



Pathological and Hematological Study for Intestinal Infections with Cestoda and Nematoda in the Domestic Chickens of Thi-Qar Province

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Abstract | The purpose of this study was to assess the prevalence of parasitic diseases in domestic hens that acquired from the poultry market between March 2023 and October 2023. In order to analyze blood parameters (Hb, PCV, RBC, and WBC), sixty mature chickens were employed. Blood samples (1 ml) were taken from each chicken's jugular vein and placed into an ethylene diamine tetraacetic acid test tube. The tube was then gently shaken. The results were obtained using the Cell-Dyn Ruby equipment. The dissected intestinal portions of the sacrificed chickens were extracted in order to look at the pathological alterations, and the chickens' intestines were checked for the presence of parasites. The findings showed that the overall rate of helminthes infection was 86.67%, with Cestoda accounting for 84.62% and Nematoda for 36.54% of cases (many of which had mixed infections). Five species of cestodes were recorded included: *Raillietina echinobothrida* (71.15%), *Raillietina tetragona* (38.46%), *Raillietina cesticillus* (13.46%), *Choanotaenia infundibulum* (17.31%), and *Hymenolepis* sp (53.85%). There were three type of nematode: *Ascaridia galli* (28.85%), *Heterakis gallinarum* (21.15%), and *Epomidiostomum* (7.69%). Our results showed that there is significant decreasing in the concentration of Hb, PCV, and RBC (P values= 0.021, 0.009, 0.034) respectively of chickens infected with helminthes compared to the control group. While the WBC was noticed with increased significantly (P value= 0.045) in the infected chickens. Histological examination of the chickens' intestinal sections showed heterophilic infiltration together with villi and mucosal gland loss and degradation.

Keywords | Helminthes, Cestodes, Nematodes, Chicken, Pathological, Blood parameters

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INTRODUCTION

Birds are an important source of animal protein in the world; their meat contains many indispensable compounds, such as essential amino acids and vitamins, which are an important source of the B-complex, in addition con-

taining iron and lower cholesterol levels (Al-Aredhi and Al-Mayali, 2020). The common internal parasitic infections occur in poultry include gastrointestinal helminthes (cestodes and nematodes), *Raillietina echinobothrida*, *R. tetragona*, *R. cesticillus*, *Davainea proglotina*, *Choanotaenia infundibulum*, *Amoebotaenia cuneata*, *Hymenolepis can-*

taniana, and *H. carioca*. These helminthes are among the most significant cestodes of poultry (Shifaw *et al.*, 2021). *Raillietina* species can cause reduced growth, emaciation, weakness, dullness, emaciation, and convulsions. Additionally some birds showed paralysis and obstruction of the digestive tract. Their larval stage, known as a cysticercoid, is found in a variety of invertebrate intermediate hosts, including small mini-wasps, termites, ants, beetles, and houseflies (Jha, 2019). In poultry, the illness is known as “nodular tapeworm disease,” and the infected birds’ hemoglobin and sugar levels are below average (Jilo *et al.*, 2022).

The most important nematoda found in chicken are *Ascaridia galli*, *Heterakis gallinarum*, *Capillaria caudinflata*, *Strongyloides avium*, *Trichostrongylus tenuis*, and *Subulura brumpti* (Ohaeri and Okwum, 2013). The information on prevalence status, illness control, and future disease trends, which can be predicted using the gastrointestinal parasite infection data, will be helpful for efficient farm management. Understanding a farm’s conditions is essential to creating best practices and preventive initiatives, which in turn makes it easier to pinpoint the variables that influence the prevalence of disease (Wuthijaree *et al.*, 2024). Other significant microscopic changes linked to tapeworm infection include capillary congestion, fibrosis, and proliferation in the gut as well as lymphocytic and eosinophilic infiltrations (Demis *et al.*, 2015). Some common characteristics of village chickens that infected with helminthes include a significant reduction in hemoglobin, villous atrophy, catarrhal enteritis, granuloma formation in the duodenum, desquamation of villi, congestion of sub- mucosal glands, inflammatory response, and vacuolation of epithelial cells (Belete *et al.*, 2016). Helminthes infections are known to cause interference with host metabolism, which results in poor feed utilization and reduced growth rate as well as size and age at maturity (Thyagarajan, 2011; Nnadi and George, 2010; Van *et al.*, 2020). The great danger posed by these worms is caused by the movement of the parasite within the tissues of the body leading to many pathological changes such as diarrhea, infections and weight loss in severe cases (Singh *et al.*, 2021). The severity of symptoms caused by worms depends on the type, number and location of the parasite in the host body (Elmajdoub *et al.*, 2023). Because there haven’t been much research on the subject in Thi-Qar province, the current study aims to identify and diagnose helminthes (cestoda, nematode), as well as determine their impact on certain blood parameters and examine the histological changes in the intestinal tract of domestic chickens.

MATERIALS AND METHODS

SAMPLE OF STUDY

From March 2023 to October 2023, 60 domestic chickens were chosen randomly and bought from the local markets in Thi-Qar Province, which is located in the south of Iraq.

Every chicken was brought alive and housed in cages at the biology department/ College of Education for Women/ University of Al-Shatrah.

BLOOD SAMPLES COLLECTION AND SAMPLE PROCESSING

To study the hematological parameters, blood samples were collected from jugular vein of each chicken, 1 ml of blood was place into a test tube that contain Ethylene Diamine Tetra Acetic acid), tubes then shackd gently. The hematological parameters then were analyzed following (Dacie and Lewis, 1991) description.

ISOLATION OF HELMINTHES

Cervical dislocation was used to sacrifice the chickens. The jugular vein and carotid arteries were then cut. Then the chickens’ intestines were divided into several sections and placed in a sterile petri dish containing 0.9% normal saline physiological solution. The intestines then divided into four parts: esophagus, gizzard, intestine, and cloaca. The four parts were then cut longitudinally, and their content were examined under a stereoscope. The process of searching for intestinal worms begins with the naked eye and using a magnifying glass and dissecting microscope. The micro-needle was also used to isolate the small worms.

After isolating the worms and washing them with distilled water. The cestoda and nematode which removed from the intestine were preserved into vials containing AFA (Alcohol Formalin Acetic acid). The methods outlined by (Gibbons *et al.*, 1996) were used to process the helminths. Regarding cestodes following the process outlined by (Permin and Hansen ,1998), identification was completed once the whole mounts had been dyed. For the overall staining necessary to conduct morphological investigations, aceto alum carbine solution was utilized. For morphological identification, nematodes were positioned on glass slides and submerged in glycerine for a minimum of half an hour. A light microscope with x10 and x40 objective lenses was used to examine the slides (Khalil *et al.*, 2006). These helminths were identified using helminthological keys (Yamaguti, 1959; Yamaguti, 1961; Schmidt, 1986; Calnek *et al.*, 1991).

HEMATOLOGICAL ANALYSIS

Hemoglobin level determination (HB), Packed cell volume (PCV), red blood cell (RBC) and total count of leukocytes (WBC) were measured using the Cell- Dyn Ruby device, which is an automated multi- scale device designed for diagnostic test in clinical laboratories (Abbott Diagnostic Division, 2008).

TISSUE SAMPLES COLLECTION AND HISTOLOGICAL EXAMINATION

Following sampling, the checkins were put to death, and the intestinal sections were removed in order to examine

the pathological changes. Tissue samples were kept in a 10% formalin solution, subjected to standard histopathological procedures, stained with hematoxylin and eosin, and histologically examined. The histological preparation of the intestine was according to (Bancroft and Steven, 2012).

STATISTICAL ANALYSIS

In the current study, chi-square test, t-test, and the mean $\pm$ standard deviation (Mean $\pm$ SD) were used to investigate the significant differences in the effect of worm infections in chickens. All statistical analyses were performed using the statistical software package SPSS V.17.

RESULTS AND DISCUSSION

ISOLATION OF HELMINTHES

The different helminthes were isolated and identified from the gastrointestinal tracts of the infected chickens obtained in the study area. The parasites recovered consist of four (4) Cestodes and three (3) Nematodes. The cestodes are *Raillietina tetragona*, *Raillietina echinobothridia*, *Raillietina cesticillus*, and *Choanotaenia infundibulum*. While the nematodes are *Ascaridia galli*, *Heterakis gallinarum*, and *Capillaria spp.* The overall prevalence of gastrointestinal helminthes in the study area as shown in (Table 1) was (86.67 %). The prevalence rates of chicken with cestodes infections were (84.62 %) and (36.54 %) nematodes. There was a statistically significant difference ($P < 0.05$) in the prevalence rates of Cestodes and Nematodes infection.

Table 1: Number and percentage of local chickens infected with helminthes.

Tapeworm	Chickens	No. infected	%*
Cestode	60	44	84.62
Nematoda		19	36.54
Total		52	86.67

Cal.X²: 0.674, df:1, Tab.X²: 6.53, P. value ≤ 0.05

*Many cases with mixed infection.

The highest infection prevalence was due to *Raillietina echinobothridia* (71.15%); followed by *Hymenolepis cantainana* (53.85%) and *R. tetragona* (38.46%), while *R. cesticillus* (13.46%) and *Choanotaenia infundibulum* (17.31%) were found to be the least frequently recorded cestode species (Table 2).

Ascaridia galli (28.85%) was the most prevalent Nematode species followed by *Heterakis gallinarum* (21.15%), *Epomidiostomum* (7.69%) was the least frequently recorded (Table 3).

HEMATOLOGICAL PARAMETERS

Results showed that there is some effect of helimethes on the blood parameters, by decreasing the Hemoglobin level determination (HB) (12.83 ± 1.65), Packed cell volume (PCV) (20.02 ± 3.07), red blood cell (RBC) (2.59 ± 0.45)

and total count of leukocytes (WBC) (8.96 ± 7.72) ($P \leq 0.05$) of chickens infected with tapeworms compared to the control group. While the WBC (8.96 ± 7.72) noticed to be significantly increased in the infected chickens compared to the control group (8.40 ± 3.18). The results of the current study showed significant differences (P value= 0.048) for the percentage of granulocytes (3.65 ± 0.81) when compared with the control group (3.15 ± 0.25). The current study showed a non-significant decrease in lymphocytes (88.38 ± 5.68) compared with the control group (3.15 ± 0.25) as shown in (Table 4).

Table 2: Isolated Custody and their incidence in local chickens.

Custody	Infected	%
<i>Raillietina echinobothrida</i>	37	71.15
<i>Raillietina tetragona</i>	20	38.46
<i>Raillietina cesticillus</i>	7	13.46
<i>Choanotaenia infundibulum</i>	9	17.31
<i>Hymenolepis cantainana</i>	28	53.85
Total	44	84.62

Cal.X²: 0.572, df:1, Tab.X²: 5.54, P. value ≤ 0.05 .

Table 3: Isolated Nematoda and their incidence in local chickens.

Nematoda	Infected	%
<i>Ascaridia galli</i>	15	28.85
<i>Heterakis gallinarum</i>	11	21.15
<i>Epomidiostomum</i>	4	7.69
Total	19	36.54

Cal.X²: 0.723, df:1, Tab.X²: 6.82, P. value ≤ 0.05 .

GROSS PATHOLOGY

Each bird was between mildly and severely malnourished, with ruffled feathers and signs of diarrhea on the bird's rear feathers. During the anatomical examination, tapeworms were found in the intestine's duodenum and jejunum. The white worms, which ranged in length from 15 to 25 cm, produced intestinal blockage in the intestinal mucosa where their anterior ends were firmly attached. There was evidence of mucosal tissue in the colon as well as dark red exudates, or digested blood. The tapeworm produced necrotic foci where their heads adhered to the intestinal wall. *Raillietina echinobothrida* has an oval-shaped sucker and a retractable, hook-armed rostellum that can reach a maximum length of 25 cm. The scolex of worm is spherical in shape, with short and broad neck, as shown in (Figure 1).

By measuring 10-15 cm long and having rostellum hooks, the tapeworms were microscopically identified as *Choanotaenia infundibulum*. The sucker has an almost circular form. The scolex was found to be triangular in form and pointed anteriorly. The mature segments have a bell-shaped shape, and the neck is thin. Consisting of several ribbon-like body

Table 4: The effect of the helimenthes on some blood parameters of infected chickens and controls.

Groups	HB g/dL Mean $\pm$ SD	PCV% Mean $\pm$ SD	RBC $10^6/\mu\text{L}$ Mean $\pm$ SD	WBC $10^3/\mu\text{L}$ Mean $\pm$ SD	LYMPH % Mean $\pm$ SD	GRAN % Mean $\pm$ SD
Infected chickens	12.83 $\pm$ 1.65	20.02 $\pm$ 3.07	2.59 $\pm$ 0.45	8.96 $\pm$ 7.72	88.38 $\pm$ 5.68	3.65 $\pm$ 0.81
Controls	14.9 $\pm$ 0.69	32.77 $\pm$ 1.26	2.71 $\pm$ 0.10	8.40 $\pm$ 3.18	88.65 $\pm$ 3.39	3.15 $\pm$ 0.25
P-value	0.021	0.009	0.034	0.045	0.078	0.048

segments that progressively get wider from the front to the back. It has a pale color, completely covered in tegument, elongated, and flat dorso-ventrally. The head section, known as the scolex, the unsegmented neck or growth region, and the body proper, known as the strobila, make up the complete body.

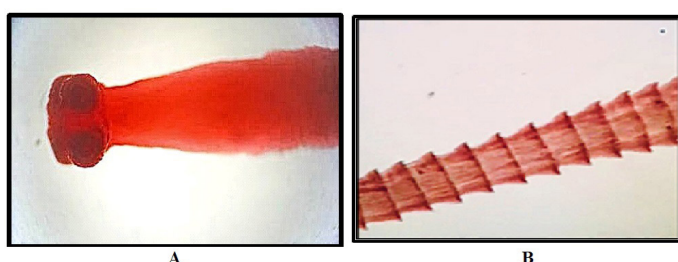


Figure 1: *Raillietina echinobothrida* (acetocarmine stain). **A:** Scolex (40 X); **B:** Mature proglottids (40 X).

RAILLIETINA CESTICILLUS: This species is easily identified from other birds by its large scolex with a broad rostellum, bright white color, and absence of neck. This massive, powerful tapeworm, which can reach a length of 15 cm, deeply embeds its scolex in the mucosa of the duodenum or jejunum. The unique, broad, flat rostellum has a double row of 300–500 hammer-shaped hooks that operate as a retractable piston, pushing in to the scolex's outer sleeve and providing the mucosa with a firm grip. It has four feeble, unarmed suckers (Figure 2).

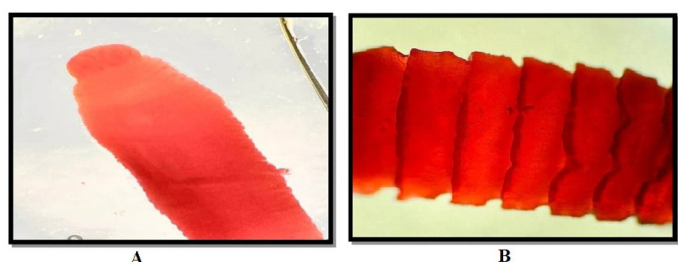


Figure 2: *Raillietina cesticillus* (acetocarmine stain). **A:** Scolex (20 X); **B:** Gravid proglottide (40 X).

HETERAKIS GALLINARUM: This small white caecal worm has three tiny, equal-sized lips on its mouth in addition to two lateral membranes that almost completely round its body. The vulvar apparatus is housed in a fully developed bulb at the end of the worm's distinctive oesophagus. The male, which has long alae with 12 pairs of papillae and a fully formed preanal sucker, is 7–13 mm in length. The left spicule is big and is 0.37–1.9 mm in length, whereas the

right spicule is thin and measures 2 mm. The spicules are not equal. About 10 to 15 mm is her length. Its visible vulva is located around midway down the body (Figure 3).

FEMALE EPOMIDIOSTOMUM SP.: Excretory hole, Pharynx, and Vulva region (located from the anterior end of the body). There is a nerve ring, however it is distant from the anterior end. The smooth vulva is situated behind the midsection of the body, a distance from the posterior end. The body visibly narrows behind the anus.

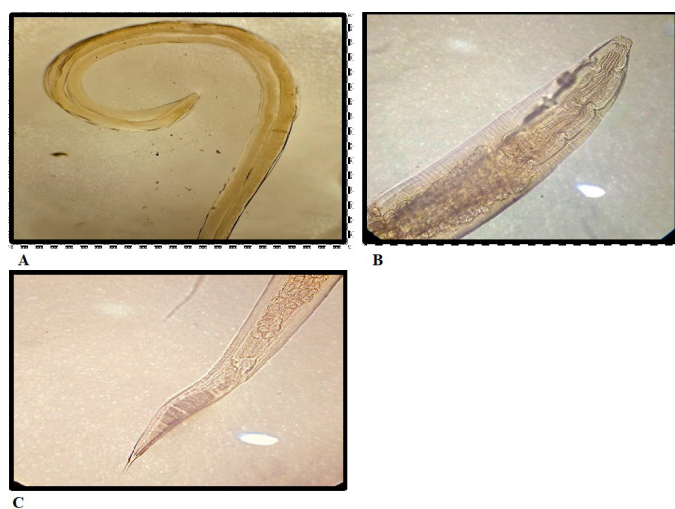


Figure 3: *Heterakis gallinarum* **A, B:** Anterior portion of Female (20X); **C:** posterior portion of Female (40X).

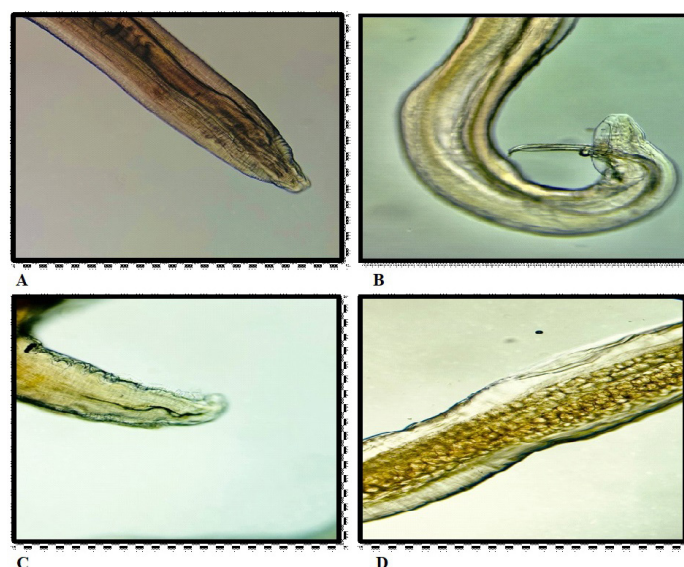


Figure 4: *Epomidiostomum* sp. Female; **A, B:** Anterior and posterior portion of male (20X); **C:** Posterior portion of Female (20X); **D:** Egge (20X).

Histological examination of many intestinal sections showed heterophilic infiltration together with villi and mucosal gland loss and degradation. Edematous villi associated with cell necrosis. the wall of the small intestine showing fibrosis in lamina muscularis mucosae, with the presence of blood bleeding and inflammatory cells (Figure 5). Erosion and degeneration of the mucosa layer, with the appearance of ulcer and irregularity of the muscular layer (Figure 5), and transformation of the muscle layer into fatty tissue and the complete destruction of all layers of the intestine (Figure 6). Necrosis of the epithelial cells of the mucosa layer, necrosis of the muscle layer, and shedding of the epithelial cells towards the intestinal lumen (Figure 6).

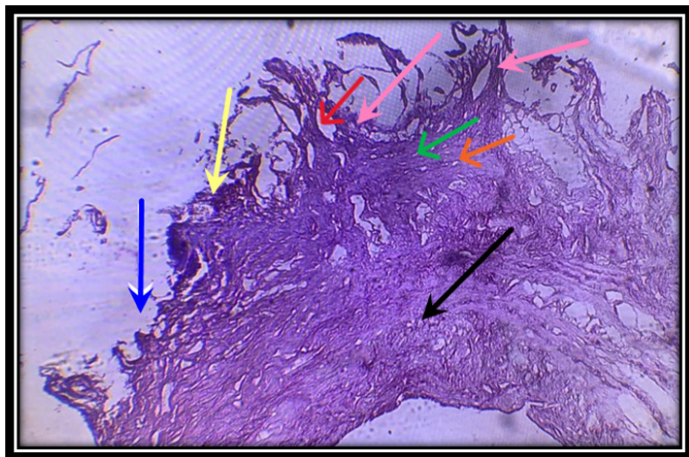


Figure 5: A cross-section of the wall of the small intestine showing fibrosis in lamina muscularis mucosae(), with the presence of blood bleeding (), inflammatory cells (), erosion (), degeneration of the mucosa layer(), with the appearance of ulcer() and irregularity of the muscular layer(). (400X).

ISOLATION OF HELMINTHES

The general morphological characterizations of *Railletina echinobothrida* and *Railletina tetragonain* in the current study correspond with previous descriptions (Elmajdoub *et al.*, 2023), recorded this study prevalence rate of infected with tapeworms in local chickens (11%).

The high overall prevalence of infection with gastrointestinal helminthes that were observed in this study (86.6%) confirmed the report of (Afa *et al.*, 2019) that gastrointestinal helminthes in local chicken countries may be close to 100% and, the same percentage was recorded in Kenya (Wamboia *et al.*, 2020). (Mathews *et al.*, 2024), found that the overall prevalence of infection was 87%.

One of factors that may be responsible for the high prevalence rate of gastrointestinal helminthes recorded in this study include a favorable climatic condition which encourages the development of the helminthes, another factor that might be responsible for the high prevalence free feed-

ing, this method allows chickens to roam freely in search of food thereby feeding on insects and other soil dwelling invertebrates (Adekola and Promise, 2023).

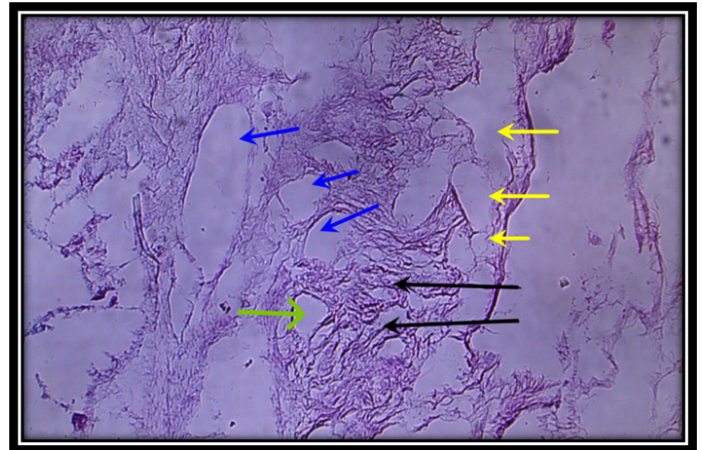


Figure 6: A cross-section of the large intestine showing the transformation of the muscle layer into fatty tissue and the complete destruction of all layers of the intestine(), necrosis of the epithelial cells of the mucosa layer(), necrosis of the muscle layer (), and shedding of the epithelial cells towards the intestinal lumen().(1000X).

In this study, Cestode is found to be the most prevalent followed by Nematoda. This data is similar to the reports of (Abah *et al.*, 2019) who recorded a higher prevalence in Cestodes especially *Railletina spp.* than Nematodes in their studies. However, these results disagree with (Adekola and Promise, 2023) in Nigeria which found that Nematodes are found to be most prevalent followed by Cestodes. We think that the reason for the high infection rate is consistent with what was mentioned in (Ayeh-Kumi *et al.*, 2016). The reason for this could be attributed to the scavenging habit of local chickens, which involves searching for food in places like soil, drains, dumpsite etc. This behavior could expose them to parasitic organisms thus allowing individual birds to contact one or more forms of gastrointestinal parasites.

The most common Cestode in this study was *Railletina echinobothrida* 71.15% higher than other Cestode. This result agrees with (Elmajdoub *et al.*, 2023) in Libya where they found that the infection rate of *R. echinobothrida* was 54.5%, and (Wamboia *et al.*, 2020) in Kenya reported that the infection rate of *R. echinobothrida* was 33.3 %. Additionally, (Mathews *et al.*, 2024) mentioned that *R. echinobothrida* was the most dominant with a prevalence of 72.67%. *R. echinobothrida* is one of the most common types in domestic chickens (Islam *et al.*, 2020).

A nematode, *Ascaridia galli* had the highest prevalent rate among other helminthes that was recovered in this study. The result of this study is similar to reports of (Adekola and Promise, 2023) in Nigeria as the commonest and important helminthes of poultry. *A. galli* infection which causes mild/

acute enteritis, hinders vital nutrients absorption and lowers erythropoiesis (Wamboia *et al.*, 2020). *Heterakis gallinarum* was detected in the small intestine and caecum of 21.15% of chickens, this result was accepted with (Taweya *et al.*, 2020). *Epidimiosomum* sp. was recorded in experimentally infections of chickens (Al-Mayali, 2009).

HEMATOLOGICAL PARAMETERS

The concentrations of Hb, PCV, and RBC were decreased as a result of parasitic influence on the hematological parameters. The tapeworms caused iron and copper deficiency. Some types of Cestoda penetrate the villi deeply, resulting in hemorrhagic enteritis and necrosis in cases of severe infection. Birds are impacted by intestinal worms because they cause nutritional depletion by removing necessary nutrients from the digestive system (Demis *et al.*, 2015; Berhanu and Dessie, 2014).

Blood loss is caused by a certain kind of Nematoda. Heavy infections are associated with bloody diarrhea and hemorrhagic enteritis. This is most likely the result of multiple factors, particularly a vitamin B12 deficiency, which can cause large but few red blood cells to form, malabsorption, and gastrointestinal blood loss from an infection with intestinal parasites (Belete *et al.*, 2016; Aade and Wankhede, 2022).

This result agreed with (Taweya *et al.*, 2020) in Ethiopia, (Bhure *et al.*, 2011) in India and (Anah *et al.*, 2017) in Al-Diwaniyah city who study the cestode in domestic chickens and their effect on some hematological parameters.

While, the WBCs were elevated in this study it may be an immune reaction against the parasite and the infectious process, and this response in turn may also contribute to reducing the effect of the parasite on the bird and the possibility of bird continuing to live and survive death (Ibrahim, 2013), this result agree with (Bhure *et al.*, 2010) in India and (Anah *et al.*, 2017) in Al-Diwaniyah city. The average rise in lymphocytes between positive and negative chickens (Al-Obaidi, 2011; Al-Abady *et al.*, 2016; Naza *et al.*, 2023) observed a similar finding, The influence of the intestinal and caecal inflammation may be responsible for the increase in the lymphocyte count. Because humeral antibody production, cell-mediated immunity, and immunological response are the main functions of lymphocytes, chronic antigenic stimulation may lead to a significantly increased circulating lymphocyte pool (Taweya *et al.*, 2020).

The proportion of granular blood cells is an indicator of the immune and inflammatory response of chickens infected with tapeworms. According to some studies, tapeworm infection can lead to a decrease in the proportion of total granulose blood cells, which are the cells responsible for fighting parasites and allergies. It is believed that these changes are reflected in the effect of tapeworms on blood

and immune functions in chickens, this result agree with (Anah *et al.*, 2017) in Al-Qadisiya.

The study concluded that tapeworms negatively affect blood standards in domestic chickens and reduce their disease resistance and productivity.

HISTOLOGY

Pathological lesions in the intestines were accompanied by the release of bloody mucus with glaucoma. This may be due to the erosion and migration of these parasites in the intestinal wall and their attachment to the intestinal layers, which makes them easy to move and travel to the deeper layers. This was confirmed by the researcher (Aldiri, 2020).

The worms caused catarrhal enteritis at the site of their attachment inside the intestine, which was accompanied by hyperplasia and the formation of granulomas, which is considered to be of pathological importance because it causes a decrease in the efficiency of intestinal flora in absorbing nutrients, and this was confirmed by researchers (Mushattat *et al.*, 2022).

During histological examination, it was revealed that there was necrosis in the intestinal villi and destruction of epithelial cells where the worm's head attached. This led to the infiltration of white blood cells in response to the inflammatory reaction, and this is consistent with that reported previously (Yagoob *et al.*, 2017).

Worm toxins can occasionally be secreted together with the secretory and excretory (E/S) products of the worms. These toxins disrupt the intestine's enzymatic function and make it harder for nutrients to pass through the intestinal membrane. (Shohana *et al.*, 2023).

CONCLUSIONS AND RECOMMENDATIONS

According to the findings of this study, local chicken in Thi-Qar province have a high prevalence rate of gastrointestinal helminthes (cestode and nematode). The infection influenced blood parameters and caused histological changes in the intestinal tract. The frequency and biological variables that have a major impact on the helminth population require more investigation. Consequently, the local chicken's infection rate will decline. Raising the level of education for breeders of chickens by extending testing and administering the necessary vaccinations to safeguard the birds. Therefore, in order for farmed hens to provide as wholesome food for humans, they must be kept free from parasitic infections.

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The authors sincerely thank the Research Laborato-

NOVELTY STATEMENT

The novelty of our research is that it includes studying the effect of parasitic infection in domestic chickens, which are considered an important source of human food, with few studies in Dhi Qar Governorate that include the effect of this infection on blood parameters and tissue changes in infected chickens.

AUTHOR'S CONTRIBUTION

A. RK. Conceptualization. Sample collection, methodology (worms' isolation and diagnosis, staining), first draft writing.

H. ZS. Sample collection, methodology (worms' isolation and diagnosis, staining), methodology supervised, first draft writing- editing- and corresponding.

H. ZA. Material preparation and supplies, blood parameters analysis, formal analysis.

M. SK. Sample collection. blood parameters analysis, Histology work.

CONFLICT OF INTEREST

The authors have declared no conflict of interest.

REFERENCES

- Aade PU, Wankhede JH (2022). Effect of a new species *Cotugnia wankhedii* Sp. NOV Cestode parasites on haematological parameters in *Gallus gallus domesticus*. *Asian J. Adv. Res.*, 5(1):791-795.
- Abah HO, Idota EE, Adamu M (2019). Gastrointestinal helminths of local chickens slaughtered in live bird markets in Makurdi Metropolis, Benue State, Nigeria. *Niger. J. Parasitol.*, 40(1): 314-317. <https://doi.org/10.4314/njpar.v40i1.20>
- Abbott Diagnostic Division (2008). Cell- Dyn Ruby System Operators Manual.
- Adekola SS, Promise EA (2023). Prevalence of gastrointestinal helminths of local chickens (*Gallus gallus domesticus* Linnaeus, 1758) in Modakeke, Ile-Ife, Osun State, Southwestern, Nigeria. *Environtropica – An Int. J. Trop. Environ.*, 18: 021-029 .
- Afia UU, Usip LR, Udoaka UE (2019). Prevalence of gastrointestinal helminths in local and broiler chickens in Ibesikpo Local Government Area, Akwa Ibom State, Nigeria. *Am. J. Zoolog. Res.*, 7(1): 1-7.
- Al-Abady FA, Al-Snafi AE, Al-Ghezy ZS (2016). Diagnosis and quantitative detection of *Toxoplasma gondii* in male and female laboratory rats using qReal -Time PCR. *Pharm. Chem. J.*, 3(2): 122-130.
- Al-Aredhi HS, Al-Mayali HM (2020). Molecular diagnosis of zoonosis parasitosis between human and aquatic birds in AL-Delmaj Marsh, Iraq. *Biochem. Cell. Arch.*, 20(1): 1673-1677.
- Aldiri MFA (2020). Prevalence of tapeworm infestation in laying hens in Hama Governorate. MSc thesis, Hama University. Faculty of Veterinary Medicine. Dep. Anim. Dis., Syria.
- Al-Mayali HMH (2009). Prevalence and distribution of gastrointestinal helminths in local chickens in Al-Diwaniya region. *J. Wasit Sci. Med.*, 2(1): 56-77.
- Al-Obaidi NAH (2011). Detection of heat shock protein 70 among aborted women infected with *Toxoplasma gondii* in Thi-Qar governorate. MSc thesis, Thi-Qar Univ. Coll. Educ. Pure Sci., Iraq.
- Anah SA, Alwan MS, Al-Ibrahimi LA (2017). Effect of the infection of cestode in some hematological standards in domestic chicken. *Al-Qadisiyah. J. Pure Sci.*, 22(3): 175-181.
- Ayeh-Kumi PF, Larbie NG, Michael OT, Forson OA (2016). Prevalence of gastrointestinal parasites in chickens sold in some major markets in Greater Accra, Ghana. *Int. J. Poult. Sci.*, 15: 335-342. <https://doi.org/10.3923/ijps.2016.335.342>
- Bancroft J, Steven A. (2012). Theory and practice of histological techniques. Churchill livingstone, London.
- Belete A, Addis M, Ayele M (2016). Review on major gastrointestinal parasites that affect chickens. *Journal of Biology, Agric. Healthc.*, 6:(11): 11-21.
- Berhanu M, Dessie S (2014). Gastrointestinal helminthes of chickens in outskirts of Hawassa, Southern Ethiopia. *Global Vet.*, 12:557-561.
- Bhure DB, Nanware SS, Kardile S P, Dhondge RM (2010). Haematological Parameters of *Columba livia* infected with helminth parasites in Aurangabad District, (M. S) India. *The Escosphere, An Int..Biannual. J. Environ. BioL. Sci.*, 1(1): 133-135.
- Bhure DB, Naware SS, Kardile SP, Hafeez M (2011). Haematological observation of *Gallus gallus domesticus* infected with *Cotugnia dignopora*. *Res. Sci. TechNOL.*, 3(9): 15-16.
- Calnek BW, Barnes HM, Dougald LR, Beard CW, Saif YW (1991). *Disease of Poultry*. Ames Press, USA.
- Dacie JV, Lewis SM. (1991). *Practical textbook of haematology*. 7th ed. Edinburgh: Church Livingstone. p. 37-85.
- Demis C, Anteneh M, Basith A (2015). Tapeworms of poultry in Ethiopia: A review. *Br. J. Poult. Sci.*, 4(3): 44-52.
- Elmajdoub LO, Mousa M, Omar MA, Sorour SS (2023). Prevalence and morphological characterization of intestinal cestode parasites in local chickens (*Gallus gallus domesticus*) and pigeons (*Columba livia domesticus*) from Misurata, Libya. *Compend. Sci. Vet.*, 13(01): 17-21.
- Gibbons LM, Jones A, and Kahlil LF. (1996). *Laboratory manual for eighth international training course on identification of parasites of economic importance*. UK: CABI. Institute of Parasitology.
- Ibrahim A (2013). Hematological and some biochemical values of indigenous chickens in Al-Ahsa, Saudi Arabia during summer season. *Asian J. Poult. Sci.*, 6:138-145. <https://doi.org/10.3923/ajpsaj.2012.138.145>
- Islam MS, Dey AR, Shanaz P, Thahsin F, Mohammad ZA (2020). Intestinal parasitic infection in commercial chickens in Sirajgonj. *J. Bangladesh Agril. Univ.*, 18(1):111-116. <https://doi.org/10.5455/JBAU.94747>
- Jha AK (2019). Histopathological studies of tapeworm *Raillietina tetragona* (Molin, 1858) from the gastro-intestine of indigenous chicken (*Gallus domesticus* L.) farming in

- Kirtipur, Nepal. *Int. J. Vet. Sci. Anim. Husbandry*, 4(4): 01-06.
- Jilo SA, Abadula TA, Abadura SZ, Gobana RH, Hasan LA, Nair SP (2022). Review on epidemiology, pathogenesis, treatment, control and prevention of gastrointestinal parasite of poultry. *Inte. J. Vet. Sci. Ani. Husbandry*, 7(5): 26-34. <https://doi.org/10.22271/veterinary.2022.v7.i5a.439>
- Khalil LF, Jones A, Bray R (2006). *Keys to the cestoda parasites of vertebrates*. Oxford Shire, CAB International.
- Mathews A, Pasupuleti J, Shameem U (2024). Prevalence of gastrointestinal helminth parasite infections in country chicken from Visakhapatnam District, Andhra Pradesh India. *J. Parasitic Dis.*, 48(1): 95-107. <https://doi.org/10.1007/s12639-023-01644-0>
- Mushattat SJ, AL-Saedi MRM, Haber SH (2022). Histopathological changes in the gastrointestinal tract of local chickens infected with parasite *Choanotaenia infundibulum*. *Uttar Pradesh J. Zool.*, 43(8): 48-54. <https://doi.org/10.56557/upjoz/2022/v43i83012>
- Naza S, Rafiquea A, Ashrafa A, Batoolb S, Alhidarycand IA, Shamsi S (2023). Haematological alterations under the anti-helminthic application in *Pavo cristatus*. *J. Appl. Anim. Res.*, 51(1): 630-636. <https://doi.org/10.1080/09712119.2023.2265955>
- Nnadi PA, George SO (2010). A cross-sectional survey on parasites of chickens in selected villages in the sub humid zones of South-Eastern Nigeria. *J. Parasitol. Res.*, 14(6):18-24. <https://doi.org/10.1155/2010/141824>
- Ohaeri CC, Okwum C (2013). Helminth parasites of domestic fowls in Ikwuano, Abia State Nigeria. *J. Nat. Sci. Res.*, 11(3): 1-5.
- Permin A, and Hansen JW. (1998). *Epidemiology, diagnosis and control of poultry parasites*. Rome: Food and Agriculture Organization of the United Nations.
- Schmidt GD (1986). *Handbook of tapeworm identification*. CRC Press. Inc. Florida.
- Shifaw A, Feyera T, Walkden-Brown SW, Sharpe B, Elliott T, Ruhnke I (2021). Global and regional prevalence of helminth infection in chickens over time: A systematic review and meta-analysis. *Poult. Sci.*, 100(5): 101082. <https://doi.org/10.1016/j.psj.2021.101082>
- Shohana NN, Rony SA, Ali MH, Hossain MS, Labony SS, Dey AR, Farjana T, Alam MZ, Alim MA, Anisuzzaman (2023). *Ascaridia galli* infection in chicken: Pathobiology and immunological orchestra Immunity, Inflammation and Disease.11: e1001. <https://doi.org/10.1002/iid3.1001>
- Singh M, Kaur P, Singla LD, Kashyap N, Bal MS (2021). Assessment of risk factors associated with prevalence of gastrointestinal parasites in poultry of central plain zone of Punjab, India. *Vet. World.*, 14(4): 972-977. <https://doi.org/10.14202/vetworld.2021.972-977>
- Taweya D, Waktole H, Tolossa YH (2020). Hematological and serum changes associated with gastrointestinal helminthes infection in naturally infected scavenging chicken in and around Bishoftu, Ethiopia. *Adv. Biol. Res.*, 14(3): 119-125.
- Thyagarajan D (2011). *Diseases of poultry*. 1st ed. Delhi: Satish Serial Publishing House. New Delhi, India.
- Van NTB, Yen NTP, Nhung NT, Cuong NV, Kiet BT, Hoang NV, Hien VB, Chansiripornchai N, Choisy M, Ribas A, Campbell J, Thwaites G, Carrique-Mas J (2020). Characterization of viral, bacterial, and parasitic causes of disease in small-scale chicken flocks in the Mekong Delta of Vietnam. *Poult. Sci.*, 99(2): 783-790. <https://doi.org/10.1016/j.psj.2019.10.033>
- Wamboia P, Waruirua RM, Mbuthiaa PG, Nguhiub GM, Beborra LC (2020). Haemato-biochemical changes and prevalence of parasitic infections of indigenous chicken sold in markets of Kiambu County, Kenya. *Int. J. Vet. Sci. Med.*, 8(1): 18-25. <https://doi.org/10.1080/23144599.2019.1708577>
- Wuthijaree K, Tatsapong P, Yung-Rahang S, Thirawong P, Pongmance K (2024). Prevalence of Natural Gastrointestinal Helminth Infection of Thai Indigenous Chickens Aged 12-18 Weeks in Small-Scale Chicken Farms on River Plains in Central Thailand. *Adv. Anim. Vet. Sci.*, 12(4): 693-702. <https://doi.org/10.17582/journal.aavs/2024/12.4.693.702>
- Yagoob G, Khaki A, Feizi A, Haidar S, Raza A (2017). Epidemiological and pathological studies on the helminthic parasites in native chickens of Tabriz city, Iran. *Genet. Mol. Res.*, 16(4): 16039824. <https://doi.org/10.4238/gmr16039824>
- Yamaguti S (1959). *Systema helminthum*, Vol. II. The cestodes of vertebrates. Interscience Publishers, New York and London.
- Yamaguti S (1961). *Systema helminthium*. Vol. III. The nematodes of vertebrates, Pt. I and II. Interscience Publishers, New York and London.