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Prevalence of Equine Lung Worm (Dictyocaulus Arnfieldi) and Its Associated Risk Factors in Jimma Town, South West Ethiopia

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Abstract
This study was conducted to assess the prevalence of equine lung worm (*Dictyocaulus arnifieldi*) and its associated risk factors in Jimma town. The cross sectional study was conducted from November, 2014 to April, 2015 in Jimma town, Southwestern Ethiopia. Faecal samples were collected from 384 randomly selected equines (51 donkeys, 295 horses and 38 mules) and examined using modified Baermann technique to determine first stage larvae (L1) of *Dictyocaulus arnfieldi*. The overall prevalence of lung worm in Jimma town was found as 11.2% (43/384). At animal species level the prevalence of lung worm infection in donkeys, mules and horses were 35.29% (18/51), 21.1% (8/38) and 5.8% (17/295), respectively with higher statistical significant difference (P=0.000). Higher prevalence of infection was recorded in equines with ≥10 years of age (20.6% (21/102)) followed by age groups ≤3 years and 4-10 years with prevalence of 12.6% (11/87) and 5.6% (11/195), respectively. In this study, equines with poor body condition were found highly infested (31.5%) compared to good (3.1%) and medium (10.8%) body condition with P value of 0.000. Sex of the animals was found to have no significant association with lung worm infestation with prevalence of 13% in females and 9.9% in males (P > 0.05). This result indicated that equine lungworm was found important disease condition in the area. Hence, regular deworming and pasture management are recommended to reduce the worm burden in the equine.
Keywords: Dictyocaulus arnfieldi, Equines, Jimma, Prevalence, Risk factors

1. Introduction

Ethiopia, with its great variation in climate and topography, possesses one of the largest equine populations in the world. Alemayehu (2004) reported that, the country has the highest equine population probably with the highest density per square kilometer and it has a total of 6.9% and 42.4% in the world and Africa equine population, respectively. Numerically, Ethiopia has 21.7 million horses, 5.57 million donkeys, the second largest in the world next to China, and 380 thousand mules (CSA, 2009).

Equines (donkeys, mules and horses) play an important role as working animals in many parts of the world, for packing, riding, carting and ploughing. Equine power is very crucial in both rural and urban transport system. This is because of its cheapness and availability and so provides the best alternative transport means in places where the road network is insufficiently developed and the landscape is rugged and mountainous and in the cities where narrow streets prevent easy delivery of merchandise (Feseha *et al.,* 1991). In some areas of North West Kenya and Southern Ethiopia, donkey meat is a delicacy and the milk believed to treat whooping cough (Fred and Pascal, 2006).

Even though mules and donkeys have often been described as sturdy animals; they succumb to a variety of diseases and a number of other unhealthy circumstances. Among these, parasitic infection is a major cause of illness (Sapakota, 2009). Lungworms are widely distributed throughout the world providing nearly perfect conditions for their survival and development but are particularly common in countries with temperate climates, and in the highlands of tropical and subtropical countries. *Dictyocaulidae* are known to exist in East Africa (Ethiopia, Kenya and Tanzania) and South Africa (Hansen and Perry, 1996).

Dictyocaulus arnfieldi is the true lungworm affecting donkeys, horses, ponies and zebras and is found throughout the world (Smith, 2009). Donkeys and their crosses (Mules) are the natural hosts for lungworm and the condition in horses is usually found in those that have been in the company of donkeys and mules (Rose and Hodgson, 2000). Adult *Dictyocaulus* worms are slender, medium sized roundworms which have a whitish to grayish color. This parasite has both digestive system and nervous system but have no excretory system (Bowman, 2003).

Animals become infected with lung worm infection mainly while grazing, but infection can also happen indoors through contaminated hay or bedding (Junquera, 2014). The major pathologic changes occur in equine after infection can be divided into prepatent, patent and post patent phase. However, the pathogenic effects of lungworm depends on their location within the respiratory tract, the number of infective larvae ingested, the animal immune status, body condition of the animals, on the nutritional status and age of the host (Fraser, 1991).

Body condition can be considered as a major risk factor to lung worm infection in equines. This is due to the fact that, poorly nourished animals appear to be less competent in getting rid of infection although it is not unusual for well-fed animals to succumb to the disease provided the right environmental conditions are made available (Tihitna *et al.,* 2012). Lung worm infection may have different severity among different age groups.

Hence, the older and younger animals are taught to have higher sensitivity as they have decreased immunity to combat infections (Andersen and Fogh, 2010).

Despite the huge numbers of equine population and the increasing importance of equines in the Ethiopian economy, very little research relating to equine lungworm has been conducted. Apart from few studies in other parts of Ethiopia, there has not been enough reports on equine lungworm in Jimma town, where equines are back bone of the economy of the study area. In addition to this, risk factors like age of animals, body condition and sex in association with lung worm infection in equines were not reported specifically in Jimma town. The present study was conducted to determine the prevalence of lung worm infection of equines in Jimma town and to assess the associated risk factors with *dictyocaulosis* of horses, donkeys and mules.

2. Material and Methods

2.1. Study area

The study was conducted at Jimma town, located 350 km south-west of Addis Ababa. The town's geographical coordinates are 7°41' N latitude and 36° 50' E longitude. The town is found at an average altitude of about 1,780 m above sea level. It lies in the climatic zone locally known as "Woyna Daga" (1,500-2,400 m above sea level) which is considered ideal for agricultural activities. The town is generally characterised by warm climate with a mean annual maximum temperature of 30°C and a mean annual minimum temperature of 14°C. The annual rainfall ranges from 1138-1690 mm. The maximum precipitation occurs during the three months period from June through August, with minimum rainfall occurring in December and January. From a climatic point of view, abundant rainfall makes this region one of the best watered of Ethiopian highland areas, conducive for agricultural production. The annual minimum and maximum temperature are about 14.4°C and 26.7°C, respectively (**Alemu *et al.*, 2011**). The equine population of the area were found to be 2463 (1892- horses, 324- donkeys and 247-mules) (CSA, 2009).

2.2. Study design and animals

A cross-sectional study was conducted from November to April (2014/ 2015) on equines by collecting their faeces. Fecal samples were directly collected from the rectum of 384 equids (horses = 295, donkeys = 51and mules = 38) of all age groups, body conditions and both sex groups. Simple random sampling technique was employed to select individual study animals. All animals included in this study were local breeds, kept under extensive management system used for packing and transportation.

2.3. Sample collection and larval identification

Faecal samples were collected directly from the rectum of each equine using arm length rubber gloves and placed in 28 ml glass; screw-corked universal bottles were labeled accordingly and soon brought to Jimma University, College of Agriculture and Veterinary Medicine, Parasitology Laboratory for examination. Faecal samples were processed on the day of collection and/or stored in a refrigerator at 4 degree Celsius until processing. Coprological examination was performed using a modified Baermann technique for the detection of *Dictyocaulus arnfieldi* first stage larvae (L1) following standard procedures described by Charles and Robinson (2006).

The age of the selected equines were determined by inspecting and estimating the incisor eruption times **(**Crane, 1997; Svendsen, 1997). Therefore, Equines were grouped into three age categories namely equines less than or equal to three years, four to ten years and greater than and equal to ten years of age. Similarly, for present study, body condition was scored as poor, medium and good according to Tihitna *et al.* (2012).

2.4. Sample size determination

The sample size was determined by considering with no previous study in the area and by taking 50% prevalence. The sample size for the study was calculated using (Thrusfield, 2005) formula. Accordingly, a sample size of 384 equines was considered for the study.

$$n = \frac{(1.96)^2 \text{Pex}\,(1 - \text{Pex})}{\text{d}^2}$$

Where: n = required sample size, Pex = recorded previous prevalence = 50%, d = desired absolute precision =5%

2.5. Data analysis

The collected data during sampling and laboratory results was entered and stored in Microsoft Excel spread sheet 2007 (Microsoft Corporation, Redmond, Washington, USA) and SPSS (version 17; SPSS Inc., Chicago, IL, USA) was used to analyze the data. The data were thoroughly screened for errors and properly coded before subjecting to statistical analysis. Descriptive statistic was used to estimate the prevalence for *D. arnfieldi* in the study area. Risk factors such as age, sex and body condition were analyzed using the Pearson chi-square test. P

value less than 0.05 was considered as statistical significant.

3. Results

The examination of 384 fecal samples of equine revealed 43 positive and 341 negative animals with the overall prevalence of 11.2%. The prevalence was found to be 35.3%, 21.1% and 5.8% in donkeys, mules and horses, respectively with statistical significance difference among study animals (P<0.05) (Table 1).

Table 1: Mean prevalence of lungworm infection in different equine species

Species	Total examined	No of positive	Prevalence (%)	p-value
Horse	295	17	5.8	0.000
Donkey	51	18	35.3	
Mule	38	8	21.1	
Total	384	43	11.2	

As the result shown in table 2, there was higher statistical significance variation (P=0.000) among different age groups and body condition score in study animals. Out of 384 equines, the prevalence with sex of study animals was 13% (21/162) in female and 9.9% (22/222) in male (P=0.349). Similarly the prevalence of lung worm with poor, medium and good body condition score were 31.5% (17/54), (10.8% (22/203)) and (3.1% (4/127)), respectively (p=0.000). Among age groups the prevalence of the disease was found higher in equines ≥ 10 years of age (20.6% (21/102)) followed by ≤ 3 years (12.6% (11/195) and 4-10 years of age (5.6% (11/87) (P=0.000).

Table 2: The prevalence of lung worm infection with different risk factors

Risk factors	No. examined	No of positive	Prevalence%	p-value
Sex				
Female	162	21	13.0	0.349
Male	122	22	9.9	
BCS				
Poor	54	17	31.5	0.000
Medium	203	22	10.8	
Good	127	4	3.1	
Age				
≤3years	87	11	12.6	0.000
4-10years	195	11	5.6	
≥10years	102	21	20.6	
Total	51	18	35.29	

4. Discussions

The overall prevalence of lungworm infection in the study population was 11.2% (43/384) with the highest prevalence in (35.29%) in donkeys and the lowest prevalence (5.8%) in horses. Getahun (1993) reported an overall prevalence of 20% in Bale and Shiferaw (1993) reported a prevalence of 23.2% in Wonchi, Ethiopia. Their report was found higher than the present study. This difference could be due to the difference in environmental conditions, sample size, sampling time and management practice favoring the survival of the larvae of the parasite (Tihitna *et al.,* 2012).

In this study, relatively higher overall prevalence of *Dictyocaulus arnifieldi* was recorded in donkey (35.29%) than mules and horses. This was analogous with the reports of Legese (1996) and Tihitna *et al.* (2012) who described a prevalence of 30.5-32.8% and 35.3% in Dira Dawa and Estern Ethiopia and in and around Jimma town, respectively. The observed higher prevalence in donkeys might be due to the fact that, they are a reservoir host for lung worm (Rose and Hodgson, 2000) and attributed to the fact that less attention is given to these animals by far lower than their workload (Tesfaye and Curran, 2005).

The present study report on the prevalence of *Dictyocaulus arnifieldi* in donkeys (35.29%) was found lower than the reports of Feseha *et al*. (1991), Hassan *et al*. (2004) and Andersen and Fogh (2010); which was 83 % , 70.5% and 87.5% in Ethiopia, Sudan and Denmark, respectively. On the contrary, lower prevalence of lungworm in donkeys was reported by Ayaz (2003) and Bakirci *et al*. (2004) as 0.6%-14.6% and 9.67%, respectively. In several studies, 50-80% of donkeys have been found infected with *Dictyocaulus arnfieldi* (Hassan *et al.,* 2004; Klei, 1986; Clayton and Duncan, 1981). These differences in prevalence might be due to differences in agro-ecology, management systems, season and sample size (Hassan *et al*., 2004).

The present prevalence of lungworm infection in mules (21.1%) was analogues to previous findings of Eshetu (2000) who reported 20% prevalence of *D. arnfiledi* in and around Bahir Dar. But higher prevalence (29.3%) has been reported by Clayton and Duncan (1981) and Klei (1986). Similarly, higher prevalence of lungworm in mules (54%) was reported by Lyons *et al*. (1985) in central Kentucky, USA. In the present study,

lowest infection rate was observed in horses (5.8%). This finding is in agreement with that of Arslan and Umur (1988) and Lyons *et al*. (1985) with a prevalence of 1.17%-1.73% and 2% in Kentucky, USA, respectively. However, the current result was higher than the past findings of Saeed *et al*. (2010) and Yacob and Ashenafi (2013) who reported 4.26% and 0.5% in Lahore (Pakistan), and Arsi- Bale, respectively. These differences in prevalence might be due to differences in management systems, season, sample size and agro-ecology (Tihitna *et al.,* 2012).

The age of animals was found as a major factor for the variation (P=0.000) in the prevalence of lungworm infection. A prevalence of 12.6%, 5.6% and 20.6% were recorded in animals ≤3 years, 4-10 years and ≥10 years of age, respectively. The present result was in agreement with Tihitna *et al*. (2012) reported as 18%, 10.98% and 22.95% in young, adult and old age groups, respectively. This might be related to the condition that older and younger animals are taught to have decreased immunity (Andersen and Fogh, 2010).

In the present study, high prevalence of lung worm was recorded in animals with poor followed by medium and good body condition score 31.5%, 10.8% and 3.1%, respectively. This result was similar with Tihitna *et al.* (2012) reported as 50%, 16.3% and 5.2% in poor, medium and good body condition animals. This might be due to the fact that, poorly nourished animals appear to be less competent in getting rid of infection. Animals with medium and good body condition were found to have lower infection rate. This may be due to the fact that, this animals were mainly used for work in day time i.e. had lower grazing hours (Yacob and Ashenafi, 2013).

5. Conclusion

The current study assessed the prevalence of *Dictyocaulus arnfieldi* in equines and its associated risk factors and found higher prevalence in the study area. Based on the results of the present study, the prevalence of equine lungworm were highest in donkeys followed by mules and horses. In addition to this, higher infection rate was recorded in equines with ≥10 years of age followed by age groups ≤3 years and 4-10 years. This is may be due to inadequate development of the immune system. The prevalence of infection rate was found higher in animals with poor body condition than medium and good body condition. More-over, as compared to other literature reports, body condition, age and species of the animals were found to be the important risk factors associated with equine lung worm infection. Whereas, sex of the animals had no association with *Dictyocaulus arnfieldi* infestation in study animals. Animals of different species, age and sex group graze on communal pasture could favor the survival and might facilitated easy transmission of this parasite to uninfected animals. Hence, donkeys should graze in a separate pasture from horse and mule. The findings of this study also indicate that strategic deworming and rotational grazing programs are important.

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7. References

Alemayehu, L. (2004). Case study on reproductive activity of equines in relation to environment factors in central Ethiopia, Berlin: Hum Bold University of Berlin, PhD thesis, Pp: 8-13.

Alemu, A., Tsegaye, W., Golassa, L. and Abebe, G. (2011). Urban malaria and associated risk factors in Jimma town, south-west Ethiopia. *Malaria Journal*, 10:173.

Andersen, S. and Fogh, J. (2010). Prevalence of lungworm *D. arnfieldi* in donkeys in Denmark and in horses in herds together with donkeys. *Nord Veternary Medicine*, 33: 484-91.

Arslan, M.O. and S.Umur. (1998).The helminth and *Eimeria* (Protozoa) species in horse and donkey in Kars province of Turkey. *Turkiye Parazitologi Dergisi*, 22: 180- 184.

Ayaz, E. (2003). The prevalence of *Dictyocaulus arnfieldi* in horses and donkeys. *Turkiye Parazitologi Dergisi*, 14: 77-81.

Bakirci, S., Çirak, V.Y., Gülegen, E. and Karabacak, A. (2004). Parasites found by fecal examinations in horses in the Gemlik Military Stud Farm. *Turkiye Parazitologi Dergisi*, 28: 35-37.

Beelitz, P., Gobel, E. and Gothe, R. (1996). Endoparasites of donkeys and horses kept together in Upper Bavaria. Range of species and intensity of infestation. *Tierarztliche Praxis,* 24: 471-475.

Bowman, D.D. (2003). Georgis' Parasitology for Veterinarians, 8th Ed., USA, New York Saunders, Pp: 166-168.

Central Stastical Authority (CSA). (2009). Federal Democratic Republic of Ethiopia, Central Stastical Authority (CSA). A Report on Livestock and Livestock characteristics (Private peasant holdings), Addis Ababa, Pp: 183.

Charles, M.H. and Robinson, E. (2006). Diagnostic veterinary parasitology for veterinary technicians, 3rd Ed., Mosby Inc. St. Louis, Missouri, Pp: 243.

Clayton, H.M. and Duncan, J.L. (1981). Natural infection with *Dictyocaulus airnfieldi* in pony donkey and foals. *Research in Veterinary Science*, 31: 278-280.

Crane, M. (1997). Medical. In: The professional hand book of the donkey, 3rd edition. Whittet Books Limited, 18 Anley Road, London W14 OBY, Pp.19-36.

Eshetu, G. (2000). Preliminary survey on the health and reproductive status of "Gari" Mules in and around Bahir Dar, Pp: 45.

Feseha, G., A. Mohammed and Yilma, J. (1991). Vermicular endoparasitism in donkeys of DebreZeit and Menagesha, Ethiopia. Donkeys, mules and horses in tropical agricultural development. Proc. Colloq. On donkeys, mules and horses. Eds. D. Fielding and R.A. Pearson, University of Edinburgh, Center for tropical veterinary medicine: UK, Pp: 156-160.

Fraser, C. M. (1991). The Merck Veterinary Manual. A hand book of Diagnosis Therapy and Disease prevention and control for the Veterinarians 7th Ed., Merck and Co; Inc, Rahaway, NIT, USA, Pp: 714-717.

Fred, O. and Pascal, K. (2006). Extension approaches to improving the welfare of working equines. Kenya Network for Dissemination of Agricultural Technologies (KENDAT), Nairobi, Kenya, Pp: 1-28.

Getahun, F. (1993). Helminths and external parasites of equines species in Bale Administrative region, Ehiopia, Pp: 55.

Hansen, J. and Perry, B. (1996). The Epidemiology, Diagnosis and control of Helminthes parasites of ruminants, ILRAD, Nairobi, Kenya, Pp: 83.

Hassan, T., Salih, M.M. and Abakar, A.D. (2004). A Survey of Gastrointestinal Nematodes of Donkeys (Equus asinus) in Khartoum State, Sudan. *Journal of Animal and Veterinary Advances*, 3: 736-739.

Junquera, P. (2014). *Dictyocaulus* species, parasitic lungworms of Cattle, Sheep, Goats and other Livestock.Biology,prevention and control.*Dictyocaulus filaria, Dictyocaulus viviparus,Dictyocaulus arnfieldi*. In: Merck Veterinary Manual, Merck and Co, Inc, Whitehouse Station, N.J., USA, Pp: 885-910.

Klei, T.R. (1986). Other parasites: recent advances. Veterinary Clinics of North America. *Equine Practice*, 2: 329-336.

Legese, Y. (1996). Preliminary survey on management aspects and health problem of donkey in Dire Dawa and East Oromia, Ethiopia, Pp: 34.

Lyons, E.T., Tolliver, S.C., Drudge, J.H., Swerczek, T.W. and Crowe, M.W. (1985). Lungworms (*Dictyocaulusarnfieldi*): prevalence in live equids in Kentucky. *American Journal of Veterinary Research*, 46: 9-21.

Rose, F.R. and Hodgson, R.D.S. (2000). Manual of Equine practice. 2nd Ed., USA, Saunders, Pp: 224.

Saeed, K., Qadir, Z., Ashraf K. and Ahmad, N. (2010). Role of intrinsic and extrinsic epidemiological factors on Strongylosis in horses in Lahore. *The Journal of Animal and Plant Sciences*, 20(4): 277-280.

Sapakota, C.R. (2009). A Report on Prevalence of Helminthes Parasites in Mules of Brick Kiln, Pp: 160.

Shiferaw, Y. (1993). Preliminary survey on helminthiasis and management practice of equine in Wenchi Awraga, Ethiopia, Pp: 32-78.

Smith, P.B. (2009). Large animal internal medicine, 4th Ed., USA, Mosby Elsevier of Lalitpur District, Pp: 232-321.

Svendsen, E.D. (1997). Parasites abroad. The professional hand book of the donkey, 3rd Ed. Whittet Books Limited, 18 Anley Road, London W14 OBY, Pp.166-182.

Tesfaye, A. and Curran, M. (2005). A longitudinal survey of market donkeys in Ethiopia. Holetta Research Center, Addis Ababa, Ethiopia. *Tropical Animal Health Production* 1: 87-100.

Thrusfield, M. (2005). Veterinary epidemiology 3rd Ed., Veterinary Clinical Studies Royal (Dick) School of Veterinary Studies University of Edinburgh, Pp: 233.

Tihitna, S., Basaznew, B., Mersha, C. and Achenef, M. (2012). Occurrence of Lungworm Infection in Equines and Their Associated Risk Factors. *Global Veterinaria,* 8(1): 35-38.

Yacob, H.T. and Ashenafi, H. (2013). Epidemiological study on Gastrointestinal Helminthes of horses in Arsi-Bale highlands of Oromia Region, Ethiopia. *Ethiopia Veterinary Journal*, 17(2): 51-62.