Journal of Animal and Veterinary Advances 11 (4): 517-520, 2012
ISSN: 1680-5593

Prevalence of Coccidiosis in Domestic Rabbits (*Oryctolagus cuniculus*) in Northwest China

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Abstract: In this study, prevalence of coccidiosis in domestic rabbits in Northwest China was investigated. A total of 1,622 fecal specimens of rabbits were collected between March 2008 and June 2011 from 69 different areas in 5 provinces, Northwestern China. About 14 species of *Eimeria* were examined, namely, *E. stiedai*, *E. media*, *E. magna*, *E. irrestidua*, *E. piriformis*, *E. exigua*, *E. intestinalis*, *E. coecicola*, *E. neoleporis*, *E. nagpurensis*, *E. leporis*, *E. flsvescens*, *E. matsubayashii* and *E. perforans*. The overall prevalence of these coccidial infections in rabbits was 78.11% (1627/1622). Concurrent infections involving two species were common. Significant differences in prevalence were not observed among five provinces but there exist differences in the dominant species of coccidia. There exists significant difference in prevalence between the adult rabbits (>6 months old) and juvenile rabbits (<3 months old). This is the first extensive survey of the prevalence of *Eimeria* sp. infection in domestic rabbits in Northwest China which provides useful epidemiological information for the prevention and control of coccidiosis.

Key words: Prevalence, coccidiosis, domestic rabbits, species, infection, China

INTRODUCTION

Coccidiosis is one of common diseases in rabbits which is cause by protozoan parasites (Levine, 1985). So far at least 15 species of *Eimeria* in rabbit have been identified. Of these species of coccidiosis affecting rabbits, *E. stiedai* is the only one that invades the liver (Taylor *et al*., 2007; Al-Mathal, 2008). The other species, namely, *E. stiedai*, *E. media*, *E. magna*, *E. irrestidua*, *E. piriformis*, *E. exigua*, *E. intestinalis*, *E. coecicola*, *E. neoleporis*, *E. nagpurensis*, *E. leporis*, *E. flavescens*, *E. matsubayashii* and *E. perforans* parasitize the small intestine (Catchpole and Norton, 1979; Levine, 1985; Li and Ooi, 2009). These coccidians can lead to retarded growth, diarrhoea and even mortality thus causing considerable economic losses (Peeters *et al*., 1981; Bhat *et al*., 1996; Taylor *et al*., 2007; Yakhchali and Tehrani, 2007).

In recent years with the rapid development of rabbit industry in Northwest China, coccidiosis in rabbits is increasing than ever before which has posed a serious threat to rabbit breeding industry. Although, some studies on coccidiosis had been carried out in domestic, most of these studies were restricted only to treatment of the coccidiosis (Ai *et al*., 2011; Wang *et al*., 2010). The epidemiological date about coccidiosis in rabbits was very limited in Northwestern China (Meng *et al*., 2007; Qiao *et al*., 2008). Up to now, there has not a general understanding of coccidial infection in domestic rabbit in 5 provinces, Northwestern China. In order to develop an effective prevention and control program to fight against rabbit coccidiosis, it is important to gain comprehensive epidemiological information on the prevalence of coccidiosis in rabbits. The aim of this study was to determine the prevalence of coccidiosis and some aspects of its character in domestic rabbits (*Oryctolagus cuniculus*) in Northwest China.

MATERIALS AND METHODS

Collection of fecal samples: A total of 1,622 fecal samples of domestic rabbits (*Oryctolagus cuniculus*) were collected from 5 provinces (Xinjiang, Gansu, Shanxi, Ningxia, Qinghai), Northwest China between March 2008 and June 2011. The 69 sampling sites including large-scale rabbit farms or backyard farms are located in different regions of 5 provinces. Most regions in Northwest China were dry, arid and semi-arid land. The average annual precipitation ranges from 50-800 mm. The average annual relative temperature of five provinces ranges from 0-16°C.

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Fecal samples were from the rabbits that had not been treated by any anti-coccidia drugs. Fecal samples were collected directly from farms and transferred into parasitological laboratory. The sampling date and sites of the rabbits were recorded for each sample.

Isolation of oocysts and sporulation: A suspension of each fecal sample (3 g/30 mL water) was strained through a sieve and resulted filtrate subjected to the centrifugal sedimentation (Long *et al*., 1976; Bhat and Jithendran, 1995). To isolate the oocysts of Eimeria, the sediments were examined by centrifugal flotation with saturated sugar solution. The collected oocysts were transferred into 2.5% aqueous potassium dichromate ($K_2Cr_2O_7$) solution (w/v) and incubated at 25°C for 168 h with gentle shaking on a horizontal shaker at 200 rpm for sporulation by assessing under a light microscope at a magnification of 600x.

Morphological identification: The features of sporulated oocysts including shape, shape index, size inner and outer wall, cap and time of sporulation, micropyle and residium were measured and the identity of species of coccidia was determined by the keys previously described by researchers (Francalancia and Manfredini, 1967; Pellerdy, 1974; Catchpole and Norton, 1979; Levine, 1985).

Statistical analysis: The statistical analyses of prevalence of coccidiosis in domestic rabbits in northwestern China were performed by using the χ^2-test with Excel (Microsoft® Excel 2003). Differences with a $p<0.05$ were considered significant.

RESULTS AND DISCUSSION

The prevalence in five provinces in domestic rabbits ranged from 73.36-87.54%. Gansu province had the highest prevalence of 87.54% which was followed by Shanxi, Ningxia, Xinjiang and Qinghai with prevalence of 78.09, 77.04, 74.99 and 73.36%, respectively. The overall prevalence of coccidial infections in Northwest China was 78.11% (1627/1622) (Table 1). No significant differences in prevalence were seen among five provinces ($p>0.05$) but there exist differences in dominant species of coccidia.

About 14 species of *Eimeria* were examined namely, *E. stiedai* (17.81%; 289/1622), *E. media* (16.58%; 269/1622), *E. magna* (13.75%; 223/1622), *E. irrestidua* (23.98%; 389/1622), *E. piriformis* (8.69%; 141/1622), *E. exigua* (7.77%; 126/1622), *E. intestinalis* (9.31%; 151/1622), *E. coecicola* (10.05%; 163/1622), *E. neoleporis* (9.00%; 146/1622), *E. nagpurensis* (10.30%; 167/1622), *E. leporis* (6.04%; 98/1622), *E. flavescens* (8.75%; 142/1622), *E. matsubayashii* (6.98%; 113/1622) and *E. perforans* (19.61%; 318/1622) (Fig. 1 and Table 2). Concurrent

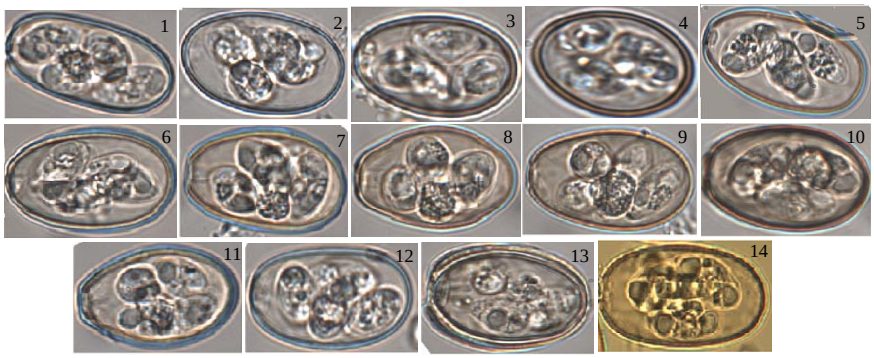

Fig. 1: About 14 species of rabbit coccidia in northwest China (Sporulated oocysts of *Eimeria* sp.) 1. *E. media*; 2. E. *leporis*; 3. *E. perforans*; 4. *E. exigua*; 5. *E. neoleporis*; 6. *E. irrestidua*; 7. *E. matsubayashii*; 8. *E. piriformis*; 9. *E. coecicola*; 10 (width of No. 9 and 10 is 20 μm). *E. magna*; 11. *E .intestinalis*; 12. *E. nagpurensis*; 13. *E. flavescens*; 14. *E. stiedai*. Bar = 20 μm

Table 1: Prevalence of coccidia in domestic rabbits in five province, Northwest China

Provinces	No. of sampling sites	No. of fecal samples	No. of positive fecal samples	Prevalence (%)	*Eimeria* sp.	Dominant species of coccidia
Xinjiang	17	426	319	74.88[a] (319/426)	10	*E. perforans*, *E. exigua*
Gansu	12	305	267	87.54[a] (267/305)	14	*E. perforans*, *E. irrestidua*
Shanxi	13	379	292	77.04[a] (292/379)	14	*E. perforans*, *E. irrestidua*
Ningxia	15	283	221	78.09[a] (221/283)	11	*E. perforans*, *E. stiedai*
Qinghai	12	229	168	73.36[a] (168/229)	12	*E. perforans*, *E. irrestidua*
Total	69	1622	1267	78.11 (1267/1622)	14	-

No significant differences in prevalence were seen among five provinces ($p>0.05$)

Table 2: Prevalence of 14 *Eimeria* sp. among 1,622 fecal samples in Northwest China

Eimeria sp.	No. of positive	Percentage of positive
E. stiedai	289	17.81 (289/1622)
E. media	269	16.58 (269/1622)
E. magna	223	13.75 (223/1622)
E. irrestidua	389	23.98 (389/1622)
E. piriformis	141	8.69 (141/1622)
E. exigua	126	7.77 (126/1622)
E. intestinalis	151	9.31 (151/1622)
E. coecicola	163	10.05 (163/1622)
E. neoleporis	146	9.00 (146/1622)
E. nagpurensis	167	10.30 (167/1622)
E. leporis	98	6.04 (98/1622)
E. flavescens	142	8.75 (142/1622)
E. matsubayashii	113	6.98 (113/1622)
E. perforans	318	19.61 (318/1622)

Table 3: Concurrent infections of *Eimeria* sp. in 1,622 samples in Northwest China

Species of *Eimeria*	No. of positive	Percentage of positive
2	665	52.49 (665/1622)
3	206	16.26 (206/1622)
4	81	6.39 (81/1622)
5	52	4.10 (52/1622)
>6	9	0.55 (9/1622)

infections involving two species of *Eimeria* in 1,622 fecal samples from Northwest China were common (Table 3). There exists significant difference ($p<0.05$) in prevalence between different feeding equipments (with or without defecation device) (Table 4). Significant difference ($p<0.05$) in prevalence was observed between the adult (>6 months old) and juvenile rabbits (<3 months old) (Table 5).

Although, many studies on survey of *Eimeria* species infections in rabbit have been reported all over the world (Catchpole and Norton, 1979; Peeters *et al*., 1981; Kasim and Al-Shawa, 1987; Hobss and Twigg, 1998; Gres *et al*., 2003; Yakhchali and Tehrani, 2007; El-Shahawi *et al*., 2011), the prevalence and dominant species of coccidia vary from different geographical areas (Levine, 1985; Meng *et al*., 2007; Qiao *et al*., 2008; Taylor *et al*., 2007; Razavi *et al*., 2010). In this study, the comprehensive survey of coccidiosis in domestic rabbits in Northwestern China was carried out. The overall prevalence of these coccidial infections in rabbits was 78.11% (1267/1622) (Table 1). About 14 *Eimeria* sp. of coccidia were found in five provinces, northwest China (Fig. 1) which account for different percents of all samples (Table 2). Of the species observed of *Eimeria* sp. affecting the rabbit's intestines, *E. perforans*, *E. coeciola*, *E. exigua* and *E. perforans* did not show clinical symptoms; *E. irresidua*, *E. piriformis*, *E. irresidua*, *E. media* and *E. magna* cause slight growth retardation and diarrhoea while *E. flavescens* and *E. intestinalis* caused weight loss and severe diarrhoea showing high pathogenicity in young rabbits.

Table 4: Prevalence of coccidiosis in domestic rabbits with different feeding equipments

Feeding equipments	No. of fecal samples	No. of positive	Percentage of positive
Cages with defecation device (self-cleaning)	544	265	48.71 (265/544)[a]
Cages without defecating device	1078	1002	92.95 (1002/1078)[b]
Total	1622	1267	78.11 (1267/1622)

Different lowercase letters in the same column indicate significant differences at $p<0.05$

Table 5: Prevalence of coccidiosis in domestic rabbits at different ages

Rabbit age	No. of fecal samples	No. of positive	Percentage of positive
>6 months old	431	209	48.49 (209/431)[a]
3-6 months old	565	447	79.11 (447/565)
<3 months old	626	611	97.60 (611/626)[b]
Total	1622	1267	78.11 (1267/1622)

Different lowercase letters in the same column indicate significant differences at $p<0.05$

Coccidiosis usually spread from one rabbit to another through a rabbit's excrement or through soiled food or bedding. The Northwest region is one of the poorest and most underdeveloped areas in China, rabbit industry has become one of important ways of increasing farmers' income in recent years. Due to the primitive feeding equipment and hygiene status, coccidiosis in rabbits is widespread in rural areas in China. In the survey, the results showed that the coccidial infection is closely associated with different feeding equipments (Table 4). The prevalence is obviously low in rabbits whose cages have defecation device (self-cleaning) while the prevalence is high when rabbits were fed under crowded or poor sanitary conditions. Moreover, concurrent infections involving two species among 1,622 fecal samples were common which account for 52.49% (665/1622) (Table 3). Therefore, it is important to carry out the routine disinfection for keeping the cages and environment clean which can effectively reduce the risk of the rabbit ingesting infected oocysts.

It was also found that there exist significant differences in prevalence between the adult and juvenile rabbits. The prevalence in adult rabbits (>6 months old) was lower than that of juvenile rabbits (<3 months old) (Table 5). Moreover infected adult rabbits usually do not show the clinical symptoms. From an immunological point of view, adult rabbits may be asymptomatic because repeated infections may elicit the acquired immunity through their developed immune systems. However, undeveloped immune systems make juvenile rabbits more susceptible in clinical cases.

CONCLUSION

The present study indicated that coccidial infection in rabbits is serious and widespread in 5 provinces,

Northwest China. Comprehensive strategies and measures should be taken to prevent and control coccidiosis in domestic rabbits under the present production conditions in China.

ACKNOWLEDGEMENTS

This research was supported by a grant from the State Basic Research Development Program of China (973 Program) (No.2010CB530204) and the National Natural Science Foundation of China (No.30960274).

The researchers thank the staff from State Key Laboratory of Veterinary Etiological Biology for technical support and all field staff who provided the fecal samples for this study.

REFERENCES

Ai, B.Y., X.F. Qiao, J.K. Chen, Y. Yang and B.Z. Mi *et al*., 2011. Effects of anti-coccidia chinese herbal medicine on blood biochemical indices of rabbits. Shanghai J. Anim. Husb. Vet. Med., 1: 2-3.

Al-Mathal, E.M., 2008. Hepatic coccidiosis of the domestic rabbit *Oryctolagus cuniculus domesticus* L. in Saudi Arabia. World J. Zool., 3: 30-35.

Bhat, T.K. and K.P. Jithendran, 1995. *Eimeria magna*: The effect of varying inoculum size on the course of infection in *Angora* rabbits. World Rabbit Sci., 3: 163-165.

Bhat, T.K., K.P. Jithendran and N.P. Kurade, 1996. Rabbit coccidiosis and its control: A review. World Rabbit Sci., 4: 37-41.

Catchpole, J. and C.C. Norton, 1979. The species of *Eimeria* in rabbits for meat production in Britain. Parasitology, 79: 249-257.

El-Shahawi, G.A., H.M. El-Fayomi and H.M. Abdel-Haleem, 2011. Coccidiosis of domestic rabbit (*Oryctolagus cuniculus*) in Egypt: Light microscopic study. Parasitol. Res., 10.1007/s00436-011-2479-0.

Francalancia, G. and L. Manfredini, 1967. Diagnosis of species of the rabbit coccidiosis (*Eimeria*). Vet. Ital., 18: 304-310.

Gres, V., T. Voza, A. Chabaud and I. Landau, 2003. Coccidiosis of the wild rabbit (*Oryctolagus cuniculus*) in France. Parasite, 10: 51-57.

Hobss, R.P. and L.E. Twigg, 1998. Coccidia (*Eimeria* spp.) of wild rabbits in Southwestern Australia. Aust. Vet. J., 76: 209-210.

Kasim, A.A. and Y.R. AI-Shawa, 1987. Coccidia in rabbits (*Oryctolagus cuniculus*) in Saudi Arabia. Int. J. Parasitol., 17: 941-944.

Levine, N.D., 1985. Veterinary Protozoology. 1st Edn., Lowa State University Press, Lowa State, pp: 171-179, 221-222.

Li, M.H. and H.K. Ooi, 2009. Fecal occult blood manifestation of intestinal *Eimeria* spp. infection in rabbit. Vet. Parasitol., 161: 327-329.

Long, P.L., B.J. Millard, L.P. Joyner and C.C. Norton, 1976. A guide to laboratory techniques used in the study and diagnosis of avian coccidiosis. Folia Vet. Lat., 6: 201-217.

Meng, Q.L., G.F. Tian, H.B. Yan and D.F. Zhang, 2007. Investigation on species of rabbit coccidia in Xinjiang province. Prog. Vet. Med., 28: 44-47.

Peeters, J.E., R. Geeroms, R. Froyman and P. Halen, 1981. Coccidiosis in rabbits: A field study. Res. Vet. Sci., 30: 328-334.

Pellerdy, L.P., 1974. Coccidia and Coccidiosis. 2nd Edn., Parey, Berlin, ISBN: 9783489733171, Pages: 959.

Qiao, J., X.P. Cai, G.F. Tian, Q.L. Meng and H.B. Yan *et al*., 2008. Investigation of species of rabbit coccidia in Lanzhou. Chin. J. Vet. Med., 44: 43-44.

Razavi, S.M., A. Oryan, E. Rakhshandehroo, A. Moshiri and A.M. Alavi, 2010. *Eimeria* species in wild rabbits (*Oryctolagus cuniculus*) in fars province, Iran. Trop. Biomed., 27: 470-475.

Taylor, M.A., R.L. Coop and R.L. Wall, 2007. Veterinary Parasitology. 3rd Edn., Blackwell Publishing Co., USA., Pages: 901.

Wang, X.Y., R. Yang, Y. Wang, K.F. Shen and C.H. Li *et al*., 2010. Development of detection method to assay the sensitivity of anti-coccidia medicine in young rabbits. Shanghai J. Anim. Husb. Vet. Med., 6: 32-33.

Yakhchali, M. and A. Tehrani, 2007. Eimeriidosis and pathological findings in New Zealand white rabbits. J. Boil. Sci., 7: 1488-1491.