

## Prevalence, associated risk factors and socioeconomic impact of Epizootic lymphangitis (EL) in carthorses in and around Gondar town

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**Abstract:** A cross sectional study was carried out from November 2016 to April 2017 in Gondar town to estimate the prevalence, associated risk factors and socioeconomic impact of Epizootic lymphangitis (EL) in carthorses. Questionnaire survey, clinical observation and microscopic examination were used for the study. The study animals were local breed carthorses located in the study area which were selected randomly. Clinical examinations were conducted in 384 carthorses. The study has revealed an overall prevalence of 23.2% (89/384). There was statistically significant association in the prevalence of epizootic lymphangitis and harnessing type, whereas horses with wound inflicting harness were almost two times at greater risk (OR=1.94, 95%CI=(1.11-3.38)) of having disease than those horses with good harnessing. The infection rate among age groups has showed that there was no significant association ( $p>0.05$ ) in the prevalence of epizootic lymphangitis among different age groups. The higher prevalence 27.4% in age groups of less than or equal to 6 year was recorded. Highest prevalence rate (27.3%) in moderate and lowest in fat body conditioned animals was observed. However, there was no statistically significant difference ( $p>0.05$ ) in the prevalence of epizootic lymphangitis in animals with different body condition scores. There was no significant difference ( $p>0.05$ ) between grooming practice and prevalence of epizootic lymphangitis. The result of questionnaire survey from 70 carthorse owners indicates that epizootic lymphangitis was the first and major important disease of carthorses by creating a negative impact on the economy of the carthorse owners. 59% owners responded that they had no knowledge or experience of disease transmissions and control mechanism. However, 47% of them are accustomed to use both traditional and modern treatment methods. Despite its impact, awareness on the transmission and control mechanism of the disease was not uniformly known by the carthorse owners. Therefore, further study on the extent of the disease and educating the owners both on the disease and its way of transmission was recommended.

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### 1. Introduction

The equine population of the world is currently reported to be about 112.5 million of which 44.3 million donkeys, 58.5 million horses and the remaining are mules (FAO, 2013). There are an estimated 90 million equines in the developing world, with the highest population concentrations in central Asia and North and East Africa (FAO, 2003). Over 60% of all horses and 95% of all donkey and mules are found in developing countries and the majority of these will be used for work. Working animals provide an essential transport resource in developing countries worldwide (Pritchard *et al.*, 2005).

Ethiopia possess 2.08 million horses, 7.88 million donkeys and 0.41 million mules (CSA, 2016). Equines have a prominent position in the county's agricultural and transport systems since the transportation activities are performed by Equids (Ameni, 2006; Hadush *et al.*, 2008). They are mainly

used as draught and pack animals and they are also used for ploughing in some parts of the country (Ameni and Siyoum, 2002). Despite all these uses, they are suffering from several diseases such as Epizootic lymphangitis (EL), African horse sickness, Ulcerative lymphangitis, dourine, rabies, anthrax, horse mange and Babesiosis (Guein, 1992). Among these, Epizootic lymphangitis seems the first in Ethiopia (Hadush *et al.*, 2008).

Epizootic lymphangitis is a chronic infectious granulomatous disease of the skin, lymph vessels, and lymph nodes of the neck, chest and legs but it can also be present as an ulcerating conjunctivitis of the palpebral conjunctiva, or rarely as a multifocal pneumonia of horses and other Equidae caused by *Histoplasma capsulatum var farciminosum* (CFS, 2009). In all cases, the lesions are nodular and granulomatous in character and the organism, once established, spreads locally by invasion and then via

the lymphatics (OIE, 2008). Epizootic lymphangitis is a contagious disease which can infect humans (Al-Ani, 1999). The yeast form of the fungus is found in the infected host and the mycelial saprophytic stage is found in the environment (OIE, 2008).

Epizootic lymphangitis is one of the infectious diseases causing huge economic losses and low productivity in horses. It has also a serious negative impact on the livelihoods of carthorse owners/drivers in the affected areas and also compromises the welfare of working horses (Mesfin, 2012). It is particularly prevalent in carthorses in most parts of Ethiopia studied (Ameni, 2006). For instance it occurs in 24.9% horses in Walliso (Asfaw *et al.*, 2012). Due to its significant impact on the livelihood of carthorse owners, it is considered a major disease of horses in many parts of Ethiopia. Data for economic losses incurred by epizootic lymphangitis is lacking but one conservative estimate showed that mortality associated losses of about 129 USD incurred per annum per owner and an average 2.5 USD decline from the net profit per day due to reduced working performance of affected horses (Hadush *et al.*, 2014).

In general, the results of a few studies conducted in the country have shown the rampant occurrence of the disease and to some degree its socio economic implications and thus warrant for appropriate control strategies so that its impact is minimized (Hadush *et al.*, 2008). Although the disease seems important, there is a shortage of information on the occurrence and prevalence of the disease. Despite of its economic importance and prevalence, little is known about EL in general and regarding its mode of transmissions and control. More research is required to understand fully transmission routes, risk factors and develop animal-side diagnostics and simple affordable, transportable, and stable therapeutics.

Therefore, the objective of this study were focused on

- To estimate the prevalence of Epizootic lymphangitis in carthorses in Gondar town
- To identify risk factors associated with the disease and
- To assess socio-economic impact of Epizootic lymphangitis.

## 2. Materials And Methods

### 2.1. Study area

The study was conducted in Gondar town from November 2016 to April 2017. It is located 740 Km the North west of Addis Ababa which it lies in semi-arid zone at an altitude of 2220 meters above sea level. The average maximum and minimum temperature of the area vary between 22-30.7 degrees centigrade and 12.3- 17.1, respectively. The region receives a bimodal rain fall, the average annual precipitation rate being

1172 millimeters. The livestock production system in the area is predominantly extensive type. The production system observed around the area combines cereal based agriculture and livestock farming. The livestock population of North Gondar is estimated to be 1,936,514 cattle, 524,083 sheep, 682,264 goats, 36,828 horses, 12,473 mules, 223,116 donkeys and 3,165,068 poultry (CSA, 2012).

### 2.2. Study population

The study was conducted on horses in Gondar town used in cart pulling activities. Almost all horses in Gondar town are horses of local breeds originating from highland districts around Gondar such as Wogera and Debark. Usually two horses pull a cart with shift, one horse in the morning and the other in the afternoon. Major carthorse stations in the town were used as collection points of carthorse.

### 2.3. The Study design

A cross-sectional study was conducted on randomly selected carthorses from November 2016 to April 2017 in Gondar town, North Ethiopia. A cross sectional and interview based studies were used to estimate the prevalence, associated risk factors and socioeconomic implications of EL.

### 2.4. Sampling Method and Sample size Determination

The sampling method employed to select the study subject was simple random sampling. The approximate sample size required to estimate prevalence in a large population can be determined for a defined precision and level of confidence. The limits of the associated intervals indicate the specified bounds within which the estimate will with the defined level of confidence. The required sample size was calculated based on Thrusfield (2005), with 95% of confidence interval and at 5% desired precision with expected prevalence of 50%.

$$N = (1.96)^2 \times P_{exp} (1 - P_{exp}) / d^2$$

Where N=number of sample size,  $p_{exp}$  =expected prevalence,  $d$  =desired absolute precision

Therefore, based on the mentioned formula 384 animals were considered in the study area.

### 2.5. Study Methodology

Inspection and palpation were clinical examination methods used. Further confirmation was made by microscopic examination. Questionnaire was used to assess risk factors and socioeconomic impacts of disease.

#### 2.5.1. Clinical Examination

Careful and systematic clinical examinations of carthorses in the study areas were done and animals which have suggestive nodular and ulcerating lesions along the lymphatic vessels were recorded as positive for EL. Those carthorses which have healed lesions or scars were also recorded as positive for EL (Amen *et al.*, 2006).

Lesions were most commonly found on the skin of the face, fore limb, and neck. Cutaneous lesions though mostly found on the legs, may also be found on the back, head and scrotum. The affected skin becomes hard and thick. Several purulent foci were apparent when the nodules were incised. Lymphatic vessels were distended and regional lymph nodes were swollen (Amen, 2007).

#### 2.5.2. Laboratory Conformation

Samples were collected using fine needle aspiration method from unruptured nodules and they were used for microscopic examinations. Before collection of samples the nodules were washed with soap and water, shaved, and disinfected with alcohol. The contents of the nodules were aspirated with needles and syringes, and used for the preparation of smears for microscopic examination. The smears were prepared on glass slide, fixed with methanol (2-3 minutes) and stained with Giemsa stain for the identification of the yeast form of HCF. Examination was made using by oil immersion at 100 x magnification until the fungus was demonstrated in the clinical specimens (Asfaw *et al.*, 2012).

#### 2.5.3. Questionnaire Survey

Data from carthorse owners were collected through prepared questionnaire format. Information like socio-demographic, awareness, and socioeconomic impact of the disease were assessed. From this study a total of 70 carthorse owners were asked.

### 2.6. Data Analysis

Data collected from the study animals were stored in MS excel spread sheet and analyzed with SPSS version 20. Descriptive statistics like percentage was used to express prevalence while Pearson's chi-square ( $\chi^2$ ) test and Odds Ratios Analyzing Method has been used to compare the association of Epizootic lymphangitis with different risk factors. In order to consider a result to be statistically significant 95% CI and p value less than 0.05 has been taken. The results were presented using frequency tables and prevalence

was expressed as the proportion of positive animals. Over 384 animals examined.

### 3. Results

#### 3.1. Prevalence and Disease Risk Factors

Epizootic lymphangitis was diagnosed based on clinical examination of characteristic lesions and confirmation was made through identification of the yeast from pus smears through Giemsa stain. The overall prevalence of EL recorded by the present study at the Gondar town was 23.2% (89/384).

In the study area, the cutaneous form of the disease was most commonly seen. There was no a distinct case with signs of ocular and or respiratory form observed rather there was a manifestation of respiratory signs in some cases with the cutaneous forms of the disease. Nodular lesions were most frequently observed on sterna region, limbs, scrotal region, head region and cervical region. Recently erupted nodules up on palpation were firm and freely movable. In severe cases ruptured nodules were observed to be arranged in a line and discharging white to yellow pus.

Pus and/ or swab samples collected from clinical cases were subjected for Giemsa staining and were confirmed as positive for typical yeast form with a halo (unstained capsule like) structure around them. The yeast forms of *Histoplasma capsulatum var. farsimosum* (HCF) were lemon-shaped with one edge wider and the other bluntly pointed. They could occur individually or in groups either free or intracellular phagocytes with in macrophages.

##### 3.1.1. Prevalence of Epizootic lymphangitis According to Age

The prevalence was higher in age less than and equal to six than in age greater than six. Age was considered as the risk factor for the high prevalence of EL; However, the age of the animals was not significantly associated ( $p>0.05$ ) in the prevalence of EL.

Table 1: Prevalence of epizootic lymphangitis according to age

Age categories	No Horse examined	No Positives	Prevalence (%)	OR (95%CI)	P- value
≤6	157	43	27.4	1.35(0.84-2.27)	0.11
>6	227	46	20.3		
Total	384	89	23.2		

##### 3.1.2. Prevalence of Epizootic lymphangitis According to the harnessing type

There was a statistically significant difference ( $P<0.05$ ) between the infection with the disease and the harnessing type that the owners used.

Accordingly, carthorses belonging to the owners with wound inflict harnessing showed significantly

higher prevalence ( $p>0.05$ ) than carthorse with good harnessing materials.

##### 3.1.3. Prevalence of epizootic lymphangitis among Body Conditions

There was no statistically significant difference ( $P> 0.05$ ) in the prevalence of EL among the body condition of horses. The highest prevalence was

recorded in those horses with moderate body conditions.

**Table 2:** Prevalence of epizootic lymphangitis according to harnessing type

Harnessing type	No. Horse examined	No Positives	Prevalence (%)	OR (95%CI)	P- value
Wound inflict	253	69	27.3	1.94 (1.11-3.38)	0.02
Not	131	20	15.3		
Total	384	89	23.2		

**Table 3:** Prevalence of epizootic lymphangitis according to body condition

BCS	No. Horse affected	No positives	Prevalence (%)	$\chi^2$	P-value
Good	81	12	14.8	5.13	0.07
Moderate	194	53	27.3		
Poor	109	24	22.0		
Total	384	89	23.2		

BCS= Body condition score

3.1.4. Grooming practice and prevalence of epizootic lymphangitis

This study has showed that there was no significant difference ( $p>0.05$ ) between grooming practice and prevalence of EL as illustrate in table 4.

**Table 4:** Grooming practice and prevalence of epizootic lymphangitis

GrPr	No. Horse examined	No. Positives	Prevalence (%)	$\chi^2$	P-value
Once a week	280	70	25.0	2.16	0.33
Once a month	55	9	16.4		
Do nothing	49	10	20.4		
Total	384	89	23.2		

GrPr= Grooming practice

### 3.2. Questionnaire Survey

According to the survey result, the educational level of the respondents was as follows: 12.8% were illiterate, 34.2 % were grade 1- 4, 25.3% were grade 5- 8 and 27% were above grade 9. The result of an interview indicated that the EL was increased from time to time and cause significant impact on the carthorse owners. According to them EL locally is called "Nidft". It indicates that among the disease that affects carthorses, EL is considered as the first and major important disease that kills their horses there by subjecting them to unemployed and poverty.

Fifty nine percent owners responded that they had no knowledge or experience of disease transmissions and control mechanism. Regarding the

solution they experienced for the disease, 47% of the interviewed carthorse owners are accustomed to use both traditional and modern treatment methods. The latter is used to be carried out by veterinarians of University of Gondar, while the former is used to be carried out by local personals that use medicinal plants. 43% of them believe that the disease has a probability of being cured if treated at early stage in either of the treatment methods. Early and moderate stages of EL are considered curable and University of Gondar, veterinary clinic is accustomed to treat such animals. However, the fate of carthorses with sever stage of the disease is euthanasia based on the willing of owners both for the sake of welfare and disease control.

**Table 5:** Results of questionnaires in percentile

Questions	Yes or to traditional healers (%)	No or to veterinarians (%)	I don't know or Both methods (%)	Total (%)
Do you know about EL	41	59	-	100
Where do you go for treatment of EL?	22	31	47	100
Do you think EL is a curable disease?	43	57	-	100

According to this study, it was observed that there was resulted in more than 50% reduction in daily earnings due to morbidity of a horse with EL (reduced working hours, clients reluctant to use horse with lesions and unproductive feed expense). Treatment costs to the owner when treating infected horse was tried to assess. However, it is difficult to estimate due to some owners who started treatment of their animals, were not committed to follow-up. As the disease progresses, the working power of affected horse decreases gradually and, the cost of feed for horse exceeds than the daily income. According to the carthorse owners, after repeated trial of both treatment methods the owners of affected carthorses are accustomed to abandon the uncured carthorses. There were some carthorses that had the gross lesions of EL that found together with the normal at carthorse gathering stations. They were found at different stages of the disease, however, in routine work as the normal carthorses. There were some owners that exploit the power of sick horse until its health deteriorates.

#### 4. Discussion

The study has tried to determine the prevalence of the Epizootic lymphangitis, associated factors and socio-economic impact of the disease. The result of this study indicated that EL was endemic to the study areas with an average prevalence of 23.2%. This might be due to that the affected and susceptible horses were stabled together at marketing place and carthorse parking stations; the presence of two horses pull a cart with shift, one horse in the morning and the other in the afternoon but sharing similar contaminated harnesses between horses and lack of awareness of the carthorse owners contributed for transmission of the disease. Similarly, damage of the skin because of improper harnessing system and carry on abrasive materials favor the entry of pathogen. In addition to this the study conducted by Ameni and Siyoum (2002) also indicated that it could be due to the fact that there were no control/intervention methods in the country. A similar study conducted by Endebu, (1996) indicated that EL is the first most important disease of carthorses at Debre-zeit and Akaka towns and an average prevalence of 21% was recorded from the data collected from 28 towns that use carthorses for the transportation of man and goods (OPPD, 2000). The highest prevalence was recorded at Mojo (39%) followed by Ejaji (36.5%), Bati (36%), Debre-zeit (29%), and Wolliso (24.9%) (Jagama and Jarso, 2016).

Clinical manifestations of HCF observed by this study were in agreement with the previous reports Al-Ani (1999); Ameni and Siyoum (2002); Jagema and Jarso (2016). EL was observed to affect any parts of the body with frequent exposure to injury are highly

affected. Nodular lesions were most commonly observed on sterna region, limbs, scrotal region, head region and cervical region. All cases of EL were cutaneous which is in line with the previous studies (Ameni, 2007; Wakjra, 2015).

The microscopic appearance of the yeast forms observed by the present study were consistent with the reports by Ameni and Siyoum (2002); Wakjra (2015).

Absence of statistically significant association between the ages of the study animals might suggest that both age of animal have almost equal likelihood of being infected with EL. Yet, a higher prevalence in age less than and equal to six was recorded. On one hand, it has been stated that horses under six years of age are more susceptible (Radostits *et al.*, 2007).

The stronger association of the infection with EL in relation to the harnessing type has been demonstrated in this study. Consequently, horses belonging to the wound inflicting harness showed significantly higher prevalence than horses with good harnessing, whereas wound inflicting harness is two times more likely to predispose animal to infection. This could imply that the widely used rubber harnesses, which have rigid and rough edge, increase the friction and wounding of the body of horses. Especially, the harness that passes across the chest pulls heavy load, so there is a high friction and frequent wounding of the chest, which facilitates the entrance of the organism. Similar situations have been reported by Ameni and Siyoum (2002).

The associations in the prevalence of EL and body condition were also compared. There was no statistically significant difference ( $p > 0.05$ ) in the prevalence of EL between animals with different body condition score. The highest prevalence was recorded in animals with body condition score of 2 (moderate). This might be because of the fact that most of cart horses with body condition score of 2 (moderate) and above are frequently used for draft purpose. Additional explanation might be due to the fact that carters have a tendency to exploit the power of infected animals (equines) for they have a perception that they cannot be cured and want to exploit and abandon the animal. The body condition of animal is one of the indicators about the well being of an individual. Thus, high prevalence of the disease observed in animals with body condition score of 2 in the current study shows that affected animals are losing body condition due EL.

The reason for this is inhumane handling of animals when they are sick in that no good management such as veterinary care and feeding were provided. This is in consistence with the finding of Amen *et al.* (2006) that most of (>95%) of cases do not recover as a result owners consider that looking

after such animal is simply waste of money and energy. Hence the impact of EL on animal welfare needs to be considered as highly important and there is a need to assess the extent of welfare compromise.

Regarding to grooming practice, the majority of carthorse owners practiced grooming their horse at the end of week; this might be due to considering giving rest for their horses. Although, the owners used similar grooming utensils for two or more horses which may be act as carrier of fungal spores (Radostits *et al.*, 2007), there is no statistically significant difference ( $p>0.05$ ) between grooming practice and prevalence of EL.

Data for economic losses incurred by epizootic lymphangitis is lacking but one conservative estimate showed that mortality associated losses of about 129 USD incurred per annum per owner (Hadush *et al.*, 2014). Study conducted so far shown that it is the first most important disease of carthorses in several towns. According to this study, it was observe that there was resulted in more than 50% reduction in daily earnings due to morbidity of a horse with EL (reduced working hours, clients reluctant to use horse with lesions and unproductive feed expense). More than 50% reduction in daily earnings due to morbidity of a horse with EL.

Although, the survey result indicated that EL was considered to be the first and major disease of carthorses, the method of transmission of the disease and its control mechanism were not uniformly known at the study area but some carters seriously complain the problem after the disease have been occurred. This finding agreed with the report of Endebu (1996); Jagema and jarso (2016). This indicates that there is a need of awareness creation in the society on the extent and transmission of the disease.

### 5. Conclusion And Recommendations

The result of the study has shown that EL was prevalent and endemic to the study area and the distribution of the disease was increasing from time to time. The prevalence of the disease increases when horses stabled together in marketing places and parking stations, sharing contaminated harnesses and lack of awareness of the carthorse owners for transmission of the disease. The economic losses associated with a high prevalence, reduced work performance of a horse and death of affected animals was a very serious problem for carthorse owners. Despite of its economic importance, EL is a least studied disease in Ethiopia. Little is known about EL in general and regarding its mode of transmission and control measures in particular. On the basis of this conclusion the following recommendations are forwarded:

- The government, community and University should be involved in the control of the disease.
- Educating owners on proper use of harness, animal welfare and EL management should be advocated.
- Advanced cases should be euthanized rather than leaving them outdoors since they are source of infection.
- The medicinal plants that the local healers use as treatment has to be investigated in depth.

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