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

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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 is 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,*...
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>
<thead>
<tr>
<th>Species of animals</th>
<th>Number of examined samples</th>
<th>Number of infected animals</th>
<th>Percentage of infection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horses</td>
<td>50</td>
<td>8a</td>
<td>16%</td>
</tr>
<tr>
<td>Donkeys</td>
<td>50</td>
<td>16a</td>
<td>32%</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>24</td>
<td>24%</td>
</tr>
</tbody>
</table>
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.

<table>
<thead>
<tr>
<th>Sex of animals</th>
<th>Number of examined horses</th>
<th>Number of infected animals</th>
<th>Number of examined donkeys</th>
<th>Number of infected animals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Males</td>
<td>24</td>
<td>4a 16.66</td>
<td>31</td>
<td>9a 29.03</td>
</tr>
<tr>
<td>Females</td>
<td>26</td>
<td>4a 15.38</td>
<td>19</td>
<td>7a 36.84</td>
</tr>
<tr>
<td>Total</td>
<td>50</td>
<td>8 16</td>
<td>50</td>
<td>16 32</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Age of animals</th>
<th>Number of examined horses</th>
<th>Number of infected horses</th>
<th>Number of examined donkeys</th>
<th>Number of infected donkeys</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than one year</td>
<td>8</td>
<td>3a 37.5</td>
<td>7</td>
<td>3a 42.85</td>
</tr>
<tr>
<td>1-3 years</td>
<td>12</td>
<td>2a 16.66</td>
<td>15</td>
<td>6a 40</td>
</tr>
<tr>
<td>More than 3 years</td>
<td>30</td>
<td>3a 10</td>
<td>28</td>
<td>7a 25</td>
</tr>
<tr>
<td>Total</td>
<td>50</td>
<td>8 16</td>
<td>50</td>
<td>16 32</td>
</tr>
</tbody>
</table>
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) × (55-60) µm with mean of 81×56 µm (Table 5). *E.*uniungulati appeared as ovoid, bright orange (Fig2) and their sizes range between (16.8-21.6 × 12-14.4) µm with mean of 19.8 × 13.2 µm (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) µm with mean of 21.6 µm (Table 5).

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

<table>
<thead>
<tr>
<th>Species of <em>Eimeria</em></th>
<th>Number of infected samples and percentage of infection</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Horses</td>
</tr>
<tr>
<td>*E.*leuckarti</td>
<td>6(75%)</td>
</tr>
<tr>
<td>*E.*uniungulati</td>
<td>3(37.5%)</td>
</tr>
<tr>
<td>*E.*solipedum</td>
<td>-</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Species of <em>Eimeria</em></th>
<th>Characteristic features</th>
<th>Measurements</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean Length ×Width µm</td>
</tr>
<tr>
<td>*E.*leuckarti</td>
<td>Ovoid with narrow end, thick wall oocyst, dark brown with distinct micropyle</td>
<td>81×56</td>
</tr>
<tr>
<td>*E.*uniungulati</td>
<td>Ovoid, bright orange</td>
<td>19.8×13.2</td>
</tr>
<tr>
<td>*E.*solipedum</td>
<td>Round, double wall layer, yellowish brown in colour with no micropyle</td>
<td>21.6</td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>Types of infection</th>
<th>Number and percentage of infected horses</th>
<th>Number and percentage of infected donkeys</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single infection</td>
<td>7(87.5%)a</td>
<td>10(62.5%)a</td>
</tr>
<tr>
<td>Mixed infection</td>
<td>1(12.5%)a</td>
<td>6(37.5%)a</td>
</tr>
<tr>
<td>Total</td>
<td>8(100%)</td>
<td>16(100%)</td>
</tr>
</tbody>
</table>

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 (Alalouisi 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. Eiemenira 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 one 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.solipemum, E.uniungulati* and *E.leackarti* were nominated from horses and *E.leuckarti* is the only valid species infecting equids, horses 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, 1077, 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 ghahfarrokh 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).

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Raue, K.; Heuer, L.; Bohm, C.; Wolken, S.; Epe, C. and Strube,


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

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

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تضمنت الدراسة الحالية فحص 100 عينة براز جمعت من كل من الخيول (50) عينة والحمير (50) عينة ، من مناطق مختلفة من مدينة الموصل ومن كلا الجنسين وبعمر مختلف ومن حيوانات سليمة سريريا وحيوانات تعاني من بعض العلامات المرضية وذلك لتشخيص انواع الأيميريا في الفصيلة الخيلية. بلغت نسبة الإصابة الكلية بجنس الأيميريا في الفصيلة الخيلية 42%, 16% (في الخيول) و34% (في الحمير) مع عدم وجود فرق معنوي في نسبة الإصابة بين الخيول والحمير ، كذلك أشارت الدراسة إلى عدم وجود فرق معنوي بين كل من ذكور وإناث الخيول والحمير وكذلك بين مختلف الفئات العمرية للحيوانات.

تم تشخيص Eimeria uniungulati و Eimeria leuckarti في عينات براز الخيول بينما تم تشخيص كل Eimeria solipedum و Eimeria uniungulati و Eimeria leuckarti من عينات براز الحمير. وكان النوع E. leuckarti هو السائد في كل من عينات براز الخيول والحمير وقد شكل نمط الإصابة بنوع واحد من الأيميريا اعلى نسبة في كل من الخيول والحمير ونسبة 5.7% و14.7% على التوالي.