J Parasit Dis (July-Dec 2012) 36(2):220–225
DOI 10.1007/s12639-012-0112-5

ORIGINAL ARTICLE

JPD

Prevalence of parasites and associated risk factors in domestic pigeons (*Columba livia domestica*) and free-range backyard chickens of Sistan region, east of Iran

Mohammad Hossein Radfar · Javad Khedri · Keivan Adinehbeigi · Reza Nabavi · Khatereh Rahmani

Received: 3 February 2012 / Accepted: 22 April 2012 / Published online: 9 May 2012

Abstract This study was carried out on free-range backyard chickens and domestic pigeons (*Columba livia domestica*) from December 2010 to November 2011 to determine the prevalence, intensity and species of internal and external parasites in Sistan region, east of Iran. Of the total of 59 (27 males and 32 females) free-range backyard chickens and 46 (26 males and 20 females) domestic pigeons inspected, 55 (93.22 %) and 39 (84.78 %) were infected respectively. Ten species of free-range backyard chickens parasites were collected from alimentary canals, body, head and neck, comprising of 3 species of nematodes, 4 species of cestodes and 3 species of ectoparasites as follows: *Ascaridia galli* (16.94 %), *Heterakis gallinarum* (23.72 %), *Subulura brumpti* (67.79 %), *Raillietina tetragona* (35.59 %), *Raillietina echinobothrida* (27.11 %), *Raillietina cesticillus* (15.25 %), *Choanotaenia infundibulum* (40.67 %), *Argas persicus* (16.94 %), *Menopen gallinae* (55.93 %) and *Menacanthus stramineus* (33.89 %). The domestic pigeons were infected with seven species of parasites including 2 species of nematodes, 2 species of cestodes and 3 species of ectoparasites as follows: *Ascaridia columbae* (15.21 %), *Hadjelia truncata* (17.39 %), *Raillietina tetragona* (26.08 %), *Raillietina echinobothrida* (28.26 %), *Argas reflexus* (13.04 %), *Menopen gallinae* (32.60 %), *Columbicola Columba* (41.30 %). This is the first survey to determine the prevalence and intensity of parasites among free-range backyard chicken and domestic pigeon species in Sistan region.

Keywords Prevalence · Domestic pigeons · Chickens · Parasites · Zabol

Introduction

Poultry are kept in backyards or commercial production systems in most areas of the world. Compared to a number of other livestock species, fewer social and religious taboos are related to the production, marketing and consumption of poultry products. For these reasons, poultry products have become one of the most important protein sources for man throughout the world.

Helminth infections have an important role causing hidden economic losses in the production of poultry meat and eggs. Also, they may have particularly deleterious or debilitating effects on infected birds, especially the young birds (squabs), causing retarding growth, interfering with healthy development, and making older birds prone to secondary infections (Adang et al. 2008a). Multiple helminthiases is common in poultry that are kept extensively, while heavy infestation is common in intensively managed stock in which they cause severe pains that affect the normal activities of the birds resulting to death. It has been reported that ectoparasites affect the health and productivity of birds, leading them to spend much time preening rather than involving in other essential life activities (Adang et al. 2008b). Moreover, some of the ectoparasites, especially tick and mites, are vectors of other poultry

M. H. Radfar
Department of Pathobiology, School of Veterinary Medicine, Shahid Bahonar University of Kerman, Kerman, Iran

J. Khedri · K. Adinehbeigi (✉) · K. Rahmani
Department of Veterinary Parasitology, School of Veterinary Medicine, Shahid Bahonar University of Kerman, Kerman, Iran
e-mail: adinehbeigi.keivan@yahoo.com

R. Nabavi
Department of Pathobiology, Faculty of Veterinary Medicine, University of Zabol, Zabol, Iran

diseases such as Pastuerellosis, Fowl Pox, Newcastle disease, and possibly chlamydia (Nnadi and George 2010). Pigeons can be reservoirs for a number of parasitic infections and transmit their parasites to other birds. Native fowls parasitic infections constitute health and economic problems as well as sources of infection for industrial poultry, wild birds and man (Eslami et al. 2009). The present study was undertaken with the objectives of determining the prevalence rates of ectoparasites and helminthes and identifying their species in free-range backyard chickens and domestic pigeons in Sistan region, Iran.

Materials and methods

Study area

This study was carried out in Sistan region in the east of Iran during December 2010 to November 2011. Sistan is located in the east of Iran and north of Sistan and Baluchestan, between pivot 30 and 18 min till 31 and 20 min in the northern region and 61 and 10 min till 61 and 50 min in the eastern region. The height of Sistan in average is between 475 and 500 m from the sea, and Zabol is the center of Sistan with the height of ~487 m up the sea. Sistan, from the north and east, is a neighbor of Afghanistan and is limited from the west and northwest to the dry deserts. The average temperature is maximum at 22 to 49 and minimum at -8, which has been reported for a 20 year period. The average annual rain in Sistan is reported at around 59 ml and the average humidity at ~40 % (Khammar et al. 2011).

Investigation of the parasites

Gastro-intestinal parasites investigation

The postmortem examination was done according to Fowler (1996), after decapitation, the abdominal and thoracic cavity were opened, followed by systemic autopsy examination which include, the oesophagus to the gizzard, the small intestine (duodenum, jejunum, and ileum), the caeca, and the ileocaeco-colic junction to the cloaca. Each section was opened longitudinally and the contents carefully washed through a 100 μM test sieve. The mucosa was scraped to collect the helminthes embedded in the mucosal layer. Finally, the contents were examined under stereomicroscope and all helminthes were counted before being fixed in 70 % ethanol for further identification Soulsby (1982). The helminthes were cleared in lactophenol and examined for morphology under light microscope at ×10 magnification. All parasites were identified using the helminthological key Soulsby (1982).

Ectoparasites investigation

The plumage of each bird was thoroughly brushed onto a white tray for the collection of ectoparasites. The feathers of the head, the neck, under the wings, body, legs and cloaca were raised and thoroughly examined with hand lens for ectoparasites. Attached ectoparasites such as louse and ticks, which could not be removed by brushing, were gently dislodged with a pair of thumb forceps and their sites noted. The ectoparasites were prepared for identification by relaxing and dehydrating them in 70 % alcohol (Beck and Davies 1981) and later mounting them on a microscopy slide under a dissecting microscope, and a light microscope. After mounted, the ectoparasites were counted and preserved in labeled vials containing 70 % alcohol (methanol) and a drop of glycerine. The ectoparasites were identified using standard texts by Soulsby (1982).

Sex investigation

The sexes of the birds were determined by necropsy. It is generally accepted that the complete development of the left ovary in females and testicles in males is achieved at the end of the fourth month of life (Gicik and Arslan 2001).

Statistical analysis

Data collected from antemortem, postmortem and laboratory findings were entered into MS Excel. Logistic analysis was carried out by SPSS software (version 19.0) at 95 % confidence level.

Results

Of the total of 59 free-range backyard chickens and 46 domestic pigeons, 55 (93.22 %) and 39 (84.78 %) were infected with one or more parasites respectively (Tables 1, 2).

A total of 59 free-range backyard chickens comprising of 27 males and 32 females and 46 pigeons comprising of 26 males and 20 females were used for the experiment. As many as 26 out of 27 males (96.29 %) and 29 out of 32 females (90.62 %) were infected in free-range backyard chickens, while 22 out of 26 males (84.61 %) and 17 out of 20 females (85.00 %) were infected in domestic pigeons (Tables 1, 2). The infection rate was found to be more prevalent in males (96.29 %; 26/27) as compared to females (90.62 %; 29/32; OR = 3.026; Tables 2, 3) in free-range backyard chicken, while the infection rate was more prevalent in females (85.00 %; 17/20) as compared to males (84.61 %; 22/26; OR = 0.946;Tables 1, 3) in domestic pigeons. The infection rate between males and females was not significantly different in free-range backyard chickens and domestic pigeons

Table 1 The prevalence of parasite infections in different age and sex groups in domestic pigeons

Age	No. of examined pigeons		Total of examined	No. of positive pigeons (%)		Infection (%)
	Male	Female		Male	Female	
Adults	20	15	35	18 (90.00)	13 (86.66)	31 (88.57)
Nestlings	6	5	11	4 (66.66)	4 (80.00)	8 (72.72)
Total	26	20	46	22 (84.61)	17 (85.00)	39 (84.78)

Table 2 Prevalence of parasite infections in different age and sex groups in free-range backyard chickens

Age	No. of examined chickens		Total of examined	No. of positive chickens (%)		Infection (%)
	Male	Female		Male	Female	
Adults	21	26	47	21 (100)	24 (92.30)	45 (95.74)
Nestlings	6	6	12	5 (83.33)	5 (83.33)	10 (83.33)
Total	27	32	59	26 (96.29)	29 (90.62)	55 (93.22)

($P > 0.05$). Of the 59 free-range backyard chickens, 47 and 12 were adults and nestlings respectively. Of the total of 46 domestic pigeons, 35 and 11 were adults and nestlings respectively. More adult free-range backyard chickens (95.74 %; 45/47) were infected than the nestlings (83.33 %; 10/12; OR = 4.910; Tables 2, 3) but the difference was not significant ($P > 0.05$). Also, adult domestic pigeons had higher prevalence (88.57 %; 31/35) than the nestlings (72.72 %; 8/11; OR = 2.911; Tables 1, 3) but the difference was not significant ($P > 0.05$). The prevalence of parasite infections in different age and sex groups in free-range backyard chickens and domestic pigeons was described in Tables 1, 2. The prevalence, intensity and species of internal and external parasites were described in Tables 4, 5, 6, 7.

Discussion

The overall prevalence rate of parasites in free-range backyard chickens and domestic pigeons was considerably high, which indicates that parasitic infection is a common problem in this area. The intensity of worms in the gastrointestinal tracts of the birds might be due to continuous ingestion of infested droppings or infested intermediate hosts of organisms such as beetles, cockroaches, earthworm, flies and grasshoppers in poorly managed stocks (Abdu 1987). A higher prevalence in adults might be related to cohort effect. However, parasite prevalence in nestlings was also high in most of the studied populations, which suggest that infections generally occurred at early ages (Radfar et al. 2012).

Table 3 Multivariate logistic regression analysis of associated factors with risk of infection in free-range backyard chickens and domestic pigeons from Sistan Region, east of Iran

Term	Odds ratio	95 % CI for OR	*P* value
Chickens			
Sex	3.026	0.280–32.657	0.362
Age	4.910	0.593–40.681	0.140
Pigeons			
Sex	0.946	0.181–4.954	0.948
Age	2.911	0.593–15.736	0.215

Ascaridia galli is one of the most common helminth species in chickens. It shows high prevalence especially in free range chickens in rural areas (Wilson et al. 1994). The observed prevalence (16.94 %) of *Ascaridia galli* in the current study was in agreement with the prevalence reported in guinea fowls in South Africa (Mwale and Masika 2011; Table 6). Blood-tinged diarrhea, loss of appetite, increased thirst, birds looking dropsy, head nodding down wards, puffing or ruffled feathers and shivering emaciated and dirty cloacal region, were the common clinical signs observed among the infected birds in the current study.

In the present study, only mild catarrhal enteritis was noticed in small intestine with presence of *Ascaridia colombae* worms (15.21 %; Table 4). In heavy infection of *Ascaridia colombae* caused obstruction, dilation and mild to necrotic ulcer in small intestine.

The prevalence of *Heterakis gallinarum* in the hindgut (caecum) was (23.72 %), which was comparable with in reported prevalence (21.3 %) in Kenya (Irungu et al. 2004; Ondwassy et al. 1999; Table 6). The prevalence of some nematodes in the caecum e.g. *Heterakis gallinarum* could be attributed to their fairly developed digestive system which gives them greater chances of establishing a host-parasite relationship.

The nematode, *Heterakis gallinarum* is non-pathogenic, but a vector for *Histomonas meleagridis* which is highly

Table 4 Prevalence and intensity of helminth infections in 46 domestic pigeons from Sistan Region, east of Iran

Site of recovery	Helminth	No. of infected pigeons	No. of parasites	Mean intensity (x)	Range	Prevalence (%)
Small intestine	*Ascaridia colombae*	7	19	2.71	1–3	15.21
Gizzard	*Hadjelia truncata*	8	41	5.12	3–12	17.39
Ileum	*Raillietina tetragona*	12	26	2.16	1–3	26.08
Small intestine	*Raillietina echinobothrida*	13	40	3.07	1–5	28.26

Table 5 Prevalence and intensity of Ectoparasite infestations in 46 domestic pigeons from Sistan Region, east of Iran

Site of recovery	Ectoparasites	No. of infested pigeons	No. of parasites	Mean intensity (x)	Range	Prevalence (%)
Under the wings	*Argas reflexus larvae*	6	24	4	3–7	13.04
Body	*Menopen gallinae*	15	107	7.13	1–22	32.60
Quill feathers of wings	*Columbicola columba*	19	114	6	3–12	41.30

Table 6 Prevalence and intensity of helminth infections in 59 free backyard chickens from Sistan Region, east of Iran

Site of recovery	Helminth	No. of infected chickens	No. of parasites	Mean intensity (x)	Range	Prevalence (%)
Small intestine	*Ascaridia galli*	10	26	2.60	2–3	16.94
Caecum	*Heterakis gallinarum*	14	46	3.28	1–8	23.72
Ileum	*Raillietina tetragona*	21	41	1.95	1–4	35.59
Small intestine	*Raillietina echinobothrida*	16	37	2.31	1–4	27.11
Ileum	*Raillietina cesticillus*	9	17	1.88	1–3	15.25
Caecum	*Subulura brumpti*	40	384	9.60	1–23	67.79
Ileum	*Choanotaenia infundibulum*	24	53	2.20	1–3	40.67

Table 7 Prevalence and intensity of Ectoparasite infestations in 59 free backyard chickens from Sistan Region, east of Iran

Site of recovery	Ectoparasites	No. of infested chickens	No. of parasites	Mean intensity (x)	Range	Prevalence (%)
Under the Wings	*Argas persicus larvae*	10	66	6.60	1–14	16.94
Body, head and neck	*Menopen gallinae*	33	206	6.24	1–18	55.93
Body	*Menacanthus stramineus*	20	168	8.40	1–14	33.89

pathogenic etiologic agent of "Black-head" disease lethal to chickens, turkeys, pheasants and other fowls. The presence of this parasite in free-range backyard chickens may cause severe debility and morbidity, while mortality may occur in extreme cases (Adang et al. 2008a).

Hadjelia truncata has been found in the gizzard of a number of birds in Europe and Asia. The intermediate hosts are various beetles (Anderson 2000). This species has also been reported in Mashhad and Birjand area of Iran (Razmi et al. 2007; Radfar et al. 2012). Eight of 46 (17.39 %) domestic pigeons were infected with *Hadjelia truncate* in the current study. burden of *Hadjelia truncata* ranged within 3 to 12 in infected birds (X = 5.12; Table 4).

Subulura brumpti had the highest prevalence (67.79 %) amongst the intestinal nematodes identified in the studied chickens. Intensities of *Subulura brumpti* ranged within 1 to 23 in infected birds (X = 9.60; Table 6). Negesse (1991) reported *Subulura brumpti* (40 %) in Ethiopia.

The high prevalence of *Raillietina* spp. could be attributed to the wide spread and accessibility of intermediate hosts (dung beetles, ants) to the free-range back yard chickens. Dung beetles and ants were very commonly observed in study area. *Raillietina echinobothrida* induces the formation of nodules in the intestinal wall, which can lead to confusion with lesions of avian tuberculosis (Ashenafi and Eshetu 2004). Although cestodes in poultry are known to cause retarded growth, enteritis, diarrhea, haemorrhages and hypovitaminosis B, heavy infections may also be associated with mortality in young birds and the loss of egg production in laying chickens. Furthermore, *Raillietina tetragona* is considered as an infectious agent in chickens (Soulsby 1982). The prevalence rate of *Raillietina tetragona, Raillietina echinobothrida and Raillietina cesticillus* was determined (35.59 %), (27.11 %) and (15.25 %) in free-range backyard chickens in the current study respectively while, the prevalence rate of *Raillietina*

echinobothrida and Raillietina tetragona was determined (28.26 %) and (26.08 %) in domestic pigeons respectively (Tables 4, 6). These differences in the prevalence rate of cestodes could be related to the differences in the prevailing environmental conditions at the sampling time (Eshetu et al. 2001). The most prevalent cestode recorded in the area was *Choanotaenia infundibulum* (40.67 %) in free-range backyard chickens. Twenty four of 59 (40.67 %) free-range backyard chickens were infected with *Choanotaenia infundibulum*. Intensities ranged from 1 to 3 (X = 2.20; Table 6). The warm weather seems to be the only time that *Choanotaenia infundibulum* could be ingested by a bird. Thus, the high prevalence of *Choanotaenia infundibulum* could be attributed high temperature in Sistan region.

Ticks transmit bacterial, rickettsial, viral, and parasitic and spirochaetal diseases in poultry (Haider Shah et al. 2004). Heavy infections with *Argas* spp. can cause blood loss leading to anemia and eventually death. Also, *Argas persicus* Larvae have been responsible for synchronous occurrence of Infectious Bursal Disease and Spirochaetosis (Abdu 1987). The prevalence rate of *Argas persicus larvae* and *Argas reflexus larvae* was recorded (16.94 %) and (13.04 %) respectively (Tables 5, 7). *Argas persicus* infestation caused paralysis in infected birds.

Chicken body lice can heavily infest free-range backyard chicken. Some authors estimate that louse infestations cause as much as (46 %) decrease in egg production. Among the lice species observed, *Menopon gallinae* had the highest prevalence (55.93 %) in free range backyard chickens and followed by *Columbicola columbae* (41.30 %) in domestic pigeons (Tables 5, 7). According to Harlin (1994), *Columbicola columbae* is the most common malophagian parasite of pigeons. The rate of infestation with *Columbicola columbae* in this study was in agreement with Harlin. *Menacanthus stramineus* may consume blood by puncturing soft quills near the bases and gnawing through the covering layers of the skin itself (Abebe et al. 1997). This caused multi-focal skin lesions on the affected birds. The prevalence rate of *Menacanthus stramineus* was recorded (33.89 %) in free range backyard chickens in the present study (Table 7).

There were no trematode parasites encountered in this study, which could be attributed to the low presence of intermediate hosts.

The current study indicates that domestic pigeons could be less susceptible to mixed infections in comparison with free-range backyard chickens. Free-range backyard chickens and domestic pigeons are considered as potential reservoirs for parasite infections and this poses a risk of contamination for modern chicken farms. Therefore, further studies are needed to elucidate the economic and hygiene impacts of multiple parasitic infections on poultry reared in backyard system.

Acknowledgments This project was funded by the Shahid Bahonar University of Kerman. We also thank Mr. Mansour Aminzadeh for his technical support.

References

Abdu PA (1987) Infectious bursal disease in pullet chicks. Avian Dis 31:204–205

Abebe W, Asfaw T, Genete B, Dorchies P (1997) Comparative studies of external parasites and gastrointestinal helminths of chickens kept under different management system in and around Addis Ababa (Ethiopia). Rev Med Vet 148:497–500

Adang KL, Oniye SJ, Ajanusi JO, Ezealor AU, Abdu PA (2008a) Gastrointestinal Helminths of the Domestic Pigeons (*Columba livia domestica* Gmelin, 1789 Aves:Columbidae) in Zaria, Northern Nigeria. Sci World J 3:33–37

Adang KL, Oniye SJ, Ezealor AU, Abdu PA, Ajanusi JO, Yoriyo KP (2008b) Ectoparasites of the Laughing Dove *Streptopelia senegalensis* (Linnaeus, 1766) (Aves: Columbidae) in Zaria, Nigeria. Inst de Ciência Biol 9:67–71

Anderson RC (2000) Nematode parasites of vertebrates their development and transmission. CABI Publishing, Wallingford

Ashenafi H, Eshetu Y (2004) Study on gastrointestinal helminths of local chickens in central Ethiopia. Rev Med Vet 155:504–507

Beck J, Davies J (1981) Medical parasitology. The CV Mosby Company, Saint Louis, pp 318–337

Eshetu Y, Mulualem E, Ibrahim H, Berhanu A, Aberra K (2001) Study of gastro-intestinal helminths of scavenging chickens in four rural districts of Amhara region, Ethiopia. Rev Sci Tech Oie 20:791–796

Eslami A, Ghaemi P, Rahbari S (2009) Parasitic infections of free-range chickens from Golestan province, Iran. Iran J Parasitol 4:10–14

Fowler NG (1996) How to carry out a field investigation. In: Jordan ETW, Pallison M (eds) Poultry diseases, 4th edn. Saunders WB Company, London, pp 422–456

Gicik Y, Arslan MO (2001) Blood parasites of wild pigeons in Ankara districts. Turk J Vet Anim Sci 25:169–171

Haider Shah A, Nisar Khan M, Iqbal Z, Sohail Sajid M (2004) Tick infestation in poultry. Int J Agr Biol 6:1162–1165

Harlin RW (1994) Pigeons. The veterinary clinics of North America. Small Anim Pract 24:157–173

Irungu LW, Kimani RN, Kisia SM (2004) Helminth parasites in the intestinal tract of indigenous poultry in parts of Kenya. J S Afr Vet 75:58–59

Khammar GhA, Heydari A, Shahmoradi L (2011) Analysis of the status of traditional knowledge and technology in energy improvement: the case of Sistan Region, Iran. J Geogr Reg Plan 4:586–592

Mwale M, Masika PJ (2011) Point prevalence study of gastro-intestinal parasites in village chickens of Centane district, South Africa. Afr J Agric Res 6:2033–2038

Negesse T (1991) Survey of internal parasites of local chickens of Southern Ethiopia. Indian J Poult Sci 26:128–129

Nnadi PA, George SO (2010) A cross-sectional survey on parasites of chickens in selected villages in the subhumid zones of south-eastern Nigeria. J Parasitol Res 2010:1–6

Ondwassy HO, Okitoi LO, Obali MP, Simwa S, Wakhusama SW (1999) Epidemiology of helminths in indigenous poultry in western Kenya. In: de Jong R, Mukisira EA (eds) Testing of livestock technologies on smallholder mixed farms in Kenya. Kenya

Radfar MH, Norouzi Asl E, Rezaei Seghinsara H, Mirzaei Dehaghi M, Fathi S (2012) Biodiversity and prevalence of parasites of

domestic pigeons (*Columba livia domestica*) in a selected semiarid zone of South Khorasan, Iran. Trop Anim Health Pro 44:225–229

Razmi GR, Kalidari GA, Maleki M (2007) First report of the *Hadjelia truncata* infestation in pigeons of Iran. Iran J Vet Res 8:175–177

Soulsby EJL (1982) Helminths, arthropods and protozoa of domesticated animals, 7th edn. The English Language Book Society and Bailliere Tindall, London, ISBN:10: 0702008206

Wilson KI, Yazwinski TA, Tucker CA, Johnson ZB (1994) A survey into the prevalence of poultry helminths in Northwest Arkansas commercial broiler chickens. Avian Dis 38:158–160