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Seasonal Effects on the Prevalence of Gastro-Intestinal Helminth Infections in Two Local Chicken Genotypes from Two Agro- Ecological Zones in Sudan

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Abstract

Parasitic diseases pose significant threats to the free-ranging chickens. This study aimed to determine the presence and intensity of helminth parasites, and to estimate the seasonal effects in two free ranging chickens, Large Baladi (*n*=80) and Bare-neck (*n*=77), in two agro-ecological zones in Sudan, Khartoum and Gadarif. The gastrointestinal tract was opened to quantify the presence and intensity of helminth infections. The results revealed that the overall prevalence of helminthes was 94.9%. Nematode infected 83.4 % of chickens, whereas 88.5% had cestodes. The only nematode was *Heterakis gallinarum* with prevalence of 83.6% in Large Baladi and 81.8% in Bare-Neck. There was no significant interaction (P>0.05) among effects of regions, genotypes and seasons on the worm burden of *H. gallinarum* except the larva counts. The occurrence of helminthes was higher during the rainfall season than in the summer season; and the rate of helminth infection in Khartoum was greater than in Gadarif. Moreover there were no significant differences in average worm counts, sex, and length of worms in genotypes (P>0.05). The prevalence of *Raillietina tetragona* was 63.1 %, *Raillietina cesticullus* 63.1 %, showed no significant difference (P>0.05) between the two genotypes and seasons. Whereas *Raillietina echinobothrida* (*P* = 0.027) was significantly different. Moreover *R.echinobothrida* 56.1 % and *Hymenolepis cantaniana* 18.5 % showed significant difference between genotypes and regions (*P*=0.005 and 0.001), respectively. It is therefore, concluded that there is a high prevalence of parasitic helminth infections in Sudan with no difference between the examined indigenous genotypes.

Keywords: Free-ranging chickens, Gastrointestinal tract, Heterakis gallinarum, Cestodes.

Introduction

The production system for native chickens in villages and rural communities in Sudan is traditionally based on letting the animals scavenge. The major constraints of village poultry production in the Sudan include inadequate health care, poor production, inappropriate housing and poor knowledge of poultry management skills (Khalafalla *et al*., 2000). The local chickens are usually left to roam free around the house with the same shelter of the family. In some instances, a small shelter is provided in some areas of Sudan (Elzubier, 1997). Farmers interviewed by Khalafalla *et al*. (2002) ranked the order of importance of village chickens as: source of food, then source of income and lastly social importance. The indigenous chicken breeds in the Sudan are called Baladi which include three types as recorded by Desai (1962). The Large Baladi (LB) is the most common type and is distributed all over the country. The average of the body weights (1350.1-1720.7) g at sexual maturity, with a small crushed comb and many colors variations. The Bare-Neck (BN) is characterized by the featherless neck, with many plumage colors, the average of the body weights (1305.1-1670.4) g. The Betwill is small and compact with very small black legs, and the average of the body weights (906.5-1560.3) g. The Betwil genotype found in the Nuba Mountains areas of the Kordofan region and is endangered due to the conflicts and people's displacement in this area (Wani, 2014).

Poultry industry in the Sudan relies on exotic breeds which represent 90% of Khartoum State poultry industry. However, the free range system accounts for about 70% of the total production (Sulieman, 1996), which it cause a wide range of problems, the most significant is uncontrolled parasitic infection. Investigations on parasite infections started in Sudan as early as 1956 in Khartoum, 1958 in Malakal and 1968 in the Darfur region (Eisa, 1976). There is limited reliable information about performance, geographical distribution of parasitic diseases and the impact of parasites on mortality and productivity in free range chickens in Sudan (Ali, 1994).

The identification of the helminth parasites of the chickens in Khartoum State was carried out by El-Khawad *et al*. (1977) who found that the most common species were: *Subulura brumpti, Raillietina tetragona, Tetrameres americana, Gongylonema ingluvicola* and *Dispharynx spiralis,* mostly as mixed infections.

Hanan *et al*. (2005) reported that in 780 intestines of commercial exotic and indigenous chickens in a survey covered Khartoum State there were 250 (32.89%) infected with *Ascaridia galli*, and the prevalence was (46.53%) in the exotic chickens in contrast to (10.18%) in the indigenous chickens. Nevertheless, it is not known whether the presence and intensity of helminth infections differed between the different regions or genotypes as well as whether the season or the environmental conditions influence the infection development.

Therefore, the aim of this study was to quantify the presence and intensity of helminth parasites in two local chicken genotypes kept in two eco-ecological zones in the Sudan, as well as to investigate the influence of seasons on the parasitic infections.

Materials and methods

Study area and birds

The study was conducted from April to September 2013, during the summer and rainfall seasons in two agro-climatic zones in Sudan, namely Khartoum (central Sudan) and Gadarif (eastern Sudan) (Fig.1). Five districts were selected from each agro-

climatic zone. Khartoum lies between latitude 15°31'N and longitude 32°45'E, in the desert and semi desert climatic region. The annual rainfall is about 162.8 mm, and the relative humidity ranges 7%-17% in summer season and 27%-51% in the rainfall season, while the average summer temperature range is 32 -41°C and the range in the rainfall season is 20-33°C. The Gadarif lies between latitude 14°02'N and longitude 35°28'E in the semi-arid climatic zone. The annual rainfall is about 800.8 mm, and the relative humidity ranges between 23%-48% in the summer season and 65%-66% in the rainfall seasons, and the minimum and maximum temperature in the summer season is 23.5-41°C and the rainfall season is 21-34°C. In the study areas, indigenous chickens are reared in the open backyards of the house. The chickens (N=157) were randomly selected irrespective of age and weight from open village markets or directly from farmers in villages around the two zones.

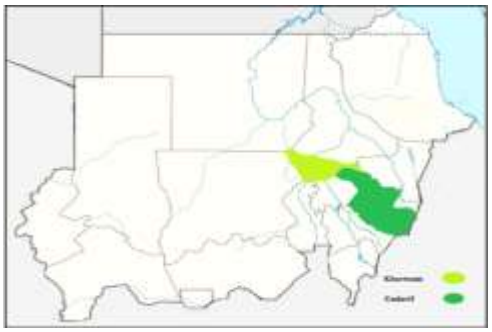

Figure 1. Location of Khartoum and Gadarif States, Sudan.

Parasitological examinations

A total of 157 individual faecal samples were collected and processed using a modified McMaster egg counting technique (McDonald, 1969). All chickens were necropsied and their gastrointestinal tracts were examined following the World Association for the Advancement of Veterinary Parasitology (W.A.A.V.P) guidelines for evaluating the effectiveness of anthelmintics in chicken and turkeys (Yazwinski *et al*., 2003). The trachea was cut open and visually examined for the presence of *Syngamus trachea*. The gastrointestinal tracts were then separated into esophagus, crop, proventriculus, gizzard, small intestine and caecum. Each part was opened in longitudinal section with scissors. The contents were washed separately under running tap water followed by scraping the mucosa of intestine and emptied into labeled petri-dishes using a sieve with a mesh aperture of 100 µm. All nematodes were identified, sexed, counted under stereomicroscope and measured for length according to the procedure described by Permin and Hansen (1998).

Cestodes were collected by submerging the intestine in water to float the worm, and then identified using standard techniques. Cestodes were stained with iron acetocarmine, dehydrated in 70% ethanol series, cleared and mounted in Canada balsam (Mosffee *et al*., 2010). The parasites were identified under stereomicroscope at 100x magnification.

Statistical analysis

The data was analyzed with SPSS (2010) and due to non-normal distributions the data were transformed using the function [log (y) = log 10 (y+10)]. The effect of regions, genotypes and seasons on prevalence of worms was calculated by using chi-square test. The effect of regions, genotypes and seasons on worm was determined by using a three-way ANOVA.

Results

No parasite's eggs were detected in the faecal samples. Out of 157 birds, 149 harbored at least one parasite species (94.9%). A total of 5 helminth species were identified. One nematode, *H.gallinarum* and four cestode species were differentiated. The prevalence *H.gallinarum* was 83.4% while

the prevalence of the cestodes was 63.1%, 63.1%, 56.1% and 18.5% for *R. tetragona*, *R. cesticillus*, *R. echinobothrida and Hymenolepis cantaniana*, respectively. No trematodes were found.

Regional and seasonal effects on prevalence and worm burdens in the genotypes:

The overall average of worm burden with *H. gallinarum* was 50.5 worms per hen. The averages of larva, female and male worms were 9.2, 31.1 and 18.8/hen, respectively (Table, 1).

The prevalence of *H. gallinarum* varied in Khartoum and Gadarif (87.4% vs 75.8%, respectively), and also the total worms differed significantly between the regions (P= 0.018; Table); whereas the prevalence in the two genotypes Large Baladi and Bare-neck slightly varied

(83.6% vs 81.8%, respectively), with no significant difference in total worms between the genotypes (P = 0.670; Table). The prevalence in summer was significantly (P = 0.047) lower than in rainfall season (80% vs 87.7%, respectively).

Table Prevalence, worm counts and length of worms of *H. gallinarum* in the two genotypes in two seasons and two regions in Sudan.

	N	Prevalence (%)	Larvae	♀ worms	♂ worms	♀ length	♂ length	Total worms
Overall	157	82.8	9.2±2.84	31.1±8.16	18.8±4.88	1.23±1.4	0.86±0.94	50.4±4.01
Regions								
Khartoum	95	87.4	10.7±1.14	30.9±3.29	18.2±1.96	1.2±0.01	0.87±0.1	59.7±1.65
Gadarif	62	75.8	7.7±1.80	15.5±5.18	9.8±3.09	1.3±0.01	0.83±0.1	32.9±1.43
P-value		-	0.155	0.013	0.022	0.001	0.775	0.018
Genotypes								
Large Baladi	80	83.6	10.8±1.57	24.3±4.50	13.9±2.69	1.2±.01	0.90±0.1	48.9±1.61
Bare-neck	77	81.8	7.7±1.45	22.1±4.16	14.1±2.49	1.3±.01	0.81±0.1	43.9±1.47
P-value		-	0.153	0.0724	0.964	0.075	0.523	0.670
Seasons								
Summer	100	80	9.9±1.11	29.9±3.19	17.9±1.90	1.3±.01	0.84±0.08	57.7±1.63
Rainfall	57	87.7	8.5±1.82	16.5±1.03	10.1±3.13	1.2±.01	0.87±0.11	35.1±1.44
P-value		-	0.500	0.030	0.035	0.019	0.785	0.047
P (locations*genotype)		-	0.403	0.688	0.867	0.018	0.665	0.650
P (locations*seasons)		-	0.033	0.169	0.303	0.005	0.686	0.138
P (genotype*seasons)		-	0.017	0.255	0.473	0.157	0.494	0.180
P(locations*genotype*seasons)		-	0.047	0.806	0.962	0.448	0.524	0.607

The results show no significant difference between the two genotypes (LB and BN) in all parameters studied. On the other hand, the total worm burden, the number of female and male worm and the length of female worm are significantly affected by the agro-ecological zone and season (table, 1). With the exception of the interaction between location and the bird's genotype all other interactions significantly affected the number of larvae. In addition the interaction of the location with both genotype and season significantly affected the number of female worm (table, 1).

For cestodes, there was highly significant difference in prevalence of *R. echinobothrida and H. cantaniana* (P = 0.005 and 0.001; Fig. 2) respectively, and no significant difference was noted in *R. tetragona*and *R. cesticillus*(P = 0.314 and 0714; Fig. 2) in the two regions. The prevalence in Khartoum was higher when compared with Gadarif region.

There was no significant difference prevalence in cestode species between the genotypes and seasons with the exception of *R. echinobothrida* (P = 0.027; Fig. 3).

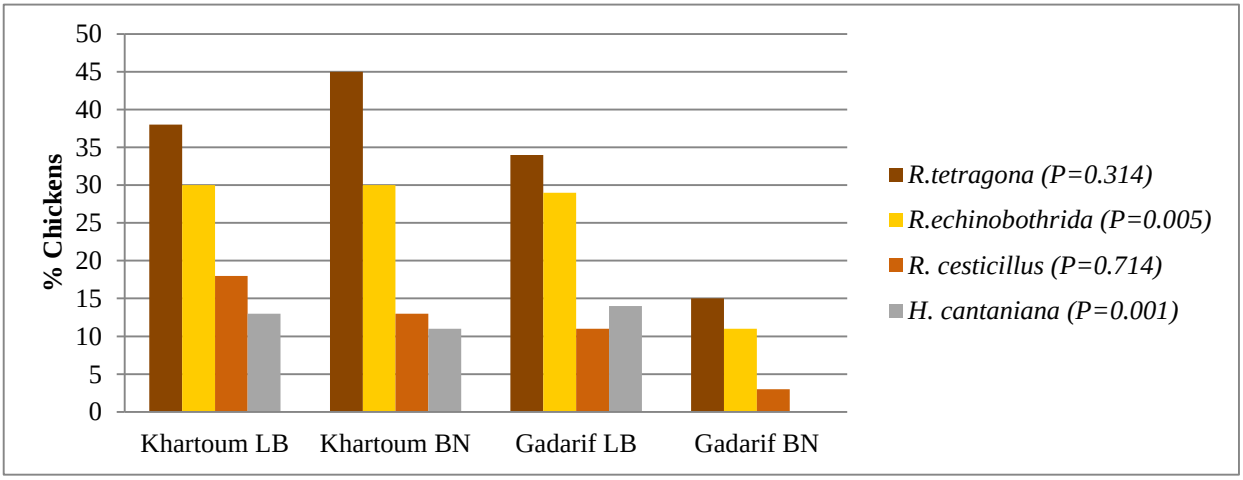

Figure2. The effects of interaction between location and genotypes on cestode species.

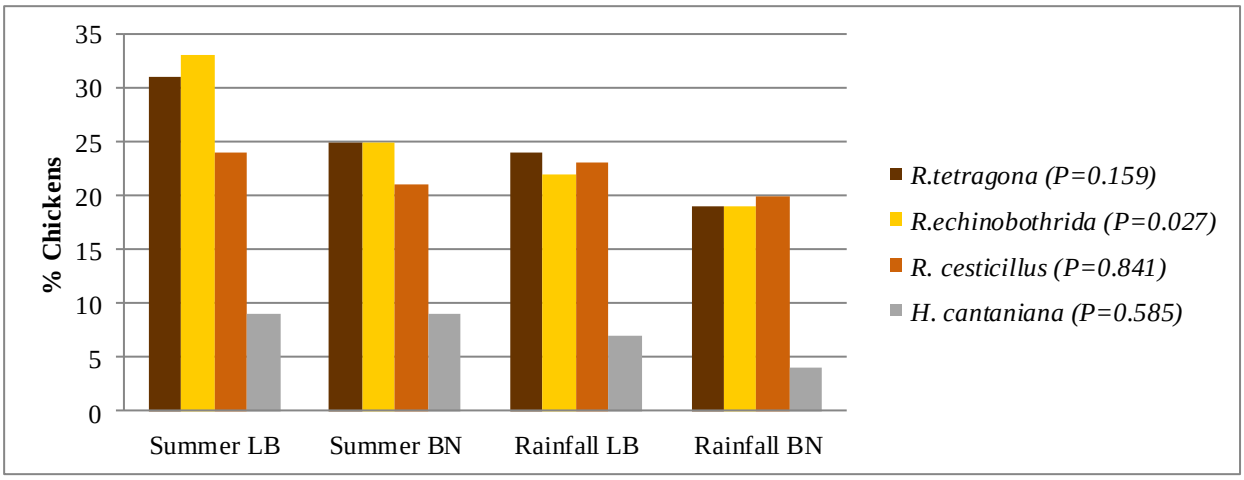

Figure3. The effects of interaction between seasonal and genotypes on cestode species.

Discussion

This study revealed that the helminth parasites are common in both local chicken genotypes. Five species of helminthes were identified comprising four cestodes and one nematode.

An overall prevalence of 94.4% was recorded in this study which differs slightly from other studies of prevalence in local chickens. In similar studies in the Sudan, however, Eisa (1976) recorded a prevalence of 89%, Saad *et al*. (1989) recorded 77.3% and Ali (1994) recorded 98.2%, which is less than Poulsen et al. (2000) who had reported 100% rates of helminth infection in Ghana.

The dominant parasites in this study were the cestode species (88.5%), which are higher than that recorded by Elowni (1983) who recorded a figure of 71.8%, and similar to Ali (1994), where it was 88.6%. The cestodes species recorded in this study *R. tetragona, R. cesticillus, R. echinobothrida and Hymenolepis cantaniana,* were similar to those reported previously with addition of *Cotuqnia digonopora, Choanotaenia infundibulium, Hymenolepis carioca* and *Amoebotaenia* according to (Abdel Malek, 1959; Eisa, 1976; El- Khawad *et al.*, 1977; Saad *et al*., 1989) in chickens in the Sudan.

The cestodes prevalence in Khartoum in this study was 100% which is higher than 79.8%, 48% and 69.4% which were recorded by Elowni (1983), Hamad (1987) and Ali (1994), respectively. In the Gadarif region, the cestodes prevalence was 98.4% which is close to the 96.3% and 98.3 reported by Elowni (1983) and Ali (1994). The higher rate of infections with cestodes recorded during this study compared to infection with nematodes maybe due to the availability and wide occurrence of the intermediate host in the study area (Ali, 1994).

The agro-climatic zones significantly influenced the amount of endoparasites as reported by Kaingu *et al*. (2010). The infection in Khartoum was higher than in Gadarif. This is attributable to the density of chicken populations and influence of the hybrids genotypes which are more affected by the endoparasites and resulted in contaminate of the local genotypes as also mentioned by Faranisi (1995) and Hanan *et al*. (2005).

The lower rate of prevalence during summer season may be due to the climatic conditions which are not favorable for the development of parasites in the host or environment, and direct sunlight or desiccation destroy the

infective larvae (L2) inside the eggs, the larvae survive for months in moist and cool environment (Parsani *et al*., 2014), in spite of the number of the worms and may simply be due to sampling variation of animals examined in the two seasons, and this finding against Naphade and Chaudhari, (2013) who found a higher prevalence in summer season.

Helminth eggs were not observed during this study, which may be due to eggs of *H.gallinarum* usually passing out through the periodically dropped caecal feces and thus often not being detected in non-caecal droppings, so to quantify the egg of *H.gallinarum* different sampling techniques are required (Clarke, 1979). Also as Daş *et al*.(2011) mentioned and the precision of faecal egg counts increase according to the concentration in faeces accretion.

The lack of trematodes infection in the study areas might be due to the absence of the intermediate host. Ali (1994) also reported that no trematodes were found in chickens in Sudan during his previous study. Soulsby (1982) also mentioned them as being less common parasite in African chickens.

The prevalence of helminth infections in local free range chickens in general, is high, which agrees with the finding of Mafwisha *et al*. (2002) and Abdelqader *et al*. (2008).

Conclusions

The results indicated that there was significance difference in prevalence among districts; also it concluded that there is a high prevalence of parasitic helminth infections in Sudan with no difference between the examined indigenous genotypes. The occurrence of helminthes was higher during the rainfall season than in the summer season, furthermore the rate of helminth infection in Khartoum was greater than in Gadarif.

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أثر الموسم على الاصابة بالديدان المعدية و المعوية في طرزين من الدواجن ببيئتين زراعيتين في السودان

رانيا محمد شمس الدين و محمد تاج الدين ابراهيم

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المستخلص

تشكل الأمراض الطفيلية مخاطر كبيرة على الدجاج في المرعي الحر. لذا أجريت هذه الدراسة بهدف تحديد وجود وشدة الديدان الطفيلية، وتقديرأثرالتغيرات المناخية الموسمية في نوعين من الدجاج المحلي في المرعي الحر وهما: البلدي الكبير (ن = 80) وعاري الرقبة(ن = 77) في منطقتين مختلفتين مناخيا في السودان وهما الخرطوم والقضارف. تم فتح الجهاز الهضمي لتحديد وجود وشدة عدوى الديدان الطفيلية، وكشفت النتائج أن معدل انتشار الديدان الطفيلية كان 94.9٪. حيث أصابت الديدان الأسطوانية 83.4٪ من الدجاج ، بينما كانت أصابة الديدان الخيطية 88.5٪ في الدجاج. الديدان الاسطوانيةالوحيدة هي من نوع *Heterakis gallinarum* بنسبة انتشار 83.6٪ في سلالة البلدي الكبير و 81.8٪ في سلالة عاري الرقبة. لم يكن هناك فرق معنوي ($P>0.05$) بين تأثير المناطق المختلفة وسلالات الدجاج والمواسم المناخية على كثافة وجود دودة *H. gallinarum* باستثناء عدد اليرقات. مستوي الأصابة بالديدان الطفيلية أعلى خلال موسم الأمطار منه في فصل الصيف، وكان معدل الإصابة في الخرطوم أكبر منه في القضارف. علاوة على ذلك لم تكن هناك فروق ذات دلالة إحصائية في متوسط عدد الديدان والجنس وطول الديدان في سلالات الدجاج ($P>0.05$). كان معدل انتشار الديدان الخيطية كالأتي: *Raillietina tetragona* 63.1 %، *Raillietina cesticullus* 63.1% ، ولم يظهر أي فرق معنوي ($P>0.05$) بين سلالتي الدواجن والموسم، بينما كانت *Raillietina echinobothrida* ($P = 0.027$) مختلفة معنويا. علاوة على ذلك، أظهرت *R.echinobothrida* 56.1 % و *Hymenolepis cantaniana* 18.5% فرقًا معنويًا بين طرز السلالة والمناطق ($P = 0.005$ و $P = 0.001$) على التوالي. لذلك استنتج أن هناك انتشارًا كبيرًا لعدوى الديدان الطفيلية في تلك المناطق مع عدم وجود فرق بين الطرز السلالات الأصيلة التي تم فحصها.