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Intestinal parasites of laying hens (*Gallus gallus domesticus*) sold in two markets of the autonomous district of Abidjan, Côte d'Ivoire

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Abstract

A study on intestinal parasitism in laying hens (*Gallus gallus domesticus*) was conducted from May to June 2024 in two municipalities of the Autonomous District of Abidjan (Côte d'Ivoire): Abobo and Adjamé. Seventy (70) digestive tracts were collected from local slaughter markets (35 per municipality) and analysed at the Laboratory of Animal Biology and Cytology of Nangui Abrogoua University. Methods combined helminthological autopsy, sedimentation, flotation and McMaster techniques. Two parasitic genera were identified: *Ascaridia* sp. and tapeworms (*Raillietina* sp.). Of the 70 samples examined, 54 harboured one or more parasites (overall infestation rate: 77.14%). Infestation rates were 72.86% by coproscopy and 82.86% by autopsy. Prevalences of *Ascaridia* sp. were 80% in Abobo and 85.71% in Adjamé; tapeworms were found exclusively in Adjamé (34.29%). Mean parasite burdens of *Ascaridia* sp. were 11.18 in Abobo and 12.04 in Adjamé, with no significant difference ($p > 0.05$). These results highlight high parasitic pressure in both municipalities and support the integration of antiparasitic prophylaxis programmes in urban poultry management.

Keywords: *Gallus gallus domesticus*; Intestinal parasites; *Ascaridia* sp.; Tapeworms; Prevalence; Abidjan

1. Introduction

In Côte d'Ivoire, livestock farming plays an important role in agricultural development and contributes significantly to the national economy. Among these activities, poultry farming is a rapidly expanding sector, particularly through intensive egg and meat production, contributing around 4.5% of agricultural GDP [8]. According to the MIRAH annual report [11], the national poultry flock reached approximately 85 million birds, including around 54 million improved-breed animals generating some 45,000 tonnes of eggs annually, a volume sufficient to meet the country's domestic consumption in full. Specifically, the laying hen segment grew from roughly 4.5 to over 5 million head between 2014 and 2019, illustrating the sustained dynamism of this subsector.

However, the sector faces significant health constraints. Among these, digestive parasitism stands out as a major obstacle to productive performance, generating considerable economic losses through impaired growth, reduced egg output, and increased mortality [7,16]. Nematodes and cestodes are particularly prevalent in poultry raised under tropical conditions [6]. Multiple field surveys conducted in West and East African countries have recorded infestation rates between 70% and 80%, notably in traditional and semi-intensive production systems [1,12,20].

In Côte d'Ivoire, data on intestinal parasitism in laying hens sold in urban areas remain poorly documented, limiting the development of appropriate control strategies. The present study aims to fill this gap by assessing the prevalence and intestinal parasite burden of laying hens sold in two municipalities of the Autonomous District of Abidjan, with the

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specific objectives of identifying the parasitic genera present, determining their prevalence and comparing mean parasite burdens between the two sites.

2. Material and Methods

2.1. Study area

The study was conducted from May to June 2024 in the Autonomous District of Abidjan (Côte d'Ivoire), in two municipalities (Figure 1). The municipality of Abobo (5°26'00" N, 4°01'00" W) lies at the northern entrance of the urban agglomeration, flanked by Anyama to the north, the Banco forest to the south, Cocody to the east, and Yopougon and the sub-prefecture of Songon to the west [3]. With the highest population density in the District, it represents a major hub for urban food supply chains. Adjamé (5°29'17" N, 4°01'56" W) occupies a central-northern position in the Abidjan conurbation, bounded by Cocody to the east, Attécoubé to the west, Le Plateau to the south, and Abobo to the north [2]. Its exceptional commercial activity centred on the largest wholesale market and the principal inter-city bus terminal in the country generates substantial flows of people, animals, and organic waste throughout the day.

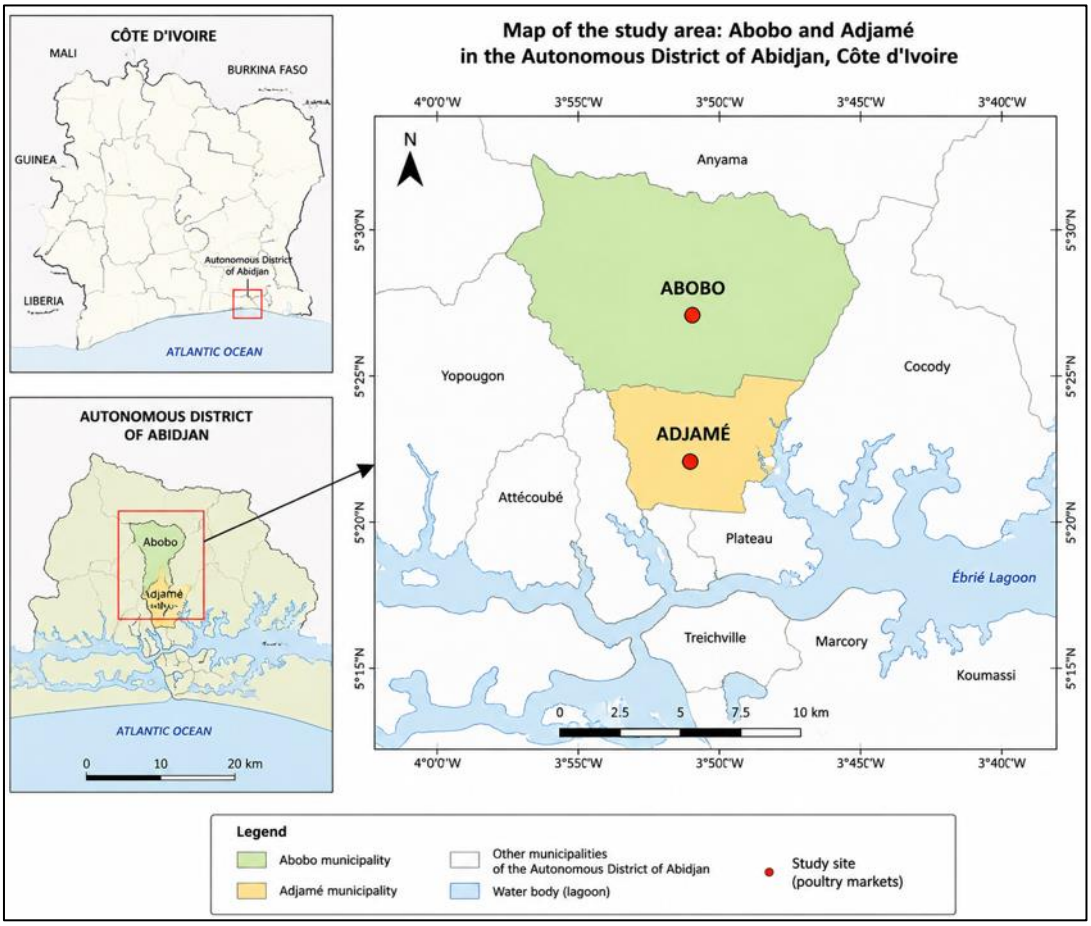

Figure 1 Map of the study area showing the municipalities of Abobo and Adjamé and the poultry markets (study sites) in the Autonomous District of Abidjan, Côte d'Ivoire

2.2. Biological material

The study covered 70 Isa Brown laying hens, all at the end of their laying cycle, collected from slaughter sites at the studied markets. Organs (small intestine, large intestine, caecum and rectum) were collected and placed individually in sterile bags, then kept in a cooler with cold packs for transport to the Laboratory of Animal Biology and Cytology at Nangui Abrogoua University. Samples not analysed on the same day were kept at 4°C for a maximum of 48 hours.

2.2.1. Helminthological autopsy

Each intestinal segment was ligated, incised longitudinally, and its contents emptied onto aluminium foil, then rinsed through a fine-mesh sieve (200 µm) under running water. The retained elements were visually examined and then inspected with a binocular magnifying glass to search for and identify adult parasites, using the identification keys of Thienpont *et al.* (1979, 1995) [18,19], Euzéby (1981, 1982) [4,5], Lichtenfels *et al.* (1994) [9] and Kaufmann (1996) [6].

2.2.2. Coproscopic techniques

For each sample, 3 g of faecal matter were collected and subjected to three techniques. **Sedimentation:** a faecal suspension was prepared by homogenising the sample in 45 ml of distilled water, then passed through a fine sieve; the resulting filtrate was centrifuged twice at 1500 rpm for 3 minutes each. The deposit was mounted on a glass slide under a coverslip and observed under the microscope at ×100 magnification after staining with methylene blue. **Flotation:** the faecal sample was suspended in 45 ml of distilled water and thoroughly mixed; following a resting period of 20 to 30 minutes to allow passive sedimentation, the upper liquid layer was discarded and the deposit was transferred to a Petri dish for microscopic examination. **McMaster's method** [6]: a 3 g faecal sample was homogenised in 45 ml of distilled water and strained through a sieve; the filtrate was then centrifuged at 2000 rpm for 5 minutes.

After discarding the supernatant, the sediment was resuspended in a saturated sodium chloride solution (NaCl, 40%; density 1.30), which promotes flotation of helminth eggs. The McMaster chambers were loaded immediately and read under the microscope at ×10 magnification after allowing a few minutes for egg migration to the surface. Eggs per gram of faeces (EPG) were calculated as:

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

2.2.3. Calculated parameters

Prevalence (%) was calculated as the ratio of the number of intestines infested by a given parasite to the total number analysed, multiplied by 100. Mean adult parasite burden was expressed as the number of parasites per positive intestine. Mean egg burden was expressed as the mean EPG per positive intestine.

2.3. Statistical analyses

Data were entered in Microsoft Excel and analysed with R Studio. Prevalences were compared using the Chi-squared test (χ^2), and parasite burdens were compared using Student's *t*-test and the non-parametric Mann–Whitney *U* test. The significance threshold was set at $p < 0.05$.

2.4. Ethical approval

The present research work does not contain any studies performed on live animals by any of the authors; sampling was restricted to digestive tracts collected post-slaughter at commercial markets.

3. Results and Discussion

3.1. Identified parasites

Macroscopic and microscopic examination of samples identified two parasitic genera: nematodes of the genus *Ascaridia* sp. [14] (adults and eggs) and cestodes of the genus *Raillietina* sp. (adult tapeworms). No *Eimeria*-type protozoa were detected, and no macroscopic coccidial lesions were observed. Adult parasites were located mainly in the small intestine. Of the 70 intestines collected, 54 were positive, giving an overall infestation rate of 77.14% (80.00% in Abobo and 85.71% in Adjamé by autopsy, considering animals positive for at least one parasite genus). This high overall infestation rate is consistent with published data from other sub-Saharan African countries, where prevalences ranging from 70% to over 80% have been reported in similar health contexts characterised by limited access to veterinary care and poor hygiene practices [12,20].

3.2. Autopsy prevalences

Ascaridia sp. was found in both municipalities: prevalence was 80% in Abobo and 85.71% in Adjamé. Tapeworms were observed exclusively in Adjamé (34.29%), being totally absent in Abobo (Table 1). These high values reflect significant parasitic pressure, probably maintained by the long retirement period of laying hens, which prolongs exposure to parasites, and by the frequent absence of broad-spectrum antiparasitic treatments.

Table 1 Autopsy prevalences (adult parasites) by municipality in laying hens from Abidjan markets

Parasites	Abobo (n=35)	Abobo (%)	Adjamé (n=35)	Adjamé (%)	p-value
Ascaridia sp.	28	80.00	30	85.71	NS
Raillietina sp. (tapeworm)	0	0.00	12	34.29	*

NS = not significant ($p > 0.05$); * = significant difference ($p < 0.05$).

The exclusive detection of *Raillietina* sp. in Adjamé (34.29%), and its total absence in Abobo, is the most contrasting result of this study. The completion of avian cestode life cycles requires arthropod intermediate hosts such as beetles, ants, or flies (Soulsby, 1982) [17]; the abundance of these invertebrates is itself conditioned by local environmental quality and the level of organic waste accumulation. In Adjamé, the concentration of commercial activities and informal markets creates conditions that are particularly favourable to invertebrate proliferation, thereby facilitating cestode transmission. Studies carried out in similar Nigerian urban settings, including the survey by Nnadi and George [13] in Enugu State, have noted a higher cestode burden in chickens from areas with abundant organic residues.

3.3. Coproscopy prevalences

Coproscopy revealed only *Ascaridia* sp. eggs, with prevalences of 74.29% in Abobo and 71.43% in Adjamé (Table 2). No significant difference was observed between the two municipalities (χ^2; $p > 0.05$). No tapeworm eggs were detected by this method in either locality. The absence of cestode eggs in coproscopic preparations is consistent with what is known about tapeworm biology: gravid proglottids are shed sporadically rather than continuously, so a single faecal examination may fail to capture them even in genuinely infected animals. This limitation of stool-based diagnosis for avian cestodosis is well documented in the helminthological literature [18].

Table 2 Coproscopy prevalences (McMaster technique) by municipality in laying hens from Abidjan markets

Parasites	Abobo (n=35)	Abobo (%)	Adjamé (n=35)	Adjamé (%)	p-value
Ascaridia sp. (eggs)	26	74.29	25	71.43	NS
Raillietina sp. (eggs)	0	0.00	0	0.00	—

NS = not significant ($p > 0.05$); EPG = eggs per gram of faeces.

The concordance between prevalences obtained by autopsy and by coproscopy, both above 70%, validates the complementarity of these two methods in the diagnosis of avian intestinal parasitism. Coproscopic techniques, particularly the McMaster method, constitute practical tools for evaluating intestinal parasitism in live poultry, as they allow quantitative estimation without requiring slaughter.

3.4. Adult parasite burdens

In Adjamé, the mean parasite burden of *Ascaridia* sp. is 12.04 worms per positive intestine, while tapeworms showed a mean burden of 1.63 worms per positive intestine in Adjamé (Table 3). The exclusive presence of tapeworms in Adjamé and their complete absence in Abobo (0 vs 34.29%) constitutes a statistically significant difference between the two sites ($p < 0.05$; Table 1). In Abobo, the burden of *Ascaridia* sp. is 11.18, with no tapeworms present (Table 3). No significant difference was observed between Abobo and Adjamé for *Ascaridia* sp. ($p > 0.05$). The absence of a significant difference in *Ascaridia* sp. burdens between the two municipalities indicates homogeneous environmental contamination by this parasite in both areas, regardless of local management variations. The eggs of *Ascaridia* sp. are highly resistant to environmental conditions, which promotes their prolonged survival in contaminated soils and contributes to the persistence of infestations [15].

Table 3 Mean adult parasite burdens (worms per positive gut) by municipality in laying hens from Abidjan markets

Parasites	Abobo (mean worms/gut)	Adjamé (mean worms/gut)	p-value
Ascaridia sp.	11.18	12.04	NS
Raillietina sp.	0.00	1.63	*

NS = not significant ($p > 0.05$); * = significant difference ($p < 0.05$).

3.5. Egg parasite burdens

The mean burdens of *Ascaridia* sp. measured by the McMaster method are 144.3 EPG in Abobo and 157.14 EPG in Adjamé (Table 4), confirming significant parasite density in both municipalities, with no statistically significant difference ($p > 0.05$). The predominance of adult parasites and the high EPG values recorded are consistent with the profile of hens at the end of their laying cycle. These animals, having been exposed for long periods to contaminated environments, have accumulated significant parasite burdens, underscoring the importance of implementing regular antiparasitic treatments not only at flock installation, but throughout the production cycle [15].

Table 4 Mean egg parasite burdens (EPG, McMaster method) by municipality in laying hens from Abidjan markets

Parasites	Abobo (mean EPG)	Adjamé (mean EPG)	p-value
Ascaridia sp.	144.3	157.14	NS
Raillietina sp.	0	0	—

EPG = eggs per gram of faeces; NS = not significant ($p > 0.05$); (—) = not applicable.

The sale of heavily parasitised birds in urban and peri-urban markets carries indirect consequences for consumers, including degraded product quality and the possible amplification of environmental contamination by helminth eggs in densely populated areas [10]. Effectively curbing this parasitic pressure will require a coordinated response involving improved sanitation at slaughter sites, systematic inclusion of anthelmintic treatments in flock management calendars, and targeted training of poultry traders and producers on parasite control.

4. Conclusion

This study documents a high prevalence of intestinal parasites in laying hens sold at the Abobo and Adjamé markets (Abidjan, Côte d'Ivoire), with an overall infestation rate of 77.14%. *Ascaridia* sp. is the dominant genus in both municipalities, while tapeworms (*Raillietina* sp.) were detected exclusively in Adjamé, suggesting a determining role of local environmental conditions in infestation dynamics. These results support the systematic integration of antiparasitic prophylaxis programmes in the management of peri-urban poultry farms, including regular treatment of animals, rigorous waste management in sales areas, and periodic parasitological surveillance. Complementary studies, including precise identification of tapeworm species, assessment of resistance to available anthelmintics, and mapping of environmental risk factors, would help optimise control strategies in this context.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors declare that they have no conflict of interest.

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