Prevalence of Bovine Cysticercosis and Status of Human Taeniasis in and Around Asella Town, Tiyoworeda, South East Ethiopia

By Adem Edao, Feyera Gemeda Dima & Feyissa Begna Deressa

Jimma University

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Keywords: bovine, cysticercosis, taenia saginata, prevalence, risk factors, taeniasis.

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Conclusion: In general, the current study revealed that the presence of bovine cysticercosis was small but it's still a public health hazard in the study area which needs increased awareness about the health impact of taeniasis.

Keywords: bovine, cysticercosis, taenia saginata, prevalence, risk factors, taeniasis.

I. INTRODUCTION

Livestock in developing countries play a crucial role in improving food security, generating cash income and are an asset. The total livestock population in Ethiopia according to 2014 estimation was 56.71 million cattle, 29.33 million sheep and 29.11 million goats (CSA, 2015), which places Ethiopia first in Africa and ninth in the world in terms of total stock population. From the total cattle population 98.96% are local breeds and the remaining are hybrid and exotic breeds. Cattle constitute large portion of livestock population and are managed by small holder farmers under extensive low input traditional system (CSA, 2015). However, its productivity remains marginal due to prevalent diseases, malnutrition and management constraints. Among that T. saginata/bovine cysticercosis is the one which remaina major public and animal health problem (EARO, 2000).

Bovine cysticercosis is an infection of cattle caused by the larval stage T. saginata which live in human intestinal. This parasite is universally distributed in developing as well as in developed countries (Gracey and Collins, 1992; Cabaret et al., 2002; Dorny et al., 2009). In humans, the disease is called taeniasis which is accompanied with symptoms like nausea, abdominal discomfort, epigastric pain, diarrhea, excessive appetite or loss of appetite, weakness, loss of weight and intestinal blockage. Sometimes, the mobile gravid segments may make their way to unusual sites such as the appendix and biliary tract and may cause serious disorders (WHO, 2013). Live cattle having C. bovis shows no symptoms, however, heavy infestation by the larvae may cause myocarditis or heart failure (Gracey and Collins, 1992). Cysticerci can remain alive in cattle anywhere from weeks to years and such infection in cattle is a public health problem as the infected raw or undercooked beef causes taeniasis in human (Garcia, 2003; Garcia et al., 2007). It has economic significance as well as the economic losses accruing from the condemned and downgraded carcasses and due to treatment of carcasses before human consumption is substantial (Yoder et al., 1994; Onyango-Abuje, 1996; Giesecke, 1997).

Bovine cysticercosis and taeniasis are common where hygienic conditions are poor and the inhabitants traditionally eat raw or insufficiently cooked or sun-cured meat (Minozzo et al., 2002). Inadequate health education and low availability of taenicides are the major obstacles for the control of such infections (Pawlowski, 1996). Due to these reasons, taeniasis is more common in developing countries including Ethiopia where meat is an important component of human diet and traditionally consumed raw on several occasions. Lack of awareness about raw meat consumption, existence of highest population density, poor hygiene and sanitary facilities some of the factors that facilitate transmission (Jones et al., 1997).

Author a: DVM, MSc in Epidemiology and Zoonotic Microbiology School Veterinary Medicine, College of Agriculture and Veterinary Medicine, Jimma University. e-mail: fey_abe2009@yahoo.com
The epidemiology of bovine cysticercosis/
human taeniasis varies from one area to another so
control measures appropriate in one area is not
necessarily of value in another. Hence, it is essential to
have adequate knowledge of the epidemiology of the
disease before contemplating control programmes. In
Ethiopia some studies have been conducted on bovine
cysticercus at different times. But the studies performed
were limited to few parts of the country and there was no
information on prevalence of bovine cysticercosis and
human taeniasis in and around Asella district. Therefore,
the objectives of this study were:

- To determine the prevalence of bovine cysticercosis
  at Asella municipal abattoir,
- To estimate status of taeniasis and associated risk
  factors in and around the study area

II. Material and Methodology

a) Description of the Study Area

The present study was conducted at Asella
municipal abattoir, and Asella town and its surrounding,
Tiyoworeda. Asella town is a capital of Arsi Zone,
Oromia regional state, Ethiopia. It is located about 175
km Southeast of Addis Ababa at 6° 59’ to 8° 49’ N
latitudes and 38° 41’ to 40° 44’E longitudes. The altitude
of the area ranges from 2500 to 3000 m.a.s.l. Asella and
its surrounding is characterized by mid sub-tropical
weather, with minimum and maxim temperature ranging
from 8.4 to 22.6°C, and the relative humidity ranging
from 43 to 60%. The average rainfall is 2000mm. The
area has a bimodal rainfall occurring from March to April
(short rainy season) and July to October (long rainy
season). According to Arsi Planning Economic and
Development Office (APEDO, 2007), the area is
densely populated, with livestock population of 85,893
cattle, 57,118 sheep, 10,725 goats, 7841 horses, 15,642
donkeys, 517 mules and 35,489 poultry. The farmers in
the area practice mixed crop-livestock farming system.

b) Study Population

The study animals comprise indigenous cattle
brought to Asella Municipal abattoir for slaughter from
different districts in and around Asella town and it
includes cattle of different age, sex, breed and body
condition categories. For the survey data, the target
populations were residents of Asella town and
surrounding kebeles (Burqa cilalo, Dosha, Harobilallo,
Café Misoma and Gora silingo) and includes all age
group >18 and both female and males

c) Study Design

A cross-sectional study was used to study the
prevalence of bovine cysticercosis at Asella municipal
abattoir by using routine meat inspection technique in
municipality slaughter house for the presence of C.
bovis. Moreover, a cross-sectional study was conducted
by a semi-structured questionnaire survey to assess the
status of T. saginata/taeniosis and associated risk
factors.

III. Sample Collection Method

a) Active Abattoir Survey

Animal samples were collected by active
abattoir survey. The study animals were selected using
simple random sampling method and age, breed, sex
and body condition of each study animals was recorded
on prepared format paper at ante-mortem. Body
condition scoring of the cattle was made based on the
guideline provide by (Nicholson and Butter, 1986) and
all animals included in the study were animals with,
medium and good body condition. Age determination
was carried out by means of their dentition as described
by (De-lahunta and Habel, 1989) and all the inspected
animals were at the age of adult and old age group.
Prior to sampling, each selected animal were given an
identification number by writing a code on its head by
using unwashable ink.

Meat inspection was made in accordance with
the procedures of Ethiopian Ministry of Agriculture Meat
Inspection Regulation (MOA, 1972) for the detection of
T. saginata's cysts. Because of owners’ discomfort on
multiple incisions for the thorough examination of major
muscles, only the masseters muscle and internal organs
such as tongue, heart, liver, kidney, lung and diaphragm
were used as indicators of the presence of cysts in the
carcass. Careful examination on the carcass of study
unit was made through palpation of the organs followed
by incision as follows: the surface and substance of
tongue was examined visually, followed by longitudinal
ventral incision from the tip of the root. Extensive deep
incision was made into external and internal muscles of
masseters parallel to the plane of the jaw (parallel to the
jaw bone from the lower jaw). Visual inspection and
longitudinal incision of the myocardium from base to
apex was made. The muscles of diaphragm were
examined visually and by making incision. Examination
of kidney, liver, and the lung was also conducted
accordingly by visualization, palpation and incision.
Cysts observed in theses organs were carefully
dissected and numbers and nature of cysts in each
organ was recorded for each animal. The nature of the
cyst was recorded as calcified and viable by visual
observation of its appearance, as (Ashwani and
Gebrehiwot, 2011) dead degenerated or calcified
cystcerci clearly form identifiable spots of white and
have fibrotic lesions, while the viable cysticerci are
pinkish-red in colour.

b) Questionnaire survey

Semi-structured questionnaire survey used to
assess, potential risk factors and its public health
importance. Questionnaire survey on the disease
occurrence and risk factor assessment was administered to 415 volunteer respondents who were selected based on convenience sampling method and the interview was conducted phase to phase. The potential risk factors of taeniasis considered in this study were: age, sex, religion, occupation, educational status, and habit of raw meat consumption. The awareness of the diseases, presence/absence of sanitation facilities like toilet and the drug used for treatment were also included in the questionnaire survey and at the end of interview some advices were provided to the respondents on how to control and prevents *T. Saginata* infection/cysticercosis.

c) **Sample Size Determination**

The desired sample size was calculated using the standard formula described by Thrusfield (Thrusfield, 2005) for simple random sampling method. Since there was no similar previous study at this area, expected prevalence was considered 50%, 5% desired absolute precision and 95% confidence level were used to calculate the minimal sample size. Hence, the sample size required was 384 heads of cattle. But to increase the precision of the study the sample size were increased and a total of 430 heads of cattle were included in the current study. For questionnaire survey sample size was calculated by using the formula given by Arsham (2002) which is:

\[ N = \frac{0.25}{SE^2} \]

Where: \( N = \) sample size, SE (standard error) = 5%.

The sample size required for the questionnaire survey as per the above formula is 100 for each site (urban and rural). However, to include different risk factors and increase the precision of the result the total number was increased to 415 individuals.

**IV. Data Management and Analysis**

The data collected were entered, recorded and stored in Microsoft excel spread sheets program version 2010. Descriptive and inferential analyzed was made by using SPSS version 20 software. Fisher’s and Chi-square (X²) tests were used to determine the variation in prevalence of infection between different groups for abattoir and questionnaire survey respectively. Statistical significance level was set at \( P < 0.05 \) at 95% confidence level to determine whether there are statistical significant differences between the parameters measured.

**V. Result**

Prevalence of *C. bovis*: the study showed that from a total number of 430 carcasses inspected, 5(1.2%) were positive for bovine cysticercosis. The statistical analysis of the data revealed that no significant difference \((p>0.05)\) was observed in the prevalence of cysticercosis in relation to the risk factors like: sex, breed, body condition and ages. But high prevalence of *C. bovis* was observed in local breed, old age and female animals relative to cross breed, adult age and male animals respectively, while almost no difference was indicated between animals of good and medium body condition as shown in Table 1.  

**Anatomical distribution of cysts:** frequency analysis of active abattoir survey revealed that nearly the there was the same distribution of *C. bovis* in the examined organs as follows: liver (0.9%), heart (0.7%), tongue (0.5%) and masseters muscle (0.5%). From the total number of 16 *C. bovis* observed on different organs, 7(43.8%), 5(31.3%), 2(12.5%) and 2(12.5%) were localized on the liver, heart, tongue and masseters muscle (table 2)and out of the total cyst observed 6 (37.5%) of them were viable with organ distribution of 50%, 33.3% and 16.7% on liver, heart and masseters muscle respectively as indicated in table 2.

**Questionnaire survey:** Of the total 415 interviewed respondents 44.3% (184/415) had contracted *T. saginata* infection at least once in their life time and the respondents confirmed that they were positive by witnessing they observed proglottids in their feces and/or under wear. Since due to religious purpose pork meat is not consumed in the study area, the proglottids observed were surely to be of *T. saginata*. From positive respondents 32% got taeniasis only before 2000E.C (2008G.C), while 6.7% got taeniasis after 2000 E.C and 5.5% were those remain positive both before and after 2000E.C. Out of those witnessed their positivity, 88.6% and 10.9% respondents used modern and traditional drugs for treatment respectively, while the remaining percent uses nothing for treatment as indicated by tables 4 respectively. Out of total respondents 90.6% (376/415) uses toilet, 73.5% (305/415) have awareness about human taeniasis.

**Association of risk factors with prevalence of taeniasis:** A statistical analysis showed that there was a highly significant variation between urban and rural, higher and lower age group, raw meat and cooked meat consumers, female and male, occupation group, and educational levels \((p<0.05)\). High prevalence of humantaeniasis was reported in rural area, male, higher age group, farmer, raw meat consumer and illiterate. But no statistical significance variation was seen among religion \((p>0.05)\) as shown below by tables 5.

**VI. Discussion**

The prevalence of *C. bovis* among the carcasses inspected at Asella municipal abattoir was 1.2% which is comparable with the findings of (Birhanu, et al., 2013) who reported prevalence of 2.58% from Bahir Dar Municipal Abattoir, 2.59% from Wolaita soddo municipal abattoir (Dawit, et al., 2012), 3% from Zeway Municipal Abattoir (Bedu, 2011), 3.6% from Addis
Ababa abattoir (Nuraddis and Frew, 2012), 3.65% from Jimma municipal abattoir (Teresa, et al., 2011), 3.11% indifferent agro climatic zones of Ethiopia (Tembo, 2001). But lower than the finding of (Dawit, 2004) 4.9% at Gondar, (Alula, 2010) 5.4% at Konbolcha, (Kebede, 2008) 18.49% in North West Ethiopia, (Abunna, 2008) 26.3% at Hawassa, (Hailu, 2005) 17.5% in East Shoa, (Fetene and Nibret,2014) 5.1%, at Jimma municipal abattoir, (Belay, 2014) 5.2% at Municipal Abbatoir of Shire, (Abunna, 2013) 12% at Yirgalem and (Liel, 2015) 5.6 at BishoftuElflora abattoir. This difference might be resulted from difference in the level of personal and environmental hygiene, habit of raw meat consumption, number of incision made at inspection site in the abattoir, and management type of the animals practiced. The main reason with low prevalence of bovine cysticercosis in the current study could be due to low number of organs inspected and low incision made at inspection site at the abattoir. In Asella municipal abattoir the commonly inspected organs for presence of C. bovis were internal organs (liver, heart, lung, tongue, and kidney) and masseters muscle while other predilection sites are rarely inspected due to multiple mutilation of carcass causes reduction in marketability of the meat and the owners not permit multiple incision of heavy muscles. This may in turn lead to omitting of infected animals as the sensitivity of detecting the parasite will decline with limited number of incisions (Wanzala, 2003) and experimental studies showed a 5-50 times higher prevalence will be achieved by complete slicing of the predilection sites (Minozzo, 2002).

But the current study’s result was higher relative to the finding of (Zdolec et al., 2012) and (Blessing et al., 2011) who reported 0.11% and 0.2% from Croatia and South Africa. This could be due to strict application of meat inspection and public health extension rules and difference in hygiene measures in the study countries. It’s known that sanitation facilities are better in the developed countries than in the developing countries in which poor environmental hygiene increase the prevalence of the diseases in the environment. More number of C. bovis was observed in the liver than other organs inspected. The reason is that absence of specific predilection site for C. bovis as stated by (Scandrett, 2009) so more number of larvae collected through mesenteric and portal veins residing in the liver.

Questionnaire survey indicated that human taeniasis was common in the study area with prevalence of 44.3%. This agree with the finding of (Mesfin and Nuraddis, 2012) 44% in Hawassa town and (Dawit and Temesgen, 2013) 44.44% in Shire Indasilassie district. But this result is lower relative to the finding of (Liel et al., 2015) 64% in Bishoftu, (Dawit, 2012) 62.5% in Wolaittasoddo, (Fetene and Nibret, 2014) 58%, (Abunna, 2013) 70% in Yirgalem, (Bedu et al., 2011) 56.7% at Zeway, (Abunna et al., 2008) 64.2% in Awassa town and (Megersa et al., 2010) 56.7% Jimma town. The reason for reporting lower prevalence of human taeniasis in the current study area could be due to the difference in the religious composition of the respondents, and sample size taken. Out of total respondents of the current study, 45.1% were Muslims that they have traditionally low habit of consuming raw meat than Christians and from the total respondents only 50.8% were raw meat consumers. Raw meat consumption is the only way of getting T.saginata infection, so as raw meat consumption decrease in the area the infection also decrease. The other is sample size difference and as sample size increase the precision will also increases. In the present study the sample size is very large (415) while in the above finding very small (not greater than 170). The other point is that some respondents shy to openly tell about taeniasis and this could also end up with low recovery of positive people in the study area.

It was revealed that T.saginata infection was more prevalent in the rural area than urban. This could be due to low level of personal and environmental sanitation facilities and absence of meat inspection in the rural area than urban area. This finding agrees with the statement of (Minozzo et al.,2002) who stated that taeniasis are common where hygienic conditions are poor and the inhabitants traditionally eat raw or insufficiently cooked or sun-cured meat.

The current study indicates that the ages of respondents have strong association with the prevalence of T.saginata infection and high in higher age group (>35 years) than other age group (<18 and 18-35 years) (table 5) which is in agreement with the previous study of (Abunna et al., 2008; Adugna et al., 2013; Liel et al., 2015). This might be due to that the habit of raw meat consumption increase with age and the higher age group have better income to consume raw meat and more prone to C.bovis. But lower age groups are student that they have no sufficient access to raw meat from butcher’s houses as commonly raw meat was eaten at this site and they are less invited than elder on different ceremony where raw meat was eaten at this site and they are less invited than elder on different ceremony where raw meat consumption culturally practiced.

In this study T. saginata was more prevalent in men than in women which is a similar report with findings of (Hailu, 2005; Abunna, 2013; Liel et al., 2015) in other parts of Ethiopia. This may be due to cultural practice in Ethiopia that men not commonly prepare their dishes at home rather they frequently visiting but cheries and restaurants than women for beef consumption. In this study no statistically significant difference were observed between the proportion of taeniasis in Muslim and Christian community which is in consent with the previous reports of (Tembo, 2001; Abunna, 2007; Dawit et al., 2012). The reason behind may be they share same culture and habit of raw meat
consumption in the study area regardless of their religion.

The current study revealed that raw beef consumers had contracted taeniasis infection more frequently than the non raw beef consumers which is inline with the report of (Megersa, 2010; Fetene and Nibret, 2014). The reason is well known that in the consumption of raw meat the degree of ingesting C.bovis with meat is higher (Gajadhar et al., 2006; Garcia et al., 2007). T. saginata infection is highly prevalent in the illiterate than literate respondents and this report agrees with the finding of (Abunna et al., 2008; Kebede et al., 2009; Adugna et al., 2013) and also the current study revealed that the farmers had contracted taeniasis than individuals with other occupational status. This difference might be from low level of awareness in the illiterate and farmers than literate individuals and other occupational status. The other reason for reporting high prevalence of taeniasis in the farmer community is that most of Ethiopian farmers are illiterate and from rural area where environmental hygiene is low and backyard slaughter was practiced with very low awareness about the diseases.

The questionnaire survey result showed that the prevalence of taeniasis in human population is decreasing and it also indicated that there was strong relationship between occurrence of T.saginata infection and residence area, age, sex, habit of raw meat consumption, occupational and educational status of the respondents. Therefore, continues public education should be provided to avoid consumption of raw meat and encourage use of latrines and improved standards of human hygiene and backyard slaughtering of cattle should be restricted and slaughter house which fulfills the necessary facilities and with qualified meat inspector should be constructed.

VII. Acknowledgements

It is our proud privilege to express our sense of thankfulness to College of Agriculture and Veterinary Medicine, School of Veterinary Medicine for providing the financial aid to complete this project. We also highly thankful to Ato Haji Geleto the meat inspector of Asella municipal abattoir, for his valuable suggestions, experience share during the abattoir visits.

Références

28. Dawit S. Epidemiology of Taenia saginata, taeniasis and cysticercosis in North Gondar zone Northwestern Ethiopia., Faculty of Veterinary Medicine, Addis Ababa University: DebreZeit, Ethiopia.2004:DVM thesis
32. Hailu D. Prevalence and risk factors for T. Saginata cysticercosis in three selected areas of eastern Shoa. Addis Ababa University, Faculty of Veterinary Medicine, Debrezeit, Ethiopia.2005: M.Sc thesis.


### Table 1: Prevalence of bovine cysticercosis in cattle based on breed, sex, body condition and age from Assella, Tiyoworeda, Ethiopia

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>Category</th>
<th>No. of examined</th>
<th>No. of affected</th>
<th>Prevalence (%)</th>
<th>Fisher’s exact p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breed</td>
<td>Local</td>
<td>418</td>
<td>5</td>
<td>1.2</td>
<td>0.868</td>
</tr>
<tr>
<td></td>
<td>Cross</td>
<td>12</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>Old</td>
<td>58</td>
<td>2</td>
<td>3.45</td>
<td>0.136</td>
</tr>
<tr>
<td></td>
<td>Adult</td>
<td>372</td>
<td>3</td>
<td>0.8</td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td>Male</td>
<td>413</td>
<td>4</td>
<td>1</td>
<td>0.183</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>17</td>
<td>1</td>
<td>5.9</td>
<td></td>
</tr>
<tr>
<td>BCS</td>
<td>Medium</td>
<td>281</td>
<td>3</td>
<td>1.1</td>
<td>0.564</td>
</tr>
<tr>
<td></td>
<td>Good</td>
<td>149</td>
<td>2</td>
<td>1.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>430</td>
<td>5</td>
<td>1.2</td>
<td></td>
</tr>
</tbody>
</table>

### Table 2: Frequency distribution of *C.bovis* in different organs examined and number of organs infected from cattle slaughtered at Assela, Tiyoworeda Abattoir

<table>
<thead>
<tr>
<th>Organs inspected</th>
<th>No. of organs inspected</th>
<th>No. of positive organs</th>
<th>Prevalence (%)</th>
<th>Total No of cyst on organ</th>
<th>Cyst viability (%) per organs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tongue</td>
<td>430</td>
<td>2</td>
<td>0.5</td>
<td>2</td>
<td>0(0/6)</td>
</tr>
<tr>
<td>Masseters muscle</td>
<td>430</td>
<td>2</td>
<td>0.5</td>
<td>2</td>
<td>16.7(1/6)</td>
</tr>
<tr>
<td>Heart</td>
<td>430</td>
<td>3</td>
<td>0.7</td>
<td>5</td>
<td>33.3(2/6)</td>
</tr>
<tr>
<td>Liver</td>
<td>430</td>
<td>4</td>
<td>0.9</td>
<td>7</td>
<td>50(3/6)</td>
</tr>
<tr>
<td>Lung</td>
<td>430</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Kidney</td>
<td>430</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>1720</td>
<td>11</td>
<td>0.64</td>
<td>16</td>
<td>100</td>
</tr>
</tbody>
</table>

### Table 3: Indicates status of taeniasis in study area in relation to time period considered

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taeniasis</td>
<td></td>
</tr>
<tr>
<td>Positive before 2000 E.C</td>
<td>133</td>
</tr>
<tr>
<td>Positive after 2000 E.C</td>
<td>28</td>
</tr>
<tr>
<td>Positive both before and after 2000 E.C</td>
<td>23</td>
</tr>
<tr>
<td>Total positive</td>
<td>184</td>
</tr>
<tr>
<td>Total respondents</td>
<td>415</td>
</tr>
</tbody>
</table>
Table 4: Shows the drug used by Taeniasis positive respondents

<table>
<thead>
<tr>
<th>Taeniasis positive individuals</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modern drug</td>
<td>163</td>
<td>88.6</td>
</tr>
<tr>
<td>Traditional drug</td>
<td>19</td>
<td>10.3</td>
</tr>
<tr>
<td>Non drug users</td>
<td>2</td>
<td>1.1</td>
</tr>
</tbody>
</table>

Table 5: Prevalence of human taeniasis with risk factors (address, age, sex and religion of respondents) in and around Asella, Tiyo woreda, Ethiopia

<table>
<thead>
<tr>
<th>Variables</th>
<th>Categories</th>
<th>No of interviewees</th>
<th>No infected</th>
<th>Prevalence%</th>
<th>X²</th>
<th>P –value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential area</td>
<td>Rural</td>
<td>307</td>
<td>151</td>
<td>49.2</td>
<td>11.2</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td>Urban</td>
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