while smaller forms are observed under an optical microscope.

The parasites collected were preserved in 10% formalin for subsequent morphological identification. This method allows not only the detection of helminths, but also the determination of their preferred location and an estimate of parasite burden, which is essential for understanding infestation dynamics and guiding control measures [13, 15].

2.1. Flotation technique

Three grams (3 g) of the homogeneous batch were placed in a mortar, crushed, then mixed with distilled water. The mixture was filtered and transferred into a test tube for centrifugation. After centrifugation, the supernatant was discarded and a flotation solution based on sodium chloride (NaCl 40%) was added. The preparation was thoroughly homogenised until a uniform emulsion was obtained, then topped up with the NaCl solution until a convex meniscus formed at the surface of the tube. A coverslip was carefully placed on the meniscus and held in place for 15 to 20 minutes. It was then gently removed and immediately placed on a glass slide for microscopic observation at magnifications ×10, ×40 and ×100 [3].

2.2. McMaster technique

Three grams (3 g) of the homogeneous batch were ground and diluted in 15 ml of distilled water. The mixture was filtered through a tea strainer to remove coarse debris. After homogenisation, the suspension was transferred into a 15 ml centrifuge tube and centrifuged. The supernatant was discarded, and the sediment was agitated before adding a sodium chloride saline solution (NaCl 40%, density 1.30) until the tube was completely filled. After further homogenisation, the McMaster counting chamber was immediately filled with this dilution. After approximately 5 minutes, allowing time for the eggs to float to the surface, the reading was carried out in both chambers of the slide at the ×10 objective of the microscope [3]. The number of eggs per gram (OPG) of faeces was calculated as:

$$\mathbf{OPG = (N_1 + N_2) \times 50}$$

Where:

N_1 = number of eggs counted in the first chamber, and

N_2 = number of eggs counted in the second chamber.

2.3. Calculated parameters

2.3.1. Prevalence

Prevalence is the ratio of the number of positive batches to the number of batches analysed:

$$\mathbf{P = (Positive\ batches\ /\ Batches\ analysed) \times 100}$$

2.3.2. Mean parasite burden

The mean parasite burden is calculated in two main ways: the mean burden per batch analysed, which is the ratio of the total number of parasites to the number of batches analysed; and the mean burden per positive batch, which is the ratio of the total number of parasites to the number of positive batches.

Mean burden per batch analysed = total number of parasites / number of batches analysed

Mean burden per positive batch = total number of parasites / number of positive batches

2.3.3. Statistical analyses

Data were collected using a recording sheet designed for the study in Excel. The variables studied included the farming site, the sex of the quails, the organs examined, the parasitic species isolated, and the total number of parasites counted per batch. Prevalences were compared between groups using the Chi-squared test, with a significance threshold set at 5% ($p < 0.05$). Mean parasite burdens were compared between groups using the non-parametric Mann-Whitney U test.

3. Results

3.1. Nangui Abrogoua farm

The results for the Nangui Abrogoua farm are presented in Table 1. Of the 360 samples grouped into 24 batches, only 6 were positive: 2 in females and 4 in males. In females, only *Eimeria sp.* was detected, exclusively in the small intestine and caecum. The overall burden was low (300 parasites) with a prevalence of 16.7%. In males, the caecum was heavily affected (3 positive batches out of 3 analysed) with a massive burden far exceeding that of females (20,000 vs. 300) and a prevalence of 33.3%. No parasites were found in the crop or gizzard. There was no significant difference between males and females. However, the localisation of parasites (absent in the crop and gizzard, present in the small intestine and caecum) represents a highly significant difference.

Table 1 Results for the Nangui Abrogoua farm

Sex	Organ	n	Batches analysed (n)	Positive batches (n)	Parasites observed	Eggs (n)
Female	Crop	45	3	0	0	0
	Gizzard	45	3	0	0	0
	Small intestine	45	3	1	*Eimeria sp.*	200
	Caecum	45	3	1	*Eimeria sp.*	100
	Total	180	12	2	1	300
Male	Crop	45	3	0	0	0
	Gizzard	45	3	0	0	0
	Small intestine	45	3	1	*Eimeria sp.*	500
	Caecum	45	3	3	*Eimeria sp.*	5,100 / 13,100 / 1,300
Total		180	12	4	1	20,000

n = number of animals; OPG = eggs per gram of faeces.

3.2. Akandjé farm

Table 2 shows the results of analyses from the Akandjé farm. Of the 360 samples grouped into 24 batches, only 7 were positive: 2 in females and 5 in males. In females, the burden was very low (100 parasites counted) with a prevalence of 16.7%. The batch positive for *Ascaridia sp.* contained practically no parasites (1 adult worm out of 45). In males, the picture was more substantial and more diverse. The caecum was massively parasitised. The small intestine showed a triple co-infection (*Ascaridia* + *Eimeria* + *Capillaria*). The prevalence in males was 41.7%. No parasites were found in the crop or gizzard. There was no significant difference between males and females. However, the localisation of parasites (absent in the crop and gizzard, present in the small intestine and caecum) represents a significant difference.

Table 2 Results for the Akandjé farm

Sex	Organ	n	Batches analysed (n)	Positive batches (n)	Parasites observed	Eggs (n)
Female	Crop	45	3	0	0	0
	Gizzard	45	3	0	0	0
	Small intestine	45	3	1	*Ascaridia sp.*	1*
	Caecum	45	3	1	*Eimeria sp.*	100
	Total	180	12	2	2	100
Male	Crop	45	3	0	0	0
	Gizzard	45	3	0	0	0
	Small intestine	45	3	2	*Ascaridia sp.* + *Eimeria sp.* + *Capillaria sp.*	1* 5,350 100
	Caecum	45	3	3	*Eimeria sp.*	600 / 5,800 / 12,300
Total		180	12	5	3	24,150

* 1 adult worm was found; this worm is not counted in the egg tally. n = number of animals.

3.3. Comparison between sites

Analysis across both sites reveals that the crop and gizzard showed a prevalence of 0% at both sites and for both sexes. The caecum was the most heavily parasitised organ, reaching 100% in males at both sites. Males were consistently more infested than females at both sites (33.3% versus 16.7% at Nangui Abrogoua; 41.7% versus 16.7% at Akandjé). Akandjé showed a slightly higher overall prevalence (29.2%) than Nangui Abrogoua (25%), with greater parasitic diversity (*Ascaridia sp.* and *Capillaria sp.* in addition to *Eimeria sp.*). *Eimeria sp.* was found at both sites and in both sexes, particularly in the caecum. The two sites did not differ significantly in the number of positive batches, organs affected, or parasite egg counts according to the Chi-squared and Mann-Whitney U tests. The two sites are therefore statistically comparable; the main difference remains qualitative, residing in parasitic species richness (3 species at Akandjé versus 1 at Nangui Abrogoua).

4. Discussion

The results of the present study reveal a higher prevalence in males than in females at both study sites (33.3% versus 16.7% at Nangui Abrogoua and 41.7% versus 16.7% at Akandjé). This difference could be explained by the greater susceptibility of males compared to females. The same findings were made by Biu *et al.* [4], who observed a higher prevalence of helminthiases in cockerels than in hens in Nigeria. Similar results were found in Mali in guinea fowl. Other authors went further by stating that the immunosuppressive effect of testosterone reduces cell-mediated and humoral immune responses, making males more vulnerable to infections [8, 17].

The crop and gizzard showed zero prevalence at both sites and for both sexes. This result is explained by the anatomical and physiological characteristics of these organs: the acidic pH of the gizzard and the mechanical nature of its activity create unfavourable conditions for the establishment of the parasites identified in this study [13].

The caecum was, on the contrary, the most heavily parasitised organ, reaching 100% in males at both sites. This could be explained by the fact that this part of the intestine is a favourable zone for the development of these parasites. Indeed, the predilection of the genus *Eimeria* for the caecal mucosa is classically described: the species *E. tsunodai* and *E. bateri*, the most pathogenic in Japanese quail (*Coturnix coturnix japonica*), carry out their schizogony and gametogony cycles there [10].

The small intestine was also affected, particularly at Akandjé, where a co-infection by *Ascaridia sp.*, *Eimeria sp.* and *Capillaria sp.* was observed in males. The localisation of these helminths in the small intestine corresponds to their

known biology: *Ascaridia* preferentially settles in the jejunum, while *Capillaria* can parasitise both the small intestine and the caecum depending on the species [13, 15].

The overall prevalence was slightly higher at Akandjé (29.2%) than at Nangui Abrogoua (25.0%), with greater parasitic richness at the first site (three parasitic genera versus one). These differences could be explained by distinct farming conditions and environmental factors at the two sites. Animal density, litter management and drinker hygiene are recognised as key factors in the transmission of coccidia and helminths in the environment [6]. The presence of earthworms and insects in the Akandjé environment could also explain the greater helminthic diversity observed at this site [15]. A similar variation in the prevalence of digestive parasites according to farming site, linked to hygiene practices and the peri-urban environment, has also been reported in local guinea fowl in Côte d'Ivoire.

It should be noted that the batch positive for *Ascaridia sp.* in the small intestine of Akandjé quails contained practically no parasites. This could correspond to an early infestation with larval stages not detectable by the examination method used, or to a sensitivity limit of the coproscopic technique [13].

The co-infection observed in the small intestine of males (*Ascaridia sp.* + *Eimeria sp.* + *Capillaria sp.*) deserves special attention: interactions between coccidia and helminths can be synergistic, with lesions induced by coccidia facilitating the penetration and establishment of helminth larvae in the intestinal mucosa [4, 6].

From a comparative perspective between sites, although the differences in overall prevalence are moderate (25.0% at Nangui Abrogoua versus 29.2% at Akandjé), the greater parasitic species diversity and higher infestation intensity at Akandjé indicate that this site presents a greater health risk for the animals. These results argue in favour of the systematic integration of an antiparasitic prophylaxis programme in quail farming management in Côte d'Ivoire, including strengthened hygiene measures, regular parasitological monitoring, and targeted therapeutic interventions.

5. Conclusion

The results of this study show that quails at both sites are affected by protozoa and helminths at the digestive level, with a high prevalence of *Eimeria sp.* at both farms. The Akandjé site is distinguished by greater parasitic diversity, also including *Ascaridia sp.* and *Capillaria sp.*, which indicates a more varied infectious pressure, probably linked to the environmental conditions and farming methods specific to the area. In sum, this research helps to fill the gap in data concerning digestive parasitism in domestic quails in West Africa and highlights the importance of conducting in-depth studies on the precise identification of *Eimeria* species, their pathogenic potential and possible resistance to the anticoccidial treatments commonly used in this part of the continent.

Compliance with ethical standards

Disclosure of conflict of interest

The authors declare that they have no conflict of interest.

Statement of informed consent

All slaughtered quails were intended for human consumption; no additional procedure was performed on live animals beyond standard slaughter practice, and the farm owners gave their consent for sample collection.

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