

susceptible to parasitic infections from their habitats, particularly gastrointestinal parasitic infections which results in heavy financial losses. These parasitic infections cause severe health problems of growth, egg laying performance and mortality [6]. Among gastrointestinal parasites, (*H. gallinarum*) is one of the most frequently diagnosed nematodes within the digestive tract of Galliformes birds [7]. The life cycle of *H. gallinarum* is direct where the fertilized eggs are passed with litter and develop in soil within two weeks. Then, they were ingested directly or by earthworms, which acted as paratenic host [8]. *H. gallinarum* infection usually did not show any clinical signs but it might induce diffuse chronic and nodular typhlitis. Also, they could transfer the other protozoan like *Histomonas meleagridis* where the infection is transmitted through the egg of the worms inducing serious lesions in ceca and liver in turkeys more than in chicken [9-11]. So, this study was planned to investigate the prevalence, morphology, morphometric characters, and pathological lesions induced by *H. gallinarum* in domestic turkeys in Egypt.

Materials and methods

Ethical approval

All instructions and requirements have been followed in this study for handling and rearing the animals for the purpose of experimental design and research. The Animal Care and Use Committee (IACUC), Faculty of Veterinary Medicine, Zagazig University, Egypt, accepted this under approval number: ZU_IACUC/2/F/205/2023.

Birds and sampling

Ninety samples of intestinal tracts were collected from slaughtered turkeys (*Meleagris Gallopavo*) (White Dutchman and American Bronze, age of 5 – 7 months); 33 samples from the slaughterhouse at El-Salam Abattoir, Cairo Province, and 57 samples from

slaughter shops at Zagazig City Sharkia Province during the period from October 2022 until January 2024. The samples were put in plastic bags, labeled and transported in an ice tank to the Laboratory of Parasitology Department, Faculty of Veterinary Medicine, Zagazig University for further examination and identification of the parasites.

Examination of the turkey ceca for H. gallinarum

Each cecum was opened using scissor and forceps and the recovered large adult worms by naked eyes were collected. The cecal mucosa was scraped by clean and sharply edged glass slide into a large petri dish (15 cm in diameter) containing a suitable amount of tap water. The scrapings were divided into small amounts in small petri dishes (5 cm in diameter) and examined both by the naked eye and by using a dissecting microscope for the presence of parasites. The observed worms were collected, counted, and prepared for further examination.

Preparation and identification of recovered worms

After several washing with distilled water, the worms were relaxed in refrigerator and transferred into lactophenol solution for at least 24 hours for clearing. For permanent preparations, the mounting of worms was done with polyvol on clean glass slides and covered with cover slips; then slides were left to dry in a hot air oven at 40 °C for 24 – 48 hours [10]. Adult worms, juvenile stages and eggs were identified microscopically as previously described [11-13].

Examination of fecal samples for the presence of H. gallinarum eggs

A small part of the fecal contents was taken from the large intestine and examined for *Heterakis* species eggs using both direct wet smears and concentration sedimentation techniques as

described by Soulsby [14], Taylor and Coop [15].

Morphological and morphometric characterizations of *H. gallinarum*

The recovered adult worms, including 10 males and 10 females, were subjected to detailed morphological and morphometric measurements. They were measured using a calibrated eye micrometer and photographed by an Amscope digital camera (China).

Histopathological examination

Histopathological sections were prepared from ceca showing lesions, following the technique described by Ashankyty and Amer [16]. Briefly, tissue samples (about 1cm x 1cm) were cut and kept in formalin 10%, dehydrated with alcohol, cleared in xylol, and embedded in

liquid paraffin wax. Afterward, the blocks were sectioned at 5 um by microtome, placed upon glass slides, stained by hematoxylin and eosin stain and examined microscopically.

Results

Prevalence of H. gallinarum in intestinal samples of turkey

H. gallinarum were detected in 33 (36.66%) out of 90 examined intestines of slaughtered domestic turkeys. The worm burden or intensity of infection was 1-73 worms per infected bird with a mean of 22 parasites. Regarding localities, out of 57 samples collected from Zagazig City, Sharkia Province, 33 (57.89%) were positive; while all the 33 samples collected from the slaughter house at El-Salam Abattoir, Cairo province were negative (Table 1).

Table 1: Prevalence of *H. gallinarum* in examined domestic turkeys

Sampling site	Examined	Infected	%	Intensity of infection		
				Min.	Max.	Mean
Zagazig city, Sharkia Province	57	33	57.89 %	1	73	22
El-Salam Abattoir, Cairo province	33	0	0 %	-	-	-
Total	90	33	36.66 %	-	-	-

Note: Min. – Minimum, Max. – Maximum.

Comparative Morphological characterizations in adult and juvenile stages of *Heterakis gallinarum*:

The adult worms appeared small (5-13 mm in length) and creamy white in color. Female length was 5-13 mm, which was higher than that of male worms (5-10 mm). The anterior end of the worms

appeared slightly curved with three well defined lips. The oesophagus extended distally forming a well-developed bulb. The cuticle had lateral allae. The later began around lips and extended to the whole length of the adult worm (Figures 1A and B).

Male adult worms

They had a stylet-like tail end with pseudobursa. The pseudobursa developed as lateral wings that tapered smoothly toward posterior end. It is characterized by the presence of round chitinized

preanal sucker and 12 pairs of papillae: 2 preanal pairs, 4 postanal pairs, and 6 adanal pairs. The spicules were unequal and the left one was longer than the right one with a tapered sharp end (Figures 1C-E).

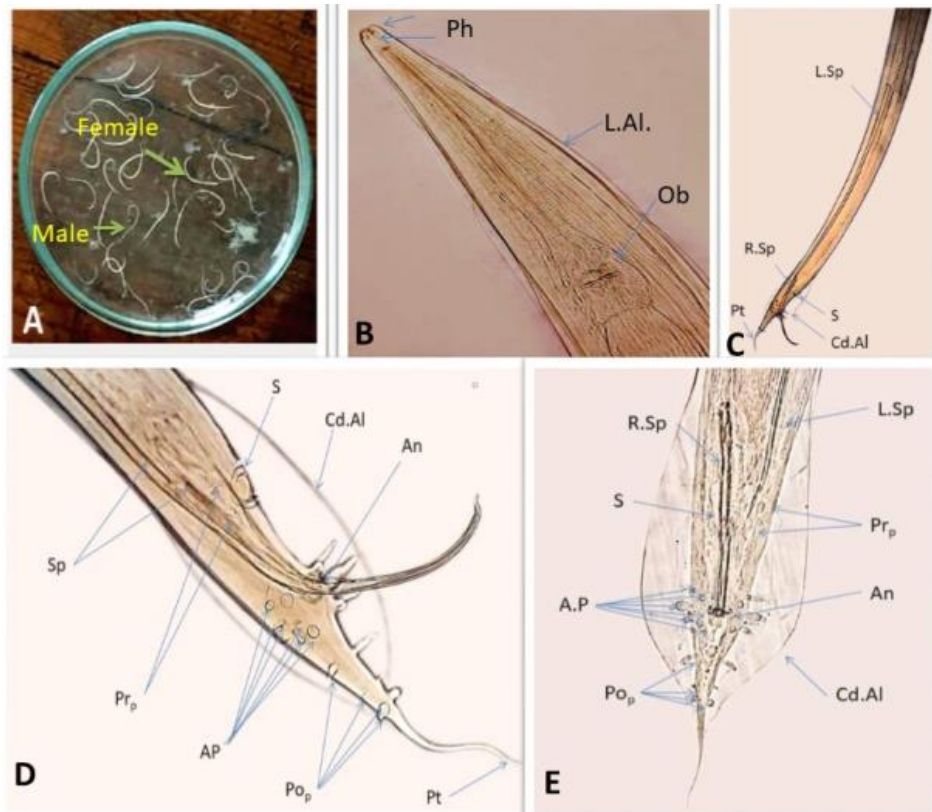


Figure 1. A: Adult worms of *H. gallinarum* obtained from ceca of domestic turkeys (digital camera); B: Anterior end of adult worms (X100); C: Adult *H. gallinarum* male posterior end, Lateral view showing unequal spicules (X100); D: Adult *H. gallinarum* male posterior end showing the preanal sucker, anal region & caudal papillae (X100); E: Adult *H. gallinarum* male posterior end, ventral view (X100).

Juvenile male

It appeared smaller in size than adult males, with a mean of 3.75 mm. It has a pair of unequal spicules (the mean of left spicule was 0.56 mm and the right one was 0.32 mm in length) and a preanal

sucker with a diameter mean of 0.04 mm. The terminal papillae were only presented as shown in Figures (2A- C).

The morphometric characteristics of both adult and juvenile males are shown in Table 2.

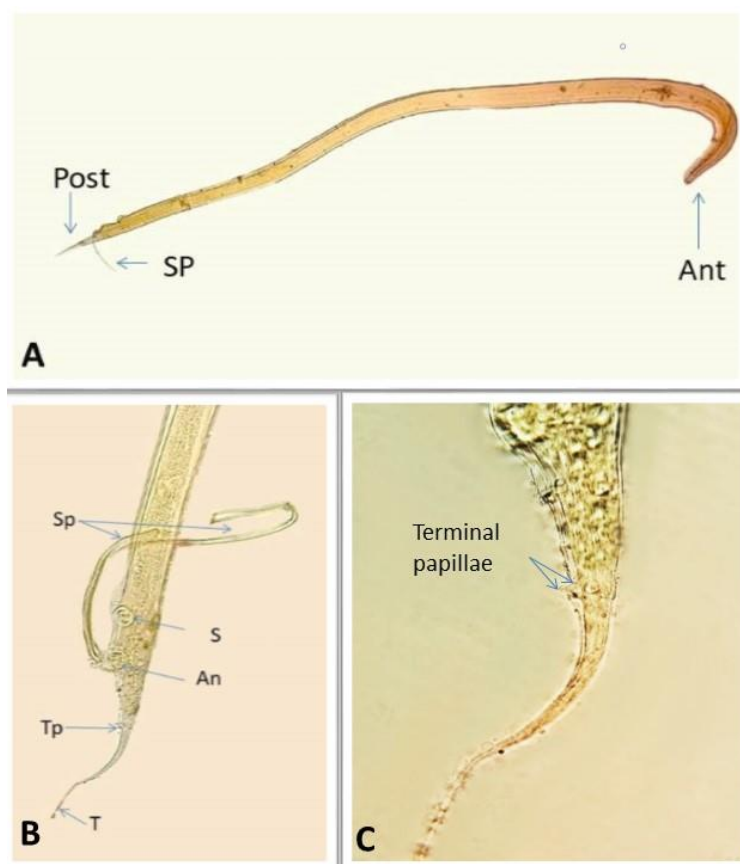


Figure 2: *H. gallinarum* juvenile male: A: Whole juvenile male (X100); B: Juvenile male posterior end (X100); C: Higher magnification of juvenile male tail region showing terminal papillae (X400).

Table 2: Morphometric characteristics of adult and juvenile male *H. gallinarum* recovered from domestic turkeys.

Item	Adult male range (mean)	Juvenile male range (mean)
Length of body (mm)	5-10(7.9)	3-6(3.75)
Width of body:		
At bulbus (mm)	0.16-0.45(0.33)	0.13-0.23(0.16)
In the middle (mm)	0.12-0.45(0.32)	0.09-0.22(0.12)
At base of wings of pseudobursa (mm)	0.11-0.13(0.19)	0.06-0.14(0.09)
Width of pseudobursa wings at:		
Preanal sucker (mm)	0.11-0.31(0.22)	0.07-0.16(0.11)
Adanal papillae (mm)	0.11-0.3(0.2)	0.06-0.15(0.09)
1 st pair of postanal papillae	0.07-0.25(0.21)	0.02-0.09(0.05)

(mm)		
Division between tail end & tail protrusion (mm)	0.03-0.09(0.08)	0.02-0.04(0.03)
Sucker diameter (mm)	0.04-0.07(0.05)	0.03-0.06(0.04)
Distance from preanal sucker to tail end (mm)	0.49-0.69(0.62)	0.33-0.67(0.45)
Length of left spicule (mm)	0.75-2.05(1.37)	0.54-0.64(0.56)
Width of left spicule:		
At proximal end (um)	22.5-60(39.55)	16-28(20)
In the middle (um)	12-30(22.5)	10-18(13)
Length of right spicule (mm)	0.36-0.70(0.57)	0.25-0.42(0.32)
Width of right spicule:		
At proximal end (um)	22.5-45(33.55)	16-32(21.5)
In the middle (um)	12-30(19.2)	8-24(13.5)

Female adult worms

The vulva was located posterior to the middle of the body (the mean was 3.8 mm from the head and 4.1 mm from the tail). There were three vaginal bends, angled posteriorly, then anteriorly, and finally directed posteriorly for another time. Also, the vulvar region is characterized by the presence of a small wart like cuticular protrusions in the vulval area. Anus was located caudally and surrounded by a pair of lips and far away from the tip by a distance of 0.9 mm (Figures 3A and B). Eggs appeared ellipsoidal, a thick smooth shell, and their length and width reached a

mean of 79.2 μm and 48.4 μm , respectively (Figure 3C).

Juvenile female

It appeared smaller than adult female worm (3 versus 8.8 mm in length) with an ill developed uterus and vulva (Figures 3D-F). The mid-portion of their bodies showed a dense band of granular material. The beginning of GIT development appeared like a central wavy line along the midline of the granular column. The morphometric characteristics of both adult and juvenile female are shown in Table 3.

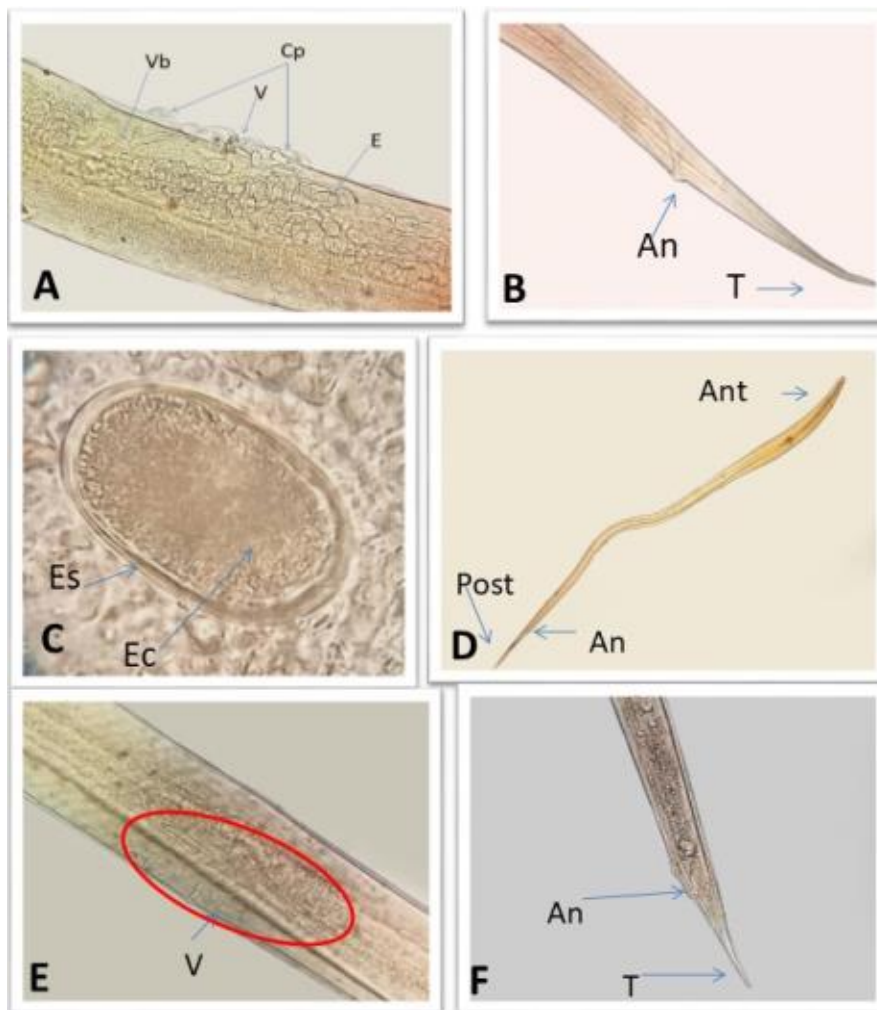


Figure3. *H. gallinarum* adult & juvenile female; A: Adult female vulval area (X400); B: Adult female posterior end (X400); C: Egg (X400); D: Whole juvenile female (X100); E: Juvenile female vulval area showing ill developed female genitalia (red circle) (X400); F: Juvenile female posterior end (X100).

Table 3: Morphometric characteristics of adult and juvenile female *H. gallinarum* recovered from domestic turkeys.

Item	Adult female range (mean)	Juvenile female range (mean)
Length of body (mm)	5-13(8.8)	2-4.5(3)
Width of body:		
At bulbus (mm)	0.19-0.48(0.35)	0.07-0.21(0.13)
In the middle (mm)	0.18-0.46(0.35)	0.07-0.15(0.11)
At vulval area (mm)	0.18-0.48(0.35)	0.1-0.17(0.13)
At anus level (mm)	0.08-0.19(0.15)	0.04-0.07(0.06)
Distance:		
From vulva to last cuticular protrusion (um)	285-600(337.8)	-

From anus to tail end (mm)	0.69-1.15(0.92)	0.22-0.66(0.38)
From vulva to head (lips)	2.1-5.28(3.8)	1.42-2.85(2.06)
From vulva to tail end (mm)	2.44-6.76(4.16)	1.41-2.50(1.77)
From vulva to anus (mm)	2.01-5.7 (3.24)	0.99-1.95 (1.29)
Egg length (um)	68-88 (79.2)	-
Egg width (um)	44-52 (48.4)	-
Egg shell width (um)	4.0	-
Inner surface of egg (um)	36-44(40.4)	-

Gross lesions and histopathological findings:

The macroscopical lesions of the infested caeca with *H. gallinarum* appeared in the form of a congested and thickened mucosal layer with numerous nodules.

The observed nodules differed in shape and colors from small pink to dark-brown or reddish, 1-3 mm in diameter, and with or without a central opening (Figure 4).

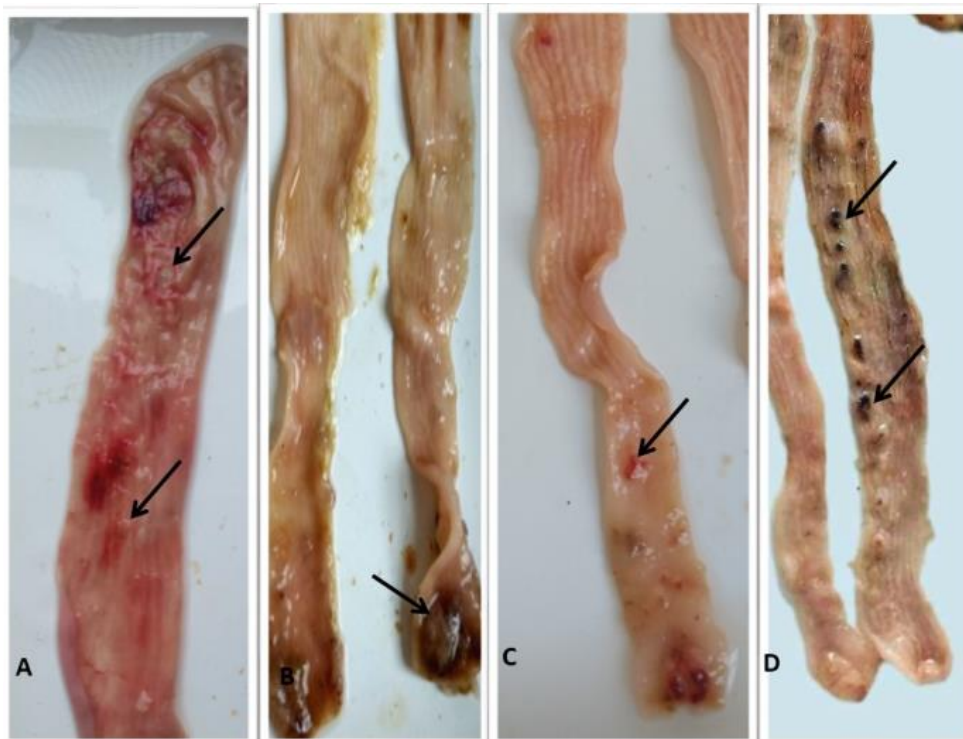


Figure 4: Macroscopic lesions of *Heterakis gallinarum* in caeca of infested turkeys; A: Congested cecal mucosa; B, C and D: various shapes of nodular lesions of infected cecal mucosa (digital photos).

The microscopical findings of the cecum showed an invaginated cecal mucosa, which is devoid from the surface epithelium towards the musculosa to form "cecal diverticulum". The mucosa showed an eroded surface with round cell infiltrations within lamina propria. Other examined fields showed diffuse granuloma within submucosal layers and cystically dilated crypts which filled with

desquamated epithelium, mucoid substance, necrotic debris, and inflammatory cells. The granuloma formed from chronic inflammatory cells primarily lymphocytes, macrophages laden hemosiderin pigment, multinucleated giant cells, dysplastic, and some crypts epithelium were also seen (Figure 5).

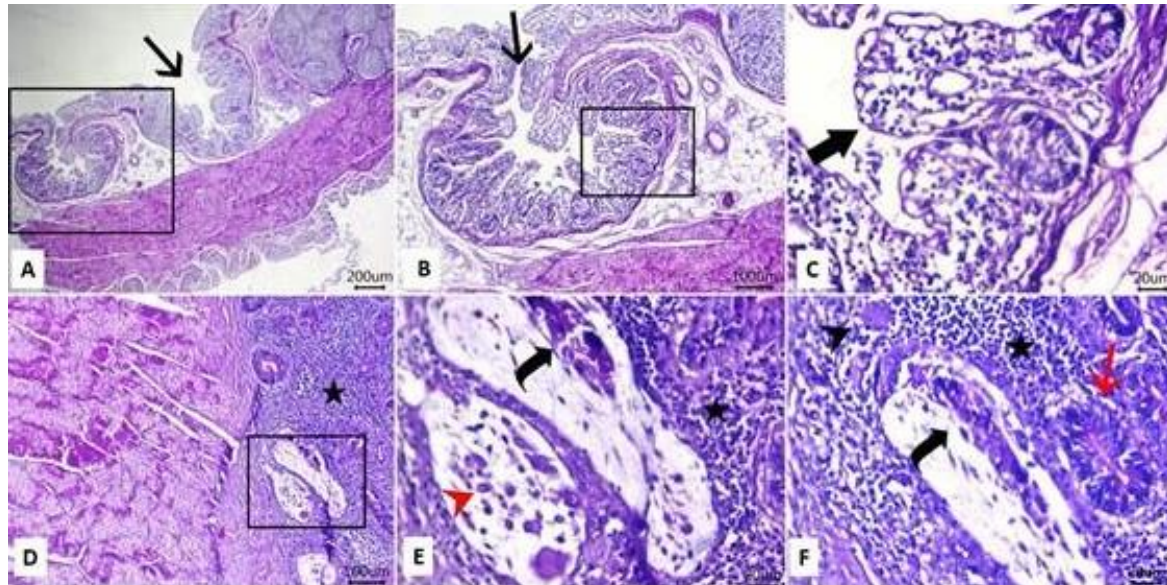


Figure 5: Photomicrograph of H&E stained sections from cecum infested with *Heterakis gallinarum* showing: A & B: Invaginated cecal mucosa (arrows) towards the musculosa; C: Eroded mucosal surface (thick arrow) with round cells infiltrations within lamina propria; D, E & F: Diffuse granuloma within submucosal layers (star) formed from chronic inflammatory cells primarily lymphocytes (stars), macrophages laden hemosiderin pigment and multinucleated giant cells (black arrowhead) beside presence of cystically dilated crypts filled with desquamated epithelium (red arrowhead), necrotic debris (curved arrows) and mucoid substance, in addition to, dysplastic some crypts epithelium (red arrow). (Scale bar A, B, C, D, E & F 200, 100, 20, 100, 20 & 20 μm respectively).

Cecal sections showed "chronic nodular typhlitis" with ulcerated surfaces and atrophied crypts. The nodules were seen within mucosal and submucosal layers (Figures 6A-D). Sections from infected cecum showed larval migratory tract within a deep submucosal layer and surrounded by fibrotic capsule. The tract

was formed from necrotic debris and necrotic inflammatory cells. Next to the migratory tract, there were focal giant cell granulomas, which were formed mainly from multinucleated cells and macrophages and were surrounded by a capsule called "granulomatous typhlitis" (Figures 6E- H).

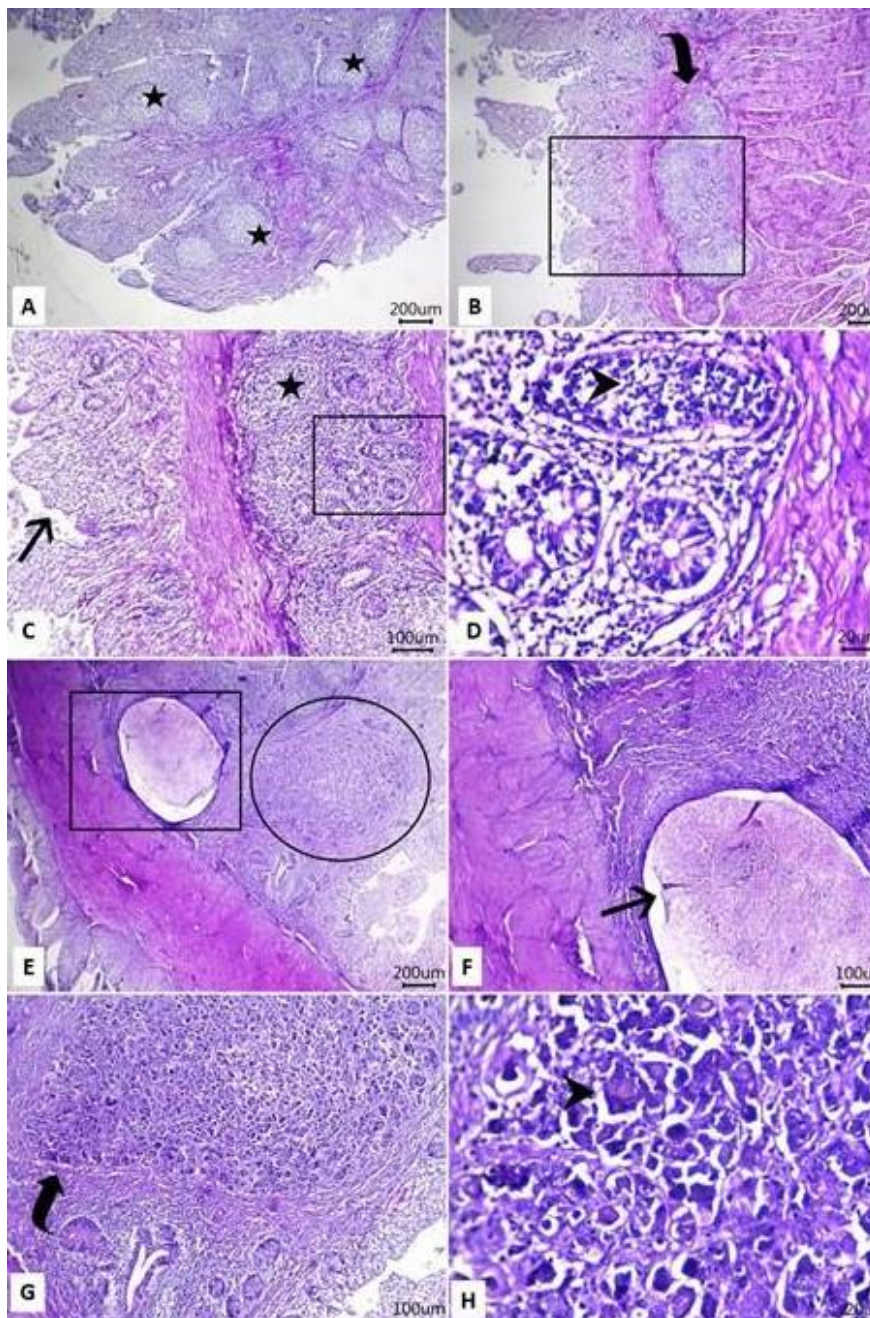


Figure 6: Photomicrograph of H&E stained sections from cecum infested with *Heterakis gallinarum* showing: A: Chronic nodular typhlitis (arrow) with atrophied crypts; B & C: Ulcerated surfaces (arrow) with mucosal and submucosal nodules (curved arrow) formed mainly from lymphocytes (star); D: Invaded some cecal crypts with chronic inflammatory cells in their lumina (arrowhead) (Scale bar A, B, C & D 200, 200, 100 & 20 µm respectively); E & F: Larval migratory tract within deep submucosal layer (arrow) and surrounded by fibrotic capsule; G: Focal giant cell granuloma (curved arrow) adjacent to migratory tract which formed mainly from multinucleated cells (arrowhead) and macrophages and surrounded by capsule (Scale bar E, F, G & H 200, 100, 200 & 100 µm respectively).

A cross section in *H. gallinarum* egg was also observed (Figures 7A and B). Some sections revealed numerous goblet cells with hyperplastic columnar lining epithelium and locally extensive areas of hemorrhages admixed with lymphocyte aggregates in the lamina propria. The hemorrhages were also observed at the

center of some lymphoid follicles. Obliteration of some crypts by hyperplastic epitheliums were seen within the submucosal layer, which was located in between diffuse granulomatous reactions. The latter were formed from lymphocytes, plasma cells, and macrophages (Figures 7C-F).

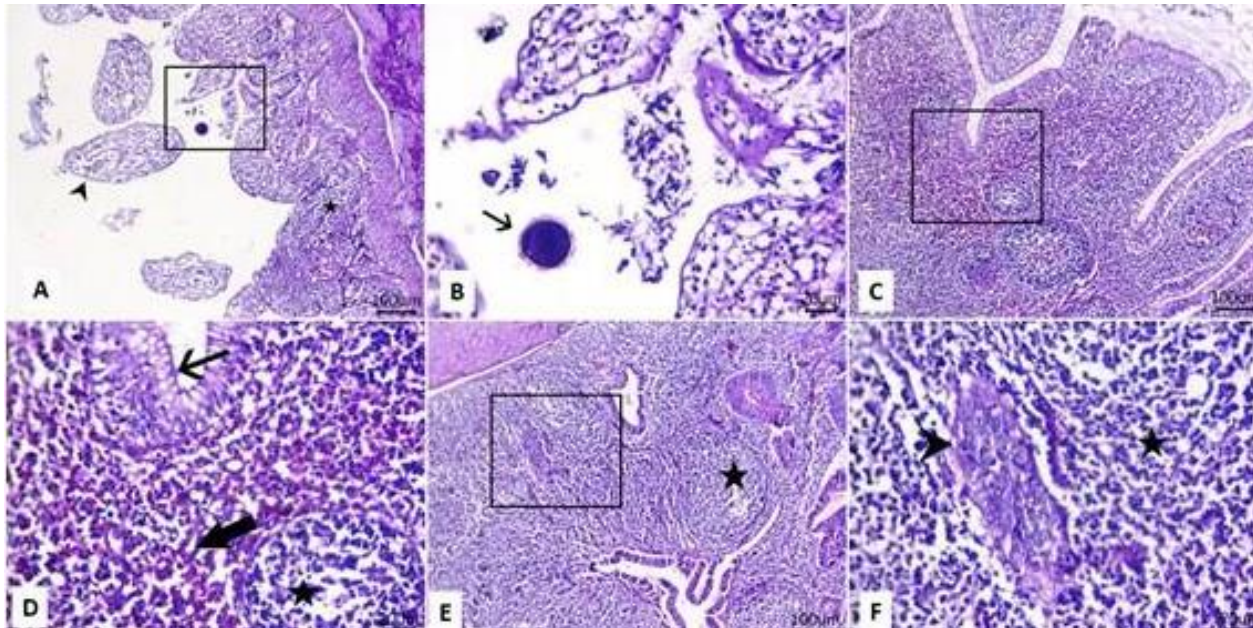


Figure 7: Photomicrograph of H&E stained sections from cecum infested with *Heterakis gallinarum* showing: A & B: Cross section in *Heterakis gallinarum* egg; C & D: Numerous goblet cells (arrow) with hyperplastic columnar lining epithelium and locally extensive areas of hemorrhages (thick arrow) admixed with lymphocytes aggregates in lamina propria and within center of some lymphoid follicles (star); E & F: Obliteration of some crypts by hyperplastic epitheliums (arrowhead) within submucosal layer which located in between diffuse granulomatous reactions (stars) (Scale bar A, B, C, D, E & F 200, 100, 100, 100, 20, 100 & 20 μm respectively).

Discussion

Heterakis gallinarum is a widely distributed cecal nematode that parasitizes many gallinaceous birds including turkeys all over the world [17]. The current study revealed that, out of 90 examined turkeys, 33 (36.66%) birds were infected with *Heterakis gallinarum*. Higher infection rates were recorded in Minas Gerais, Brazil (70%) [18], 68.6% in Colombia [19], and 62% in Dhaka City, Bangladesh [20]. While lower infection rates were reported in Punjab, Pakistan (28.3%) [21], 28% in Erbil City, Iraq [22], 16.5% in

Kathmandu, Nepal [23], 16% in Tabriz, Iran [24], 11.11% in Al-Nasiryah, Iraq [25], and 1% in Kaduna State, Nigeria [1].

In Egypt, little data was known about *H. gallinarum* prevalence. The infection rate obtained in this study (36.66%) was higher than that recorded previously in Gharbia Governorate (7.1%) [26]. The high prevalence of *H. gallinarum* infection might be due to difficult *H. gallinarum* control as a result of using low efficient anthelmintics and lower ability of disinfectants to destroy *H.*

gallinarum eggs in contaminated farms [27]. Moreover, the eggs' lifespan might reach four years [20]. Additionally, the contaminated soil and earthworms contained juvenile stages were considered as sources of bird infection [28]. The prevalence of gastrointestinal parasite infections varies between regions and countries [29]. The variance in prevalence of *H. gallinarum* in the different localities might be due to the foraging habit of turkey, different management system, poor sanitary system, environmental conditions, and the age of birds. [30,31].

The difference between the prevalence rates in Sharkia and Cairo Provinces in this study might be due to the variance in management systems. The samples collected from Zagazig City were taken from a household turkey, where they were kept in absolute freedom, feeding on many agricultural byproducts, and pastures making the prevalence high. On the other hand, the samples collected from slaughterhouse at El-Salam Abattoir were taken from turkey farms where there was great attention to the prevention and treatment of parasitic diseases using anthelmintic drugs.

In this study, worm burden was 1-73 worms with a mean of 22 parasites. This was lower than that reported by Suvarna *et al.* [18] in Minas Gerais, Brazil, who recorded a burden of 1-113 worms with a mean of 26 parasites. This difference might be attributed to the different subtypes of *H. gallinarum*, age, breed, bird susceptibility, and control-treatment system.

Dealing with the morphological characters of *H. gallinarum* adult worms recovered in this study, the worms were creamy white in color. Female length was higher than that of male worms. The anterior end of the worms appeared slightly curved with three well defined lips. The esophagus extended distally forming a well-developed bulb. The

cuticle had lateral allae. Similar descriptions and characters for *H. gallinarum* species were previously recorded [32].

Concerning the morphology of *H. gallinarum* recovered from examined turkeys in this study, adult male worms measured 5-10mm in length. Lower body length was reported by Sahu *et al.* [33] (4.75 – 6.7mm). This variance in body length might be due to another subtype of *H. gallinarum*. Males had stylet-like tail end with pseudobursa. The pseudobursa developed as lateral wings that tapered smoothly toward the posterior end. It is characterized by the presence of round, chitinized sucker. In our study, the sucker diameter was 0.05 mm lower than that earlier reported [34,35] to be 0.076 mm and 0.09mm, respectively. There were 12 pairs of papillae: 4 postanal pairs, 6 adanal pairs, and 2 preanal pairs. The same number of papillae was recorded by Tanveer *et al.* [35]. While Yevstafyeva *et al.* [36] reported that there were eleven pairs of caudal papillae and 2 unpaired presented in male *H. gallinarum* isolated from free-range chicken in Vitoria, Espirito Santo, Brazil. Males are also characterized by the presence of a pair of spicules that appeared varied in length. The left spicule was significantly longer (0.75-2.05 mm) than the right one (0.36-0.70 mm) with tapered sharp end, and this was similar to previous studies [34,37]. In contrast to the description of Permin and Hansen [8] who reported that the right spicule was almost 3 times longer than the left one and Sahu *et al.* [33] who reported that the right spicule being the longer and 1.54 -2.1 mm long while the left spicule was 0.38 – 0.65 mm long.

Concerning the morphological characters, the obtained morphological features for males were similar to those described by Tanveer *et al.* [35].

According to the metrical data, in our study, the values of most parameters in *H.*

gallinarum were lower than the values recorded by Rahman and Manap [34]. For example, length of body and left spicule were 7.9 mm and 1.37 mm, respectively. However, in prior study, they were 8.26 mm and 2.27 mm, respectively [34]. Kunwar [25] agreed with our study in diameter of preloacal sucker (0.05mm) but differ in length of left and right spicule (0.87 mm and 2.06 mm), respectively.

In this study, the female length ranged from 5-13 mm. The results were consistent with female body length recorded by Kunwar [25]. The vulva was located posterior to the middle of the body (3.8 mm from head & 4.1 mm from tail). The distance from vulva to head and to tail were 6.9 mm and 6.3 mm, respectively [25]. Brener *et al.* [20] reported that the vulva was located at the middle of the body. Values of metrical indices of female *H. gallinarum* in our study were slightly lower than those measured by Rahman and Manap [34]. For example, body length and distance from vulva to anus in our study were 8.8 mm and 3.24 mm respectively while in Rahman and Manap [34] were 9.41 mm and 3.18 mm respectively.

Eggs were ellipsoidal containing single cell with smooth, thick shell. The current results were agreed with previous study [20]. Metrical parameters of eggs in our study were lower than those recorded by Rahman and Manap [34], but similar with those recorded by Kunwar [25].

Dealing with juvenile stages, the mid portion of their bodies showed a dense band of granular material. The beginning of gastrointestinal tract development appeared like a central wavy line along the midline of the granular column. The anal opening was ill developed. This was like the description of Simoes *et al.* [38]. Juvenile female, appeared smaller than adult female worm (3 versus 8.8 mm in length) with ill developed uterus and

vulva. The juvenile female's length (3 mm) in our investigation was shorter than the juvenile female's length (9.74 mm) at day 30 as reported by Simoes *et al.* [38]. According to Mlondo *et al.* [39], the larvae's length was almost three times that of the eggs'. According to Sandaram [40], the length was 302 microns on average. According to Baker *et al.* [41], larvae were between 290 and 340 microns long. According to Roberts [42], the newly born larvae measured between 230 and 255 microns in length. In chickens infected at day 77 and necropsied 4 and 7 days post-exposure, Graybill [43] determined the average length of larvae, which came out to be 0.72 mm and 1.63 mm, respectively. A pair of uneven spicules (L.t. spicule = 0.56 mm, R.t. spicule = 0.32 mm in length) and a preanal sucker (0.04 mm in diameter) were present in the juvenile male, which was smaller in size (3.75 mm) than the adult male (7.9 mm). The length of the juvenile male was reported by Simoes *et al.* [38] to be 8.8 mm.

Difference in measurements of juvenile stages in the present and other studies may be due to stage of the juvenile worms and subtypes of *H. gallinarum*.

The macroscopical lesions of the infested ceca with *H. gallinarum* were similar to those reported by Dorman [44] in pigeon in Pakistan and Vatne and Hansen [45] in passerine bird in Japan. Sheikh *et al.* [46] reported histopathological findings of *H. gallinarum* in common pheasants as thickened, obstructed and haemorrhagic mucosa, and nodular granulomas in cecum, while submucosal findings included chronic inflammation. Whereas Tsai *et al.* [47] stated that there were degenerated and fused intestinal glands that came out as a cellular mass with a necrosis and infiltrated lamina propria in the ceca of infected chicken.

The histopathological lesions of cecum revealed intense leukocytic infiltration and chronic nodular typhlitis, the formed nodules consisted mainly of lymphocytes with few macrophages and plasma cells. Similar findings were recorded by [18,28,46,48,49]. Sandaram [40] could not to observe any nodules in the caecal mucosa of his experimentally infected birds. Wickware [50] stated that there was heavy infiltration of macrophages resulted from *H. gallinarum* infection and the size of intestinal villi was changed having pointed and blunted ends in Guinea fowl, similar lesions was also reported by Seddiek *et al.* [51] in common quail. Zghair *et al.* [52] described the histopathological findings in chicken after dual infection with *H. gallinarum* and *Histomonas meleagridis* as a complete ulceration of intestinal epithelium, severe interstitial lymphocyte, heterophil and macrophage infiltration and accumulation of fibrin exudates in caecal lumen. The histopathological sections of small areas of congestion in ceca revealed the presence of migratory larvae between the villi [38]. The tract was created by necrotic inflammatory cells and debris, and next to the migratory tract was a localized giant cell granuloma that was surrounded by a capsule "Granulomatous typhlitis" and primarily composed of macrophages and multinucleated cells. Sheikh *et al.* [46] recovered the immature *H. gallinarum* from the muscular and serosal layers of intestine of common pheasants. The muscularis layer displayed hyperplastic changes with the presence of vacuolation, congested blood vessels and hypercellularities in some crypt epithelium as reported in infected ceca of chicken in Pakistan [47].

Conflict of Interest

The authors have no conflict to declare.

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الملخص العربي

هيتراكيس جالينارم: نسبة الاصابة، الوصف الظاهري والقياسي والتغيرات الباثولوجية الناتجة في الرومي

عمر حسن محمد عامر، أحمد إبراهيم إبراهيم بدوي، غرام محمد محسن نجم، و منى محمد إبراهيم عبدالرحمن
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تنتشر عدوى هيتراكيس جالينارم في الرومي في جميع أنحاء العالم مما يسبب خسائر اقتصادية فادحة. تم إجراء هذه الدراسة لتقصي مدى انتشار هيتراكيس جالينارم في مصر. ولهذا الغرض تم تجميع وفحص وتسعون عينة من أمعاء الرومي المنزلي (ميليجريس جالوبافو) (اشتملت 57 عينة من مدينة الزقازيق بمحافظة الشرقية و 33 عينة من مجزر السلام بمحافظة القاهرة) خلال الفترة من أكتوبر 2022 حتى يناير 2024. علاوة على ذلك، تم إجراء مقارنة وصفية بين كل من الخصائص المورفولوجية

والقياسية في الديدان البالغة وتلك في طور النمو. وقد بلغت نسبة الإصابة الإجمالية 36.66%. ووصلت النتيجة الإيجابية إلى 57.89% وصفر% للعينات التي تم فحصها في مدينة الزقازيق بمحافظة الشرقية مجزر السلام بمحافظة القاهرة على التوالي. وكانت شدة الإصابة 1-73 دودة لكل طائر مصاب (متوسط 22 دودة/طائر). كما كشفت النتائج التشريحية المرضية عن وجود طبقة مخاطية سميكة مع ظهارة سطحية نخرية، وارتشاح في كريات الدم البيضاء الشديد والتهاب الأعور العقدي المزمن. كما أوضحت مقاطع من الأعورين المصابة خط سير اليرقات أثناء الهجرة داخل الطبقة التحت مخاطية عميقة محاطة بكبسولة متليفة. وعليه فقد استخلص من الدراسة الحالية التعرف على الوصف الظاهري والقياسي لديدان و أطوار النمو المختلفة سواء لذكور أو إناث هيتراكيس جالينارم.