

DIAGNOSTIC STUDY OF *EIMERIA SPECIES* IN EQUIDS IN MOSUL CITY

HAITHAM S ALBAKRI BAYDAA Y. AL-LAHAIBI AND E.G.SULEIMAN

Department of Microbiology, College of Veterinary Medicine, University of Mosul,
Mosul, Iraq**Received:** 1 October 2020; **Accepted:** 10 October 2020**ABSTRACT**

The current study included examination of one hundred fecal samples which were collected from (50) horses and 50 donkeys of different sex and age from animals with or without clinical signs from several areas of Mosul city to diagnose *Eimeria spp.* The findings showed that the total percentage of infection with *Eimeria spp.* was 24% which were 16% in horses and 32% in donkeys with no significant differences. Also, the results revealed no significant differences occurred between sex and different ages of the examined animals. *Eimeria leuckarti* and *E. uniungulati* were diagnosed in fecal samples of horses while *E. leuckarti*, *E. uniungulati* and *E. solipedum* diagnosed in fecal samples of donkeys. It was found that *E. leuckarti* was the commonest species in both animal species. It was concluded that the infection with one species of *Eimeria* was noticed forming the highest infection rates in each horses and donkeys which were (87.5%, 62.5%), respectively.

Key word: *Eimeria*, horse, donkey, diagnosis, feces, Mosul, Iraq.

INTRODUCTION

The infection with intestinal protozoa of *Eimeria* genus considered as the main important parasitic disease invading the intestinal epithelial cells of domesticated animals causing coccidiosis with high economic losses (Jader, 2011). There are many species of *Eimeria*

which infect the equids family, *i.e.* *Eimeria leuckarti*, *E. solipedum* and *E. uniungulati* (Soulsby, 1986). However, only *E. leuckarti* is a valid species infecting equids including horses, donkeys and zebra while *E. solipedum* and *E. uniungulati* represent spurious parasites, because the latter species were not detected in several research conducted in different countries (Dubey and Bauer, 2010). Some authors referred that the infection with *Eimeria spp.* are highly distributed in many countries and the percentage of infection with *E. leuckarti* in several countries has been ranging from 2-80% (Barker *et al.*, 1993, Barkirci *et al.*,

Corresponding author: E.G.SULEIMAN
E-mail address: emanghanim73@gmail.com
Present address: Department of Microbiology,
College of Veterinary Medicine, University of
Mosul, Mosul, Iraq

2004 Gundlach *et al.*, 2004, Lyons *et al.*, 2004, Uslu and Guclu, 2007)

In Iraq, there are numerous studies conducted on different gastrointestinal helminthes in equids in different cities (Yaecob *et al.*, 1988, Al Khafaji and Al-Saad, 1996, Abdul- Majeed, 2004, Alammara *et al.*, 2008). Notably, Local studies related to the prevalence and classification of *Eimeria* species in various spp. of equids family are very little with the exception of Al-alousi *et al.*, 1994 in Mosul city, Alharis, 2001 in Baghdad city and Wannas *et al.*, 2012 in Al-Diwaniyah city with the total percentages of infection with *Eimeria spp* 4%, 10.96%, 6.81%, 10.71% respectively .

The aim of this study was to classify of *Eimeria* genus and species in horses and donkeys with determination their occurrence in Mosul city.

MATERIALS AND METHODS

One hundred fecal samples, (50) samples from horses and (50) samples from donkeys were collected randomly from different regions of Mosul city.

The animals were of local breeds of both sex aged between 5 months to 10 years depending upon their dentition the general

health status of these animals vary between apparently healthy and intact to those suffering from diarrhea and emaciation.

The fecal samples were collected directly from the rectums of the animals and were placed in labeled plastic containers and were sent to the laboratory of parasitology in the college of veterinary medicine university of Mosul. The samples were microscopically examined by using direct and concentration methods, the latter technique includes flotation method using Sheather's sugar saturated solution and sedimentation method using tap water (Hendrix, 1998).

The identification and definition of the oocysts of equine *Eimeria* were based on orphometric characteristic of each oocyst of *Eimeria* species applying ocular micrometer which were followed by (Soulsby, 1986, Batelli *et al.*, 1995).

RESULTS

The results of this study revealed that the total percentage of infection with *Eimeria spp* in equids was 24%, including 16% and 32% in horses and donkeys respectively. Statistical analysis of the infection rates showed that no significant differences appeared between horses and donkeys Table (1).

Table 1: Number of fecal samples and percentage of infection with *Eimeria spp* in horses and donkeys

Species of animals	Number of examined samples	Number of infected animals	Percentage of infection
Horses	50	8a	16%
Donkeys	50	16a	32%
Total	100	24	24%

Males of horses showed higher percentage of infection than the female (16.66%) while females of donkeys showed higher percentage of infection

than the males (36.84%). However statistical analysis showed no significant differences between males and females of horses and donkeys Table (2).

Table 2: The relationship between the percentage of infection with *Eimeria spp* and sex of animals.

Sex of animals	Number of examined horses	Number of infected animals		Number of examined donkeys	Number of infected animals	
		No	%		No	%
Males	24	4a	16.66	31	9a	29.03
Females	26	4a	15.38	19	7a	36.84
Total	50	8	16	50	16	32

The Horses and donkeys less than one year old showed the highest rate of infection which were 37.5% and 42.85%, respectively while the lowest rate were detected in horses and donkeys more

than 3year old which were 10% and 25%, respectively. There were no significant differences appeared between all ages of inspected animals (Table 3).

Table 3: The relationship between the percentage of infection with *Eimeria spp* and age of animals.

Age of animals	Number of examined horses	Number of infected horses		Number of examined donkeys	Number of infected donkeys	
		No	%		NO	%
Less than one year	8	3a	37.5	7	3a	42.85
1-3 years	12	2a	16.66	15	6a	40
More than 3years	30	3a	10	28	7a	25
Total	50	8	16	50	16	32

The study indicated that horses were infected with *E.leuckarti* and *E.uniungulati* while donkeys were infected with *E. leuckarti*, *E.uniungulati* and *E.solipedum*. *Eimeria leuckarti* formed the highest percentage of infection in the fecal samples of horses and donkeys which were 75% and 56.25%, respectively (Table 4) Morphologically. *E.leuckarti* were appeared as ovoid with narrow end, thick wall oocyst, dark brown with distinct

micropyle (Fig. 1) Their sizes range between $(79.5-86.4) \times (55-60) \mu\text{m}$ with mean of $81 \times 56 \mu\text{m}$ (Table 5), *E.uniungulati* appeared as ovoid, bright orange (Fig2) and their sizes range between $(16.8-21.6 \times 12-14.4) \mu\text{m}$ with mean of $19.8 \times 13.2 \mu\text{m}$ (Table 5). The description of *E.solipedum* were a round having double wall layer, yellowish brown in color with no micropyle (Fig. 3) and their sizes were $(19.2 - 26.4) \mu\text{m}$ with mean of $21.6 \mu\text{m}$ (Table 5).

Table 4: Species of *Eimeria* identified in infected equines.

Species of <i>Eimeria</i>	Number of infected samples and percentage of infection	
	Horses	Donkeys
<i>E.leuckarti</i>	6(75%)	9(56.25%)
<i>E.uniungulati</i>	3(37.5%)	4(25%)
<i>E.solipedum</i>	-	8(50%)

Table 5: Characteristic features and measurements of oocysts of *Eimeria spp* diagnosed in fecal samples of equines.

Species of <i>Eimeria</i>	Characteristic features	Measurements	
		Mean Length \times Width μm	Range Length \times Width μm
<i>E.leuckarti</i>	Ovoid with narrow end, thick wall oocyst, dark brown with distinct micropyle	81 \times 56	(79.5-86.4) \times (55 \times 60)
<i>E.uniungulati</i>	Ovoid, bright orange	19.8 \times 13.2	(16.8-21.6) \times (12-14.4)
<i>E.solipedum</i>	Round, double wall layer, yellowish brown in colour with no micropyle	21.6	19.2-26.4



Fig. 1: oocyst of *E. leuckarti* (400x, using digital camera)



Fig. 2: oocyst of *E. uniungulati* (400x, using digital camera)



Fig. 3: oocyst of *E. solipedum* (400x, using digital camera)

Infection with one species of *Eimeria* was formed the highest infection rates in each horses and donkeys which were 87.5% and 62.5% respectively. The percentage of mixed infections with more than two species of *Eimeria* were

between 12.5% and 37.5%. Statistical analysis showed no significant differences between single and mixed infections of *Eimeria* in each of horses and donkeys (Table 6)

Table (6) Types of infection with *Eimeria* species in horses and donkeys

Types of infection	Species of animals	
	Number and percentage of infected horses	Number and percentage of infected donkeys
Single infection	7(87.5%)a	10(62.5%)a
Mixed infection	1(12.5%)a	6(37.5%)a
Total	8(100%)	16(100%)

DISCUSSION

According to the fecal examination of equids, the total percentage of infection with *Eimeria spp* was 24% forming 16% and 32% in the horses and donkeys respectively.

These results were in disagreement with those of some authors in different areas of Iraq which were 10.96% in horses of Mosul city (Alalousi *et al.*, 1994), 4% in horses of Baghdad (Alharis, 2001) and 6.8% in horses and 10.71% in donkeys of Al-Diwanyah city (Wannas *et al.*, 2012). Similarly, our findings were inconsistent with a study carried out in Turkey mentioned that 6.35% if donkeys were infected by the parasite (Tudor, 2010).

The variations in the infection rates with oocysts of *Eimeria spp* obtained in this study may be related to the several

factors such as number of samples examined, ecological and environment of conditions, biological agents, and techniques of examination applied.

High percentage of infection with *Eimeria spp* was noticed in male horses (16.66%) and in female donkeys (36.48%) with no significant differences between them.

Males and females of animals may be affected equally to the predisposing factors and other researcher referred that the sex of animals has no any effective role in infection with oocyst of *Eimeria* (Al-Bakri, 2002). These results were similar with Wannas *et al.*, 2012 Ali *et al.*, 2005 they referred that no significant differences could appear between different sexes of animals (horses, donkeys, sheep and rabbits) respectively.

However in Egypt, Attia *et al.*, 2018 found that eight males and two female working donkeys were infected by *E. leuckarti*. Furthermore, Jadder, 2011 indicated that the hormones of males and females have no effect on the percentage of infection with *Eimeria spp* and the infection with this parasites may be related to the number of examined animals and condition of the management and environment rather than other factors.

In table (3) the high rate of infection with oocyst of *Eimeria* was noticed in animals aged less than one year which were 37.5% and 42.8% respectively with no significant differences between horses and donkeys. In contrast these results were in harmony with Lyons *et al.*, 2006. On the other hand, these results were in contrast with Wannas *et al.* (2012) who found significant differences in the percentage of infections in different ages of horses and donkeys, Wheeldon, 1977 indicated that coccidian are a common incidental finding in normal healthy foals aged 30-125 days and suggests that this organism does not cause clinical signs in foals.

Lyons *et al.* (2007) found that presence of *E. leuckarti* is more in young animals. Nevertheless, some researchers stated that the age of animals may play an important role in the occurrence of coccidiosis and the intensity of the disease occurs in young ages with gradual decrease of occurrence in growing and adult animals (Radostits *et al.*, 2007, Yakhchali and Zarei, 2008). Contextually, Beelitz *et al.*, 1994 suggested that foals may become infected from the first day of birth.

In this study horses were found to be infected with *E. leuckarti*, *E. uningulati*

while the donkeys were found to be infected with *E. leuckarti*, *E. uningulati* and *E. solipedum*. *Eimeria leuckarti* were detected as the most predominant species in the fecal samples of horses and donkeys which were 75% and 56.25%, respectively.

According to our best information, identification of coccidian and their occurrences in equine family are poorly studied and local studies are few and scarce, needing further comprehensive work. Soulsby, (2) and Dubey *et al.* (2010) showed that there is substantial confusion about validity of *Eimeria* species in equids. Consecutively, three species of *Eimeria* viz., *E. solipedum*, *E. uniungulati* and *E. leuckarti* were nominated from horses and *E. leuckarti* is the only valid species infecting equids horses, donkeys and zebras while *E. solipedum*, *E. uniungulati* and Isospora are serving as spurious parasites causing accidental contamination with coccidia from other hosts leading to create a condition known as false temporary or periodic parasites.

The findings of the present study were in accordance with (Wheeldon, 1977, Lyons and Tolliver, 2018) who reported the presence of 3 species of *Eimeria* in equids. They considered that *E. leuckarti* as valid and common coccidial oocysts diagnosed in the feces of equines, in the same context they explained that *E. solipedum* and *E. uniungulati* are spurious parasites (invalid) because these species could not be found in subsequent surveys carried out worldwide (Dubey JP, Bauer 2010). Additionally, spurious coccidian or unidentified *Eimeria spp* were also reported from horses in Srilanka (Dissanayake *et al.*, 2017).

In the current study the percentage of infection with *E.leackarti* in horses and donkeys were 75% and 56.25%, respectively. The oocyst of *E.leackarti* have been reported in feces of equids from many countries with different percentage of infection, such as 2.9% (in horses), 4.1% (donkeys) in Albania (Postoli *et al.*, 2010), 17.5% (in horses) in Rio de Janeiro state (Spits dos Santos *et al.*, 2014) 7.7% in horses and donkeys in southwest Iran (Karimi ghahfarrokhi *et al.*, 2014). Studzinska *et al.* (2008) revealed that there was widespread of *E.leackarti* infection in several countries which is ranging from 2% - 80%.

Infection with one species of *Eimeria* formed the highest infection rate in horses and donkeys which were 87.5% and 62.5%, respectively some studies performed on determination of species of *Eimeria* in different hosts showed that infection with more than one species of *Eimeria* composed high percentage (Soulsby 1986). It is known that infection with one or more than one species of *Eimeria* depends on several agents such as degree of contamination of the pasture, stress, level of immunity of the animals, age of animals and lastly pathogenicity of the species of *Eimeria* as mentioned by a worker (Ali *et al.*, 2005).

REFERENCES

Abdul-Majeed, MO. (2004): Clinical pathological treatment study in horses infection with gastrointestinal worm in Mosul. Thesis MSc. Vet. Med. Mosul.

Al Khafaji, NG. and Al-Saad, KM. (1996): Common gastrointestinal parasites in drought horses in Mosul city. Mosul.Iraq.Vet.Med.J,9:51-60.

Alalousi, TL.; Arselan, SH. and Zanganal, IQ. (1`994): Study of some intestinal infection of horses in Mosul, Iraq. Vet. Med. J, 2: 85-91.

Alammara, GJ.; Alali, SJ. and Abdul, Aziz SA. (2008): Prevalence of *Parascaris equorum* infection in Karmat Ali in Basrah . Basrah. J. for Vet. Res, 7: 34-48.

Al-Bakri, HS. (2002): Parasitic Protozoa *Eimeria* and *Cryptosporidium* in goats in Nineveh Province MSc thesis, university of Mosul, college of veterinary medicine.

Alharis, KM. (2001): Survey of the intestinal protozoa in the horses in Baghdad city, Thesis Msc. Vet. Med. Baghdad.

Ali, MM.; Suleiman, EG. and Mahmoud, AF. (2005): Comparison study for incidence of *Eimeria spp* and *Cryptosporidium spp* in sheep between Mosul and Kirkuk. J. Dohuk. Univ, 8(2): 175-180.

Attia, MM.; Khalifa, MM. and Atwa, MT. (2018): The prevalence and intensity of external and internal parasites in working donkeys (*Equus asinus*) in Egypt. Veterinary world, 11:1298-1304.

Barker, IK.; Van Dreumel, AA. and Palmer, N. (1993): The alimentary system .In pathology of domestic animals, ed Jub KUF kennedy PC and Palmer N.Uth ed. Academic press, New York, 2; 304.

Barkirci, S.; Cirak, VY.; Gulegen, E. and Karabacak A. (2004): Parasites found by fecal examination in horses in the Gemlik military stud farm in

- Turkish. *Turkiye parasitology Dergisi*, 28: 35-37.
- Batelli, G.; Galuppi, R.; Pietrobelli, M. and Tampierimp (1995): *Eimeria leuckarti* (Fleisch, 1883) Reichenow, 1940 from *Equus caballus* in Italy. *Parasitologia*, 37: 215-217.
- Beelitz, P.; Rieder, N. and Gothe, R. (1994): *Eimeria leuckarti* - Infection bei Fohlen und ihren Mutterstuten in Oberbayern. *Tierärztl. Prax.*, 22: 377-381.
- Dissanayake, S.; Rajapaksa, J. and Rajakaruna, R.S. (2017): Gastrointestinal parasites of domestic and feral horses (*Equus caballus*) in Sri Lanka. *Ceylon J. Sci.*, 46: 17-26.
- Dubey, J.P. and Bauer, C. (2010): A review of *Eimeria* infection in horses and other equids. *veterinary parasitology*. <https://doi.org/10-1016/j.vetpar.2018.04.010>.
- Gundlach, J.L.; Sadzikowski, A.B.; Tom Czuk, K. and Studzinska, M.B. (2004): Parasites of the alimentary tract of horses from the Lublin district in the light of coproscopic and gross anatomopathological examination (in Polish). *Med Vet*, 60: 1289-1092.
- Hendrix, C.M. (1998): *Diagnostic veterinary parasitology*. 2nd ed. Mosby Elsevier. 240.
- Jader, H.M.A. (2011): Diagnostic study of *Eimeria spp* in sheep in Mosul city, Thesis MSc, college of veterinary medicine, University of Mosul.
- Karimi ghahfarrokhi, E.; Ahmadi, A.; Gholipour shahraki, S. and Azizi, H. (2014): *Eimeria leuckarti* (Fleisch, 1883; Reichenow, 1940) from worker horses and donkeys of Shahrekord, Iran. *Int. J. Adv. Biol. Biomed-Res.*, 2: 1980-1984.
- Lyons, E.T.; Tolliver, S.C. and Collins, S.S. (2004): Field studies on endoparasites of thoroughbred foals on seven farms in central Kentucky. *Parasitol. Res.*, 98: 496-500.
- Lyons, E.T.; Tolliver, S.C.; Collins, S.S. (2006): Field studies on endoparasites of thoroughbred foals on seven farms in central Kentucky in 2004. *Parasitol. Res.*, 98, 496-500.
- Lyons, E.T.; Tolliver, S.C.; Rathgeber, R.A.; Collins, S.S. (2007): Parasite field study in central Kentucky on thoroughbred foals (born in 2004) treated with pyrantel tartrate daily and other parasiticides periodically. *Parasitol Res.*, 100, 473-478.
- Lyons, E.T.; Tolliver, S.C. (2018): A review of *Eimeria* infection in horses and other equids. *Vet parasitol*, 251: 1-2.
- Postoli, R.; Robaj, A.; Ceroni, V.; Zalla, P.; Andoni, E. and Caushi, A. (2010): Epidemiological study on the prevalence of endoparasites of equines in Albania. *veterinary (Sarajevo)*, 59: 37-45.
- Radostits, O.M.; Gay, C.C.; Hinchliff, K.W. and Constable, P.D. (2007): *Veterinary medicine a textbook of the disease of cattle, horses, sheep, pigs and goats*. 10th ed. Edin burgh. London. New York, Oxford, Philadelphia. St Louis, Sydney Toronto, 1498-1507.
- Raue, K.; Heuer, L.; Bohm, C.; Wolken, S.; Epe, C. and Strube,

- C. (2017): 10- year parasitological examination results (2003 to 2012) of faecal samples from horses, ruminants, pigs, dogs, cats, rabbits and hedgehogs. *Parasitol Res*, 116: 3315-3330.
- Soulsby, E.J.L. (1986): Helminths .Arthropods and protozoa of domesticated animals. 7th ed. Bailliere Tindall London, pp 619-620.*
- Spits dos Santos, C.; Pereira Berto, B.; Teixeira de Jesus, VL. and Gomes Lopes, CW. (2014): Eimeria leuckarti Flesch 1883 (Apicomplexa = Eimeriidae) from horses foals in Rio de Janeiro. Coccidia, 2: 40-44.*
- Studzinska, MB.; Tomczuk, K. and Sadziko-wski, AB. (2008): Prevalence of Eimeria leuckarti in young horses and usefulness of some coproscopical methods for its detection – Bull vet inst. Pulawy, 52: 541-544.*
- Tudor, P. (2010): Study regarding the prevalence of endoparasitary infestation of donkeys from a shelter. Scientific works c series., 3-4: 454-458.*
- Uslu, U. and Guclu, F. (2007): Prevalence of endoparasites in horses and donkeys in Turkey. Bull Vet Inst. Pulawy, 51: 327-240.*
- Wannas, HY.; Dawood, KHA. and Gassem, GH.A. (2012): Prevalence of Gastro-intestinal parasites in horses and donkeys in Al-Diwaniyah governorate. Al-Qadisiya Journal of Vet. Med. Sci., 11(1):*
- Wheeldon, EB. (1977): Globidium leuckarti infection in a horse with diarrhea .Veterinary record, 100:102-103.*
- Yaacob, AY.; Wafaa, H. and Altaif, Kl. (1988): Survey of gastrointestinal helminthes of horses in Baghdad City. Vet. Med.J, 12: 221-230.*
- Yakhchali, M. and Zarei, MR. (2008): prevalence of Eimeria infection in sheep of in Tobriz suburb, Iran, Iranian J vet. Res Shiraz Uni., 9(3): 277-280.*

دراسة تشخيصية لانواع *Eimeria spp.* في الفصيلة الخيلية في مدينة الموصل

هيثم صديق البكري ، بيداء يونس اللهيبي ، ايمان غانم سليمان
فرع الاحياء المجهرية ، كلية الطب البيطري ، جامعة الموصل ، الموصل ، العراق

E-mail: emanghanim73@gmail.com Assiut University web-site: www.aun.edu.eg

تضمنت الدراسة الحالية فحص ١٠٠ عينة براز جمعت من كل من الخيول (٥٠) عينة والحمير (٥٠) عينة ، من مناطق مختلفة من مدينة الموصل ومن كلا الجنسين وباعمار مختلفة ومن حيوانات سليمة سريريا وحيوانات تعاني من بعض العلامات المرضية وذلك لتشخيص انواع الایمیریا في الفصيلة الخيلية. بلغت نسبة الاصابة الكلية بجنس الایمیریا في الفصيلة الخيلية ٢٤% ، ١٦% (في الخيول) و ٣٢% (في الحمير) مع عدم وجود فرق معنوي في نسبة الاصابة بين الخيول والحمير ، كذلك اشارت الدراسة الى عدم وجود فرق معنوي بين كل من ذكور واناث الخيول والحمير وكذلك بين مختلف الفئات العمرية للحيوانات .

تم تشخيص *Eimeria leuckarti* و *Eimeria uniungulati* في عينات براز الخيول بينما تم تشخيص كل من *Eimeria leuckarti* و *Eimeria uniungulati* و *Eimeria solipedum* في عينات براز الحمير وكان النوع *E. leuckarti* هو السائد في كل من عينات براز الخيول والحمير ولقد شكل نمط الاصابة بنوع واحد من الایمیریا اعلى نسبة في كل من الخيول والحمير وبنسبة ٨٧,٥% و ٦٢,٥% على التوالي.