INNSPUB

International Journal of Biosciences | IJB |
ISSN: 2220-6655 (Print), 2222-5234 (Online)
http://www.innspub.net
Vol. 15, No. 6, p. 363-369, 2019

RESEARCH PAPER OPEN ACCESS

Chicken gastrointestinal nematode and coccidia prevalence in Abomey-Calavi district, Benin

Hervé Brice Dakpogan[1*], Venant Pascal Houndonougbo[2], Serge Mensah[3], Roland Adekambi[1], Toussaint Hagbe[1], Grégoire Tchodo[1], Armand Bienvenu Gbangboche[1], Frédéric Houndonougbo[2], Christophe Chrysostome[2]

[1]*School of Animal Production System Management, P.O.BOX 43 Ketou, National Agricultural University, 01 P.O.BOX 55 Porto-Novo, Benin*

[2]*School of Animal Production Sciences and Techniques, Faculty of Agronomic Sciences 01 P.O.BOX 526, University of Abomey-Calavi, Benin*

[3]*National Agricultural Research Institute of Benin (INRAB), 01 P.O. BOX 884, Cotonou, Benin*

Key words: Chicken, Coccidia, *Ascaridia galli, Heterakis sp., Capillaria sp.*

http://dx.doi.org/10.12692/ijb/15.6.363-369 Article published on December 29, 2019

Abstract

Parasitic diseases are present in traditional free-range chicken production system, where there are no regular treatment measures. The diseases also persist in commercial chicken flocks, especially the deep-litter system, which provides direct-cycle parasites with a favorable environment for their proliferation. Knowledge of the prevalence of these infestations is necessary for the purpose of strengthening preventive measures. A descriptive observational study was carried out in Abomey-Calavi district on 150 chicken flocks, 70 flocks of layers, 30 flocks of broilers in commercial system and 50 flocks in free-range system. Faecal samples examination using the simple flotation technique allowed to identifying four targeted gastrointestinal parasites such as *Eimeria spp., Ascaridia galli, Heterakis spp*. and *Capillaria spp*. through an existing documented parasite egg morphological reference. The results showed that in the two chicken production systems the most prevalent parasite was *Eimeria spp*., 33.33 and 77% in layers and broilers in commercial system and 70 and 65% for adult and young birds in free-range system. It was followed by *ascaridia*, which showed almost the same prevalence in the two chicken production systems varying from 22 to 33%. Lower prevalences were recorded in *Heterakis* and *Capillaria* in the two production systems. *Heterakis* was more prevalent in commercial system while *Capillaria* more frequent in free-range chicken flocks with a total absence of *Capillaria* in broilers. The indirect-cycle characteristic of some *Capillaria* species can hamper their proliferation in strict-confinement commercial system. Problems related to poor sanitation can also explain these results, especially in commercial chicken flocks.

* **Corresponding Author:** Hervé Brice Dakpogan ✉ dakpogan2002@yahoo.fr

Introduction

In Benin, as in most African countries, there are two types of poultry production systems: the traditional extensive production system and the commercial semi-intensive production system (Onibon and Sodegla, 2005). The profitability of poultry production can be compromised by the outbreak of diseases essentially due to poor sanitation. Among the various disease agents that can affect poultry are the parasites which are responsible for considerable economic losses. These parasitic infestations are mostly subclinical and result in malnutrition, increased feed conversion ratio, decreased weight gain, reduced egg production, and mortality in young birds (Kumar *et al.,* 2016). Frequently encountered parasites both in commercial and traditional chicken production systems are nematodes and coccidia (Poulsen *et al.*, 2000).Through the combination of ubiquity, fecundity and pathogenicity of its causative agent, coccidiosis is among the ten most endemic and economically disastrous diseases that affect livestock in both developed and developing countries (Perry *et al.*, 2002; Bennett and Ijpelaar, 2005; Al-Gawad *et al.*, 2012). The prevalence of most parasitic diseases has been significantly reduced in the commercial poultry production system due to improved habitat, hygiene and good sanitation (Permin and Hansen, 1998). According to McDougald (2003), the strict confinement of birds in commercial poultry production system has been a beneficial antiparasitic measure. However, parasitic diseases continue to be a major problem in litter-based commercial and traditional chicken production systems.

The current study came up with the prevalence of coccidian infection and that of some gastrointestinal nematode parasites such as *Ascaridia galli*, *Heterakis spp*. and *Capillaria spp*. both in commercial and traditional chicken production flocks.

Materials and methods

Study area

The study was carried out in the district of Abomey-Calavi which lies within 6° 26′ 55″ N, 2° 21′ 20″ E, the total territory is 650 km².

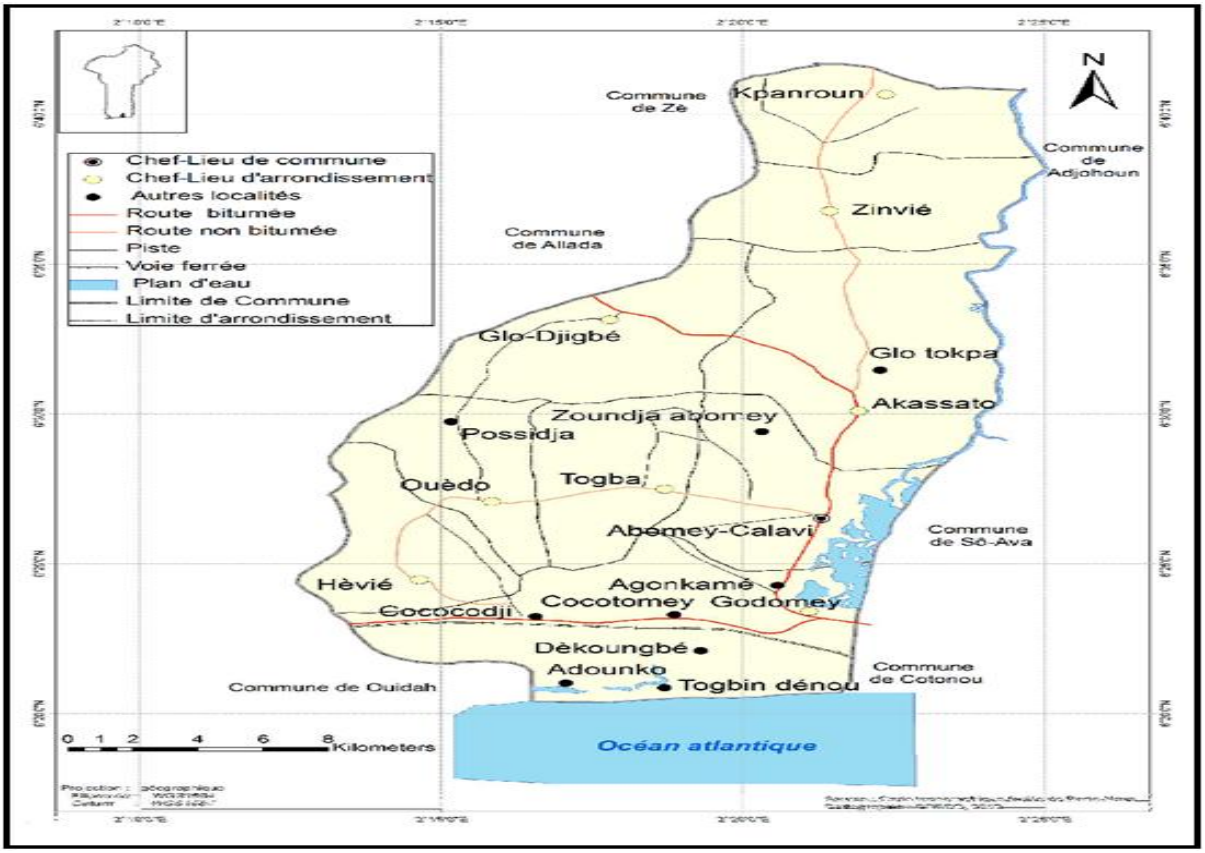

Fig. 1. District of Abomey-Calavi.

The climate is sub-equatorial marked by two rainy seasons and two dry seasons. The average mean annual minimum temperatures is 20 °C and the maximum 30 °C with the relative humidity range from 70 to 80% (Fig. 1).

Study design

The present study is a descriptive observational study with the purpose of determining the prevalence of gastrointestinal chicken parasitic infestation in litter-based semi-intensive exotic chicken rearing system and traditional extensive local chicken rearing system in the district of Abomey-Calavi. The survey was performed in the month of July in rainy season.

The optimal sample size was calculated in order to determine the number of chicken flocks to enroll in the study using the method of sample size calculation to estimate a proportion with the following formula:

$$n = \frac{z_{\alpha}^{2}\, x\, p(1-p)}{L^{2}}$$

According to Dakpogan *et al.* (2013), the coccidiosis prevalence in litter-based semi-intensive exotic layer rearing system is 36%. The prevalence can be as higher as 40% in layer chickens (Lunden *et al.*, 2000) and as lower as 25% according to Ashenafi *et al.* (2004). If for the study the 95% confidence interval of coccidiosis prevalence is set at $[0{,}25 \quad 0{,}40]$, then L = 0,075. The significance level being 0.05, then z_{α} = 1.96 which is the standardized Normal Deviate or the percentage point corresponding to a two-tailed probability of 0.05, when we consider the Normal approximation of Binomial distribution. These estimates applied in the formula gave the following sample size:

$$n = \frac{3.8416x0.325(0.675)}{0.005625} = 149.82$$

A total of 150 chicken flocks were surveyed with 70 layer hens and 30 broiler chickens of exotic breeds from litter-based semi-intensive production sector and 50 flocks in traditional extensive production system. Poultry farms were selected using a simple random sampling method in strict collaboration with the National Professional Poultry Producers Association (UNAP-Benin) based on their database in commercial chicken sector. The second stage of the selection was a non-probabilistic sampling based on the obvious willingness of the poultry producers to participate in the study. In the extensive production system the non-probabilistic method was used based on the flock size greater than or equal to 10 birds and the willingness of farmers to collaborate.

Collection of faecal samples

The droppings were collected in sealed and labeled polyethylene plastic bags. The movement of "W" inside the chicken house with the collection of droppings at every five (5) steps (Kumar *et al.,* 2014) has made possible to confer a semi-random character to the sampling in order to have representative samples. Samples were collected from all poultry farms visited. The samples were stored in a refrigerator at the Animal and Veterinary Research Laboratory (LRZVH) of Agonkanmey Agricultural Research Center (CRA) of the National Institute of Agricultural Research of Benin (INRAB) at a temperature of between 4 - 8 °C until the coprological analysis. The identity of the farmer, the location of the farm, the type of farm (layer, broiler, and local chickens) and the contact of the farmer were also collected.

Faecal sample examination

Faecal samples examination was carried out in the Laboratory of Research in Animal Ecology and Zoogeography of the National Agricultural University. The simple flotation technique using the McMaster chamber (Soulsby, 1986) allowed to demonstrating the presence or absence of four targeted gastrointestinal parasites such as *Eimeria spp., Ascaridia galli, Heterakis spp.* and *Capillaria spp.* The method consists in diluting one gram of faeces in 30 ml of saturated sodium chloride flotation fluid. The resulting fluid was homogenized by thorough stirring. The faecal suspension was filtered and a sub-sample immediately taken with a Pasteur pipette. The two fields of the McMaster counting chamber were filled with the faecal suspension. After 3 minutes, the *Eimeri*a oocysts and nematode eggs in both counting fields were counted under 10 photonic microscope

magnification. Identification of targeted nematode eggs was done using a documented morphological reference elaborated by Soulsby (1982) (Fig. 2).

Statistical analysis

The database was stored in Excel 2010 of Microsoft Corporation. Statistical analysis was performed in SPSS software version 16.0. Prevalence of parasites infestations was determined with the frequency procedure and comparisons done with chisquare test.

Results

Results in Table 1 showed the parasites prevalences in commercial chicken production system. The more prevalent parasites in litter-based commercial chicken focks in Abomey-Calavi district were coccidia and *Ascaridia*. This prevalence was 33% both for *Ascaridia sp*. and coccidia in laying hens.

In broiler chickens the coccidia prevalence was the highest, 77.8% and that of *Ascaridia galli*, 22,2%.

Heterakis spp. infestation was lower compared to coccidia and *Ascaridia galli* but, higher when compared to *Capillaria spp*. which demonstrated the lowest prevalence in commercial production system, with a total absence of its eggs in broiler chickens faecal samples.

Table 1. Prevalence in commercial chicken production system.

Chicken	*Ascaridia galli* (%)	*Eimeria spp*. (%)	*Heterakis spp*. (%)	*Capillaria spp*. (%)
Layers	33.3[a]	33.3[a]	19[a]	4.8[a]
Broilers	22.2[a]	77.8[b]	11[a]	0[a]

%: Percentage, (Values in columns that do not share the same superscript letters are significantly different at the significance level of 0.05).

Results in Table 2 showed parasites infestation rate in free-range chicken flocks. Similar to commercial chicken production system, coccidia and *Ascaridia* were the most prevalent parasites observed in traditional free-range local breed chicken production system in Abomey-Calavi district. Free-range chickens flocks *Eimeria spp*. prevalence in adult and young chickens were twice the values observed with *Ascaridia* parasite in the same age category, adult and young. Unlike the commercial production system, *Capillaria spp* infestation was higher than the *heterakis spp* infestation in traditional free-range local breed chicken flocks.

Table 2. Prevalence in free-range chicken production system.

Chicken	*Ascaridia galli* (%)	*Eimeria spp*. (%)	*Heterakis spp*. (%)	*Capillaria spp*. (%)
Adult	33,3[a]	70[a]	6,7[a]	13,3[a]
Young	26,7[a]	65[a]	6,7[a]	18,3[a]
Overall	30	67	6,7	15,8

%: Percentage, (Values in columns that do not share the same superscript letters are significantly different at the significance level of 0.05).

Discussion

The coccidial infection prevalence of laying hens in litter-based commercial exotic-breed chicken production system in the district of Abomey-Calavi was 33%. This value is similar to those observed by some authors such as Lunden *et al.* (2000), 33%; Yunnus *et al.* (2008), 27% and Dakpogan *et al.* (2013), 36%. The prevalence of coccidial infection observed in broilers chickens flock was 78%, this value is higher than that obtained by Razmi and Kalideri (2000) and lower than the prevalence observed by Béatrice (2006) which varies from 77 to

100% in broiler farms in France. Adriana *et al.* (2013) obtained 92% prevalence of coccidial infection in broilers in Romania. Coccidial infection is higher in broilers (78%) than in laying hens (33%) in the current study. The renewal of litter only once, per broiler flock coupled with the very short cycle of coccidia in 7 days may explain the higher infestation observed in broiler chickens compared to laying hens in litter-based commercial chicken production system. The prevalence of coccidial infection in traditional free-range local breed chicken farming in Abomey-Calavi district was 67%. This prevalence is similar to that obtained by Mohammad *et al.* (2011) which was 64%. Nnadi and Georges (2010) observed lower prevalence 35.5% in a wetland in southeastern Nigeria. Kaingou *et al.* (2010) recorded 27.04% in Kenya. This prevalence of 67% is higher and provides the evidence for the endemicity of coccidiosis in the extensive chicken production system that can serve as a reservoir and source of permanent infection for semi-intensive chicken rearing system, regardless of the management and biosecurity measures taken to control the disease (Dakpogan *et al.*, 2013).

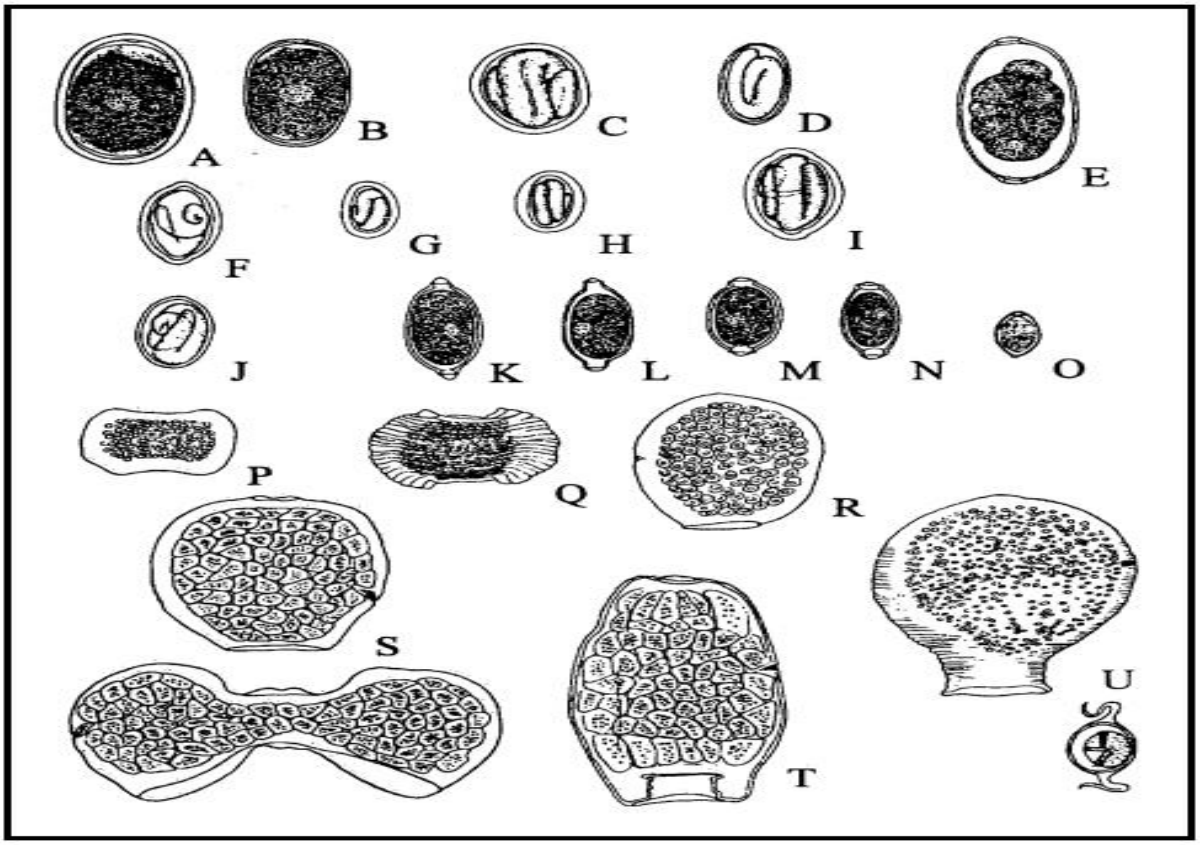

Fig. 2. Parasite eggs (A : *Ascaridia galli*, B : *Heterakis spp.* ; K, L, M, N : *Capillaria spp.*) (Soulsby, 1982).

The prevalence of *Ascaridia galli* infestation recorded in our study is 33% for layers and 22% for broiler chicken in litter-based commercial chicken flocks.

This result is close to that obtained by Martin-Pacho *et al.* (2005) in laying hens, which was 21%. According to Permin *et al.* (1999), this prevalence is 41% in litter-based intensive chicken farming system and 5% in the intensive cage chicken farming system. In free-range system, the infestation rate of *Ascaridia galli* is 30% in Abomey-Calavi district. The result is consistent with that observed by Mungube *et al.* (2008) in Kenya. Permin *et al.* (1999) obtained a higher prevalence of 63.8% in free-range extensive chicken flocks in Denmark and Hassouni and Belghyti (2006) obtained 9% a very lower infestation rate. Poor sanitation and nutrition can influence the prevalence of roundworms in animals in general. *Heterakis spp.* and *Capillaria spp.* prevalences didn't vary significantly in the two chicken production

systems with *Heterakis* more prevalent in litter-based commercial system and *Capillaria* more prevalent in free-range chicken flocks. The indirect-cycle characteristic of some *Capillaria* species such as *Capillaria caudinflita, Capillaria bursata* and *Capillaria annulata* that requires an intermediate host such as earthworm may explain its low prevalence in litter-based commercial system where chickens are housed in strict confinement.

The prevalence of *Heterakis sp*. infestation in commercial system is 19% in laying hens flocks in the district of Abomey-Calavi. Permin *et al*. (1999) obtained the same prevalence of *Heterakis gallinarum* (19.4%) in litter-based intensive chicken flocks. Prevalences in the extensive production system were 16% for *Capillaria sp*. and 7% for *Heterakis sp*.

These infestation rates are low and close to those obtained by Hassouni and Belghyti (2006) which were 6 and 10% for *Capillaria obsignata* and *Heterakis gallinarum* respectively. Mungube *et al*. (2008) obtained a prevalence of 22.8% for *Heterakis* in the free-range system. The differences were not significant in the adult and young age categories in our study.

This study highlighted the infestation rates of coccidia*, Ascaridia galli, Heterakis sp*. and *Capillaria spp*. in litter-based commercial exotic breed chicken production system and in traditional free-range local breed chicken flocks in the district of Abomey-Calavi.

Acknowledgement

Authors would like to thank the National Professional Poultry Producers Association (UNAP-Benin) for providing the members list for the sampling procedure and facilitating the participation of poultry farmers. Poultry producers both in commercial and free-range production systems also are to be thanks for their active participation in the herein study.

References

Adriana G, Loredana P, Vasile C. 2013. Prevalence and distribution of *Eimeria* species in broiler chicken farms of different capacities. Parasite **20,** 50- 59.

Al-Gawad AA, Mahdy OA, El-Massry AAN, Al-Aziz MSA. 2012. Studies on coccidian of Egyptian balady breed chickens. Life Science Journal **9(3),** 568-576.

Ashenafi H, Tadesse S, Medhin G, Tibbo M. 2004. Study on coccidiosis of scavenging indigenous chickens in central Ethiopia. Tropical Animal Health and Production **36**, 693-701.

Béatrice MBB. 2006. Prévalence des coccidies en élevage de poulets sous label rouge du GERS étude expérimentale. Thèse de doctorat. Ecole Vétérinaire de Toulouse, p 145.

Bennett R, Ijpelaar J. 2005. Updated estimates of the costs associated with thirty four endemic livestock diseases in Great Britain.a note. Journal of Agriculter Economics **56,** 135–144.

Dakpogan HB, Salifou S. 2013. Coccidiose prevalence and intensity in litter-based high stocking density layer rearing system of Benin. Journal of Animal and plant sciences **17(2),** 2522-2526.

Hassouni T, Belghyti D. 2006. Distribution of gastrointestinal helminths in chicken farms in the Gharb region-Morocco. Parasitology Research **99(2),** 181-3.

Kaingu FB, Kibor AC, Shivairo R, Kutima H, Okeno TO, Waihenya R, Kahi AK. 2010. Prevalence of gastro-intestinal helminthes and coccidia in indigenous chicken from different agroclimatic zones in Kenya. African Journal of Agricultural Research **5,** 458-462.

Kumar S, Garg R, Moftah A, Clark EL, Macdonald SE, Chaudhry AS, Sparagano O, Banerjee PS, Kundu K, Tomley FM, Blake DP. 2014. An optimised protocol for molecular

identification of *Eimeria* from chickens. Vet.Parasitol. **199,** 24–31.

Kumar S, Garg R, Banerjee PS, Ram H, Kundu K, Mandal M. 2015. Genetic diversity within ITS-1 0 region of *Eimeria* species infecting chickens ofnorth India. Infect. Genetics and Evolution **36,** 262–267.

Lunden A, Thebo P, Gunnarsson S, Hooshmand-Rad P, Tauson R, Uggla A. 2000. *Eimeria* infections in litter-based, high stocking density systems forloose-housed laying hens in Sweden. British Poultry Science **41,** 440–447.

Martín-Pacho JR, Montoya T, ArangüenaC, ToroR, Morchón C, Marcos-Atxutegi, Simón F. 2005. A Coprological and Serological Survey for the Prevalence of*Ascaridia* spp. in Laying Hens. Zoonosis and public health **52(5),** 238-242.

McDougald LR. 2003. Protozoal Infections. In: YM Saif (eds), Diseases of Poultry 11th edition. Iowa State press, Ames, IA USA.

Mohammad MH, Ahad O, Mohammad N, Fariborz A, Omid N. 2011. Prevalence of *Eimeria* species in scavenging native chickens of Shiraz, Iran. African Journal of Microbiology Research **5(20),** 3296-3299.

Mungube E, Bauni SM, Tenhagen BA, Wamae LW, Muhammed L, Nginyi JM. 2008. Prevalence of parasites of the local scavenging chicken in a selected semi-arid zone of Eastern Kenya. Tropical Animal Health and Production **40(2),** 101-9.

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. Journal of Parasitological Research **6,** 1-6.

Onibon P, Sodégla H. 2005. Etude de la sous filière "aviculture moderne" au Bénin, p 124.

Permin A, Bisgaad M, Frandsent F, Pearman M, Kold Nansen P. 1999. Prevalence of gastrointestinal helminthes in different poultry production systems. British Poultry Science volume **40,** 439- 443.

Permin A, Hansen JW. 1998. The epidemiology, diagnosis and control of poultry parasites. FAO animal health manual, no. 4. Rome: Food and Agriculture Organization of the United Nations, p 160.

Perry B, Randolph T, McDermott J, Sones K, Thornton P. 2002. Investing in Animal Health Research to Alleviate Poverty. ILRI (International Livestock Research Institute), Nairobi, Kenya.

Poulsen J, Permin A, Hindsbo O, Yelifari L, Nansen P, Bloch P. 2000. Prevalence and distribution of gastrointestinal helminths and haemoparasites in young scavenging chickens in upper eastern region of Ghana, West Africa. Preventive Veterinary Medicine **45,** 237–245.

Razni RG, Kalideri AG. 2000. Prevalence of sub-clinical coccidiosis in broiler-chicken farms in the municipality of Mashhad, Khorasan, Iran. Preventive Veterinary Medicine **44(3-4),** 247-53.

Soulsby EJL. 1982. Helminths, Arthropods and Protozoa of Domesticated Animals, 7th Ed., Lea and Febiger, Philadelphia, p 809.

Soulsby EJL. 1986. Helminths, Arthropods and Protozoa of domestic Animals. 7th Edn., Beiliere Tindal II, London, p 231.

Yunus AW, Nasir MK, Farooq U, Böhm J. 2008. Prevalence of poultry diseases and their interaction with mycotoxicosis in district chakwal: effects of age and flock size. Journal of Animal and Plant Sciences **18(4),** 107-113.