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Prevalence of intestinal parasites in quail *Coturnix coturnix* (Linnaeus, 1758) in Iraq: A Review

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ABSTRACT: Iraq is a relatively biodiverse country, particularly rich in bird species. This is due to a combination of factors that make this location a haven for many different bird species and subspecies. Therefore, the current review revealed the prevalence of nematodes, tapeworms, and protozoan parasites in quails across different environments. Additional factors influencing parasitic infection in quails including age housing management system and the presence of another animal were identified based on their prevalence across various farms. The construction of chicken and quail farms has made this species more vulnerable to a number of poultry illnesses. Due to the paucity of research on parasitic infections in quails this article reviews prior research on intestinal parasites in quails creates a thorough database to act as a reference for researchers and highlights the importance of ongoing education regarding appropriate and preventive measures for quail intestinal parasite control.

Keywords: Bird, Classification, Egg, Gastrointestinal, Worldwide

1. INTRODUCTION

These days quails have drawn special attention due to their distinctive qualities and as a meat and egg substitute for chicken and duck. Quails are the most appropriate and productive poultry because they have a quick sexual maturation, shorter incubation times, rapid growth, efficient food conversion, and a large egg production rate [1].In addition to being resistant to a several diseases, quail production is technically and economically possible despite being the smallest birds utilized for commercial purposes [2]. Because of the distinct flavor of their meat and eggs, they have achieved economic significance in the poultry business [3]. Poultry production is the most economical and efficient way to meet this demand because it requires less initial expenditure and takes the fewest amount of time for the birds to mature [4]. As an alternative poultry business, quail farming, also called corturniculture, is typically started because of the birds' exceptional meat and egg quality as well as their many nutritional and financial advantages [5]. Due to its rapid body weight gain, short raising period, and highly sought-after products, quail farming can be a cost-effective method to make some additional cash [6]. Quail meat and eggs are high in protein and very low in fat. Products made from quail can aid in the treatment of conditions such as diabetes, hypertension, liver illness, and tuberculosis [7]. Even so, quail play a significant role in supplying the demand for animal protein.

The common quail (Coturnix coturnix), which inhabits forest regions worldwide, is one of these birds. According to [8], there are around 15 distinct species that are found all over the world. Their manifestations vary significantly based on how well they have adapted to their surroundings. Depending on the species, quail sizes vary, ranging from the larger mountain quail to the Japanese quail, which is around 10 cm tall. Quail, which have a maximum length of 25 cm. Because they don't usually move, quails tend to live in one place. Due to their beautifully colored eggs and tiny amount of meat, quails are kept as poultry in several parts of the world [9]. Quail birds typically lay their eggs in nests and breed in more open spaces, including agricultural regions. Depending on the type of quail, there can be anywhere from one to twelve eggs, and the small quail hatches from the egg.

However, like other animal species, these birds are prone to parasite infection and the development of parasite infection symptoms at specific levels, which maintains the organism in a constant balance. Because the parasite must survive in the host for a little time in order to finish its life cycle, this condition arises in wild birds that are fed infrequently, particularly raptors like hawks and eagles. Any parasite must maintain the life of the host in which it parasitizes in order to exist, hence it seeks to establish equilibrium between the two [10]. Consequently, The current investigation's objective was to determine the frequency of parasite infection.

Scientific classification of quail:

- Domain:Eukaryota
- Kingdom:Animalia
- Phylum:Chordata
- Class:Aves
- Order:Galliformes
- Family:Phasianidae
- Genus:Coturnix
- Species: ***C. coturnix***

2. PREVIOUS STUDIES IN IRAQ AND AROUND THE WORLD HAVE SHOWN THAT QUAILS ARE INFECTED WITH INTESTINAL PARASITES

Like other animal species, quail can become infected with parasites and develop symptoms of the infection at specific levels, which maintains the bird in a constant equilibrium [11]. Figure (1). Any parasite must ensure the continuation of its host's existence in order to survive. In terms of biological diversity, Iraq is among the more abundant nations, particularly when it comes to bird species.

FIGURE 1. - Quail in the breeding yard

This is because of a combination of factors that make this location a refuge for numerous bird species. In the province of Al-Diwania, [12], found that 76.7% of the quail were infected with Cryptosporidium spp. In Thi-Qar province, Southern Iraq, quails infected with coccidian have the greatest infection rate (64.54%), according to [13]. In some regions of the Salah El-Din governorate, [14], study internal parasites from quail birds, including tapeworms like Diorchis sp. and Raillietina echinobothride, as well as nematodes Ascaridia columbae, Ascaridia hemaphrodita, and Capillaria columbae, at varying rates. According to [15], the use of molecular analysis and sequencing to detect cryptosporidiosis in quails has to be more sensitive and specific in Baghdad city, Iraq Figure (2).

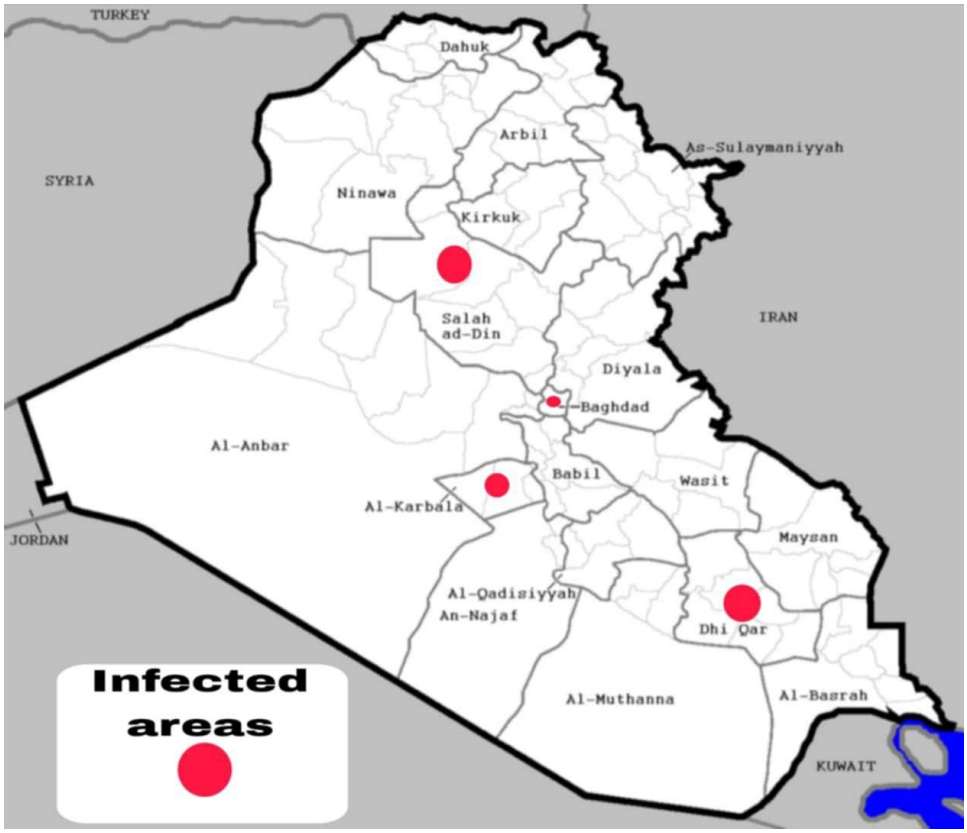

FIGURE 2. - Quail infection areas with intestinal parasites

A diverse range of nematodes, cestodes and protozoa were found in the intestinal tracts of Bobwhite quails Figure (3). These included 27 % Subulura brumpti 4 % Heterakis gallinarum 6 % unknown cestodes 45 %Trichomonas spp. 30 % Chilomastix spp. and 27 % Eimeria spp. 7% of Histomonas melegridis and 25% of Trichomonas gallinarum [16]. According to a survey of 40 Japanese and Bobwhite quails in Iran 5 % of the birds had infections with Raillietina echinobothrida and Raillietina cysticillus 20 % had intestinal cryptosporidiosis and 32–5 % had tracheal cryptosporidiosis [17]. species of capillaria. Eimeria spp. and Histomonas species. were discovered in four young Bobwhite quails that when viewed under a microscope had severe ulcerative enteritis hepatic necrosis peritonitis anorexia diarrhea and death [18]. Cryptosporidium spp. mixed infections in quails. diseases that have been linked to higher mortality rates in young quail with diarrhea include adenovirus [19] M. gallisepticum [20] and reovirus [21].

Cryptosporidiosis has been linked to respiratory problems in quails [22]. [23] discovered a number of mixed protozoan parasites such as Sphaerita spp. and Eutrichomastix globosus and Blastocystis hominis in Japanese quails that are 12 weeks old and live in the Amazon region. The protozoan parasite Histomonas meleagridis caused an outbreak of histomoniasis in southern India affecting Bobwhite quails that had high mortality rates and distinctive liver and cecal lesions [24].

During the experiment, which involved sampling the gastrointestinal tracts of freshly dead birds from local poultry slaughterhouses and screening them for endoparasites, one cestode was discovered in the small intestine of a quail. Ascaridia spp. eggs were discovered after the feces were examined. Eimeria spp. oocyst and Capillaria species. In Brazil, nine endoparasite species from the groups Cestoda, Nematoda, and Protozoa have been identified [23]. Quails infected with four different species of Eimeria according to [25, 26].

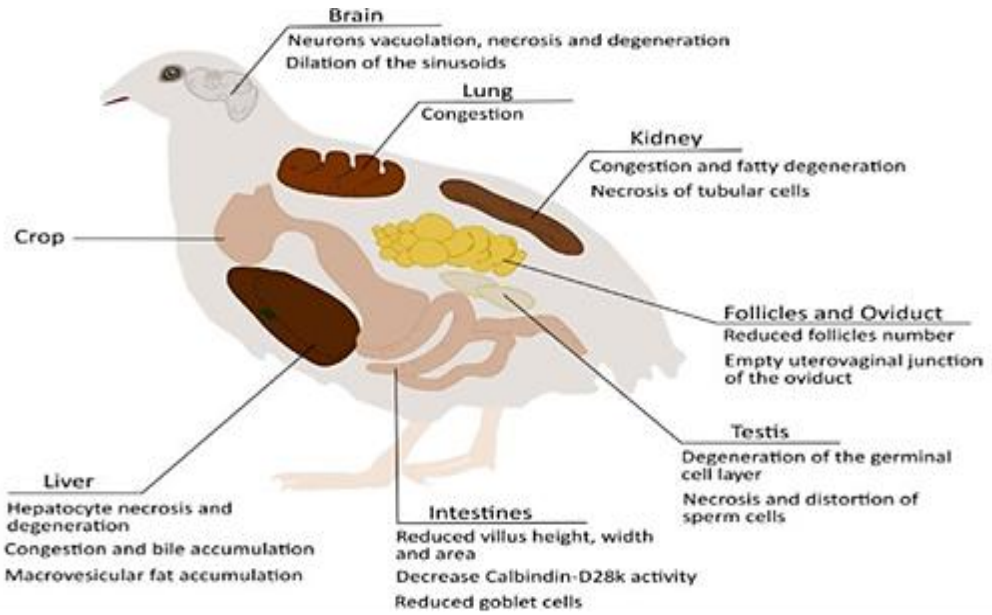

FIGURE 3. - A diagram illustrating the essential organs of the quail [27].

Parasite infestation affects nearly every species of bird kept in captivity [28]. Numerous parasitic illnesses are seen in large groups of birds kept in captivity. Feather-eating lice (Ischnocera, Amblycea) and helminthic diseases, which can be fatal, are examples of this [29]. The largest nematode found in birds' small intestines is called Ascardia galli. In domestic poultry, it is the most common and dangerous parasite. Other bird species are also susceptible to parasite infestation, which can result in anorexia, weight loss, intestinal mucosal hemorrhages, and intestinal lumen obstruction [30]. Due to a higher risk of exposure, parasitic diseases are among the most prevalent hygienic issues affecting captive birds, particularly in high density groups.

A wide range of ectoparasites can be found in birds [31].Due to their bites, these parasites have been found to cause restlessness, skin damage, stunted growth, and weight loss in birds [32]. In order to improve their quality of life on their host, parasites exhibit morphological and physiological adaptations [33]. The majority of ectoparasites have tarsal claws at the tips of their legs, which allow them to grasp onto the hairs and feathers of their hosts. Ectoparasites also change in size and shape; some, like mites, are microscopic, while others, like ticks and lice, are not [34]. Numerous bird species kept in captivity are impacted by ectoparasites [35].

Ticks, mites, flies, mall phages, and fleas are examples of parasitic arthropods that are frequently found on the skin or feathers of their hosts.According to Bala et al., ectoparasites include lice, fleas, ticks, and mites. (2011) [36] In order to grasp onto the hairs and feathers of their hosts, the majority of ectoparasites also have claws on the tips of their legs. Many ectoparasites are vectors of bacterial and fungal infections that can develop in wounds. The author maintains an online checklist of raptor hosts and their mite ectoparasites, and Philips [37, 38, 39] reviewed the parasitic mites of raptors.

A few adult ticks feeding on a domestic fowl chick can result in anemia, decreased growth, weight loss, and a depressed state of health, which can cause illness and occasionally death in many species [40, 41]. Tick bites have been known to cause fatal paralysis in a variety of small bird species [42].
The host is impacted by ectoparasites in various ways. They harm a variety of physiological comforts and harm birds' feathers [43]. Chewing lice (Ischnocera, Ambblycea) feed on feathers and skin scales and are permanent ectoparasites that mainly affect bird species. These lice can be detrimental to both wild and captive hosts because they increase feather breakage, cause tiny holes in feathers that reduce thermoregulatory capacity, and deteriorate the quality of the plumage [44].

Another frequent ectoparasite of birds is lice. Lice do not suck blood; instead, they feed on feathers and skin debris, but they do not live long outside of their host. They can easily disappear beneath feathers, making it challenging to identify them [45].

Endoparasites, which include worms (helminths) and single-celled protozoa, invade almost every organ in their host. According to Greve (1996) [46], among caged and avian birds, gastrointestinal parasitism was the most common and significant. Ramisz et al. (2014) [47] identified the species composition, prevalence, and severity of infection in a subset of parrots. Lee and associates (2005) [48].
A protozoan parasite called Trichomonas gallinae is known to infect the upper digestive tract and other organs of a

number of bird species, including Columbiformes (i.e., pigeons and doves). Parasites can have genomes that are larger than those of their free-living relatives and, in certain situations, larger than those of the hosts they live in [49].

Numerous bird species are frequently afflicted by trichomoniasis, which is caused by a group of one-celled protozoa. Pigeons, doves, and their predators, including raptors, are all infected by one strain of the parasite. Certain disease strains cause birds to develop sores in their mouths, throats, gastrointestinal tracts, and upper respiratory tracts. When birds eat contaminated food that has been dropped by infected birds, they can contract Trichomonas gallinae. Reduced appetite, physical incapacity to eat, difficulty swallowing, vomiting, dehydration, weight loss, depression, weakness, diarrhea, and respiratory distress that makes breathing difficult for the birds are among the symptoms. When Trichomonas organisms invade the liver, it can lead to damage and green biliverdinemia [50]. Coccidia represent a widely prevalent category of protozoan parasites responsible for the disease known as coccidiosis.The intestinal tract harbors coccidia, which can lead to chronic bloody stools if they proliferate or if the host is under stress. While a substantial infectious dose of coccidia may lead to severe lesions that could be fatal, an infection can also be mild enough to remain unnoticed. Simply housing a bird in a contaminated cage or aviary can lead to infection, as coccidians are capable of surviving for prolonged periods outside the bird's body. Relying solely on sanitation is a challenging, if not unfeasible, method to prevent coccidiosis. The most effective means of prevention is to incorporate a medication (coccidiostat) into the feed that inhibits the growth of coccidia within the digestive tract [51].

3. CLINICAL SIGNS AND CONTROL OF PARASITES IN QUAILS AND BIRD

According to [52], parasitism leads to reduced growth, lower egg production, emaciation, anemia, and increased mortality. Nonetheless, it is essential to adopt sanitary measures such as cleaning and disinfecting feeders and drinking containers, enforcing an all-in/all-out policy, managing rodent and insect populations, preventing the mixing of different species and age groups, and disposing of old litter in a sanitary manner [16]. To eliminate the condition, targeted treatment with anthelmintic or anti-protozoan medications is vital. To prevent water spills on quail farms, it is crucial to maintain a high stocking density, dispose of litter regularly and hygienically, and improve hygienic practices, all of which are vital management strategies [53]. Coccidiocidal drugs added to water or coccidiostats added to feed are further ways to control coccidiosis [6]. The effectiveness of prophylactic salinomycin and diclazuril as feed additives was compared in an Egyptian study with that of drinking water containing coccidiocidal amprolium ethopabate and toltrazuril against E. Japanese quails are known as tsunodai. Curative treatments had better effects on drinking water than preventive treatments according to the results [54]. Feed conversion rate intestinal ulcers diarrhea and a decrease in oocyst production are also mentioned by [55]. The FDA has approved amprolium and monensin sodium as coccidiostats for use in quail diets per [54]. In conclusion quail coccidiosis can be prevented practically through vaccination [55].

but other organs did not change significantly as reported by [56]. Heat stress caused the crypt epithelium to become hyperplasic the small intestines villus height and area to decrease the duodenums goblet cell count to drop and the duodenums Calbindin-D28k (an epithelial calcium transporter channel) activity to decrease [57]. Furthermore [58] documented that heat stress caused a reduction in villus width. Levamisole or Ivermectin (where allowed) in drinking water piperazine or fenbendazole in feed can all be used to treat nematodes [59]. When Ascaridiosis poses a problem for birds raised in a free-range setting it is advised to separate the young birds and raise them on land that has never been used for poultry. It is crucial to establish feeding and watering systems that reduce fecal contamination of food and water, as nematodes can also pose problems in deep litter houses. Treatment with levamisole piperazine salts or a benzimidazole such as flubendazole can be provided through feed or drinking water in both scenarios [60]. Piperazine and hygromycin are the common worming agents used in feed or water. Piperazine is applied at a rate of 2-3 kg per tonne of feed whereas hygromycin is typically given at 750g per tonne of feed. Additionally if desired birds may receive individual treatment with a dosage of approximately 100 mg of piperazine. Without killing the worms the traditional wormers paralyze them like narcotics. This causes the worms to separate and be released along with the excrement. Since the eggs may still be contagious at this point successful treatment may involve giving two or three wormer doses separated by seven to ten days [61].

The goal of infection control is to stop the tape worms reproductive cycle by getting rid of the intermediate hosts. Slug and snail bait which usually contains metaldehyde should therefore be placed all around the house. Although infected birds can be chemically treated many of these treatments necessitate a 24-hour fast which may disrupt mature birds ability to produce eggs. While the majority of common chemical treatments for roundworms are ineffective products like Praziquantel are effective against tapeworms [61].

4. CONCLUSIONS

The present article concludes that quails are infected with several intestinal parasites, an abnormal condition that negatively affects egg production. Moreover, these infected birds may contribute to the transmission of parasitic diseases to healthy birds. Due to the limited studies on quail parasites, future studies should be conducted to determine

the prevalence of other parasites, such as tapeworms, flukes, coccidia, and blood parasites, in intensive quail farms in Iraq. To control parasites in quail farms, it is suggested to adopt a combined management approach, regularly using appropriate medications with effective dewormers. The results of this study will help conduct extensive research on parasitic diseases of quail to control them in intensive quail farms in Iraq.

It is well known that subclinical infections brought on by intestinal parasites result in undetected production and financial losses. Undoubtedly these parasites have the potential to worsen pre-existing health conditions and reduce the flocks resistance to illnesses. The reviews conclusions lead to the following suggestions. Subclinical manifestations of many gastrointestinal parasites should be the focus of future research. The frequency of gastrointestinal parasites and their financial effects should be made known to the general public. The combined prevalence and economic effects of gastrointestinal helminths on quail would benefit from experimental research.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest

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