Causes of Organ Condemnation and Economic loss of cattle in Developing countries. Review

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Summery

Livestock has been considered as the main component of agricultural sector in most parts developing countries.They provide food in the form of meat and milk and non-food itemssuch as draft power, manure and transport services.Regardless of livestock population the sector is characterized by low productivity mainly due to low genetic potential of indigenous breeds, inadequate management, poor nutrition, high disease incidence and parasite burden.High disease incidence and parasite burden as well as various abnormalities cause extensive financial wastes.Major causes of organ and carcasses condemnations and their economic importance are parasitic(fasciolosis, cystocericosis,hydatosis), Bacterial (tuberculosis) and mixed cause of different type of abnormality.To reduce the transmission of the diseases and financial loss government should be focused on public awareness about consequences of eating of raw meat, improper use of latrines and improved standards of human hygiene,promoting construction of abattoir with their appropriate disposal pits and proper disposal of condemned organs.

1. Introduction

Livestock has been considered as the main component of agricultural sector in most parts developing countries. They provide food in the form of meat and milk and non-food items such as draft power, manure and transport services as inputs into crop production, and fuel for cooking (EASE, 2003).For example, Ethiopia is known by its high livestock population, being the first in Africa and tenth in the world. The recent livestock population estimates that the country has about 52.1 million heads of cattle, 24.2 million sheep, 22.6 million goats and 44.9 million poultry (CSA, 2008).

In tropics, livestock health problems is high due to environmental factors like high temperature and humidity, topography,and lack of standardized of animal health services,inadequate management and poor nutrition. The livestock health problem influences on productivity and fertility of herds through mortality and morbidity, loss of weight, slow down growth, poor fertility performance and decrease physical power andthe parasitic and other diseases as well as various abnormalities are considered the major once causing a significant direct and indirect economic loss in the agricultural sector (Assegid, 2000; Elsa *et al.*, 2012;Alembrhan and Haylegebriel, 2013).

The primary aim of the abattoir is to produce healthy meat, wholesome and clean products which are safe for human consumption (Cadmus and Adesokan, 2009). Besides, abattoirs provide information on the epidemiology of diseases on livestock, to know to what extent the public is exposed to certain zoonotic diseases and to estimate financial losses incurred through condemnation of affected organs and carcasses (Jibat*et al.*, 2008). Meat inspection as part of the veterinary public health activities acts in abattoir to ensures the delivery of hygienically processed meat for public consumption while preventing the transmission of infectious and zoonotic diseases to humans (Gracey, 1999). As meat is the main source of protein to population, it should be clean and free from diseases of particularly importance to the public health as tuberculosis, hydatidosis, cysticercosis and fasciolosis among other abnormalities (Sirak, 1991) the aim this paper to review the cause of organ condemnation and their economic loss in developing countries.

2. Major causes of organ condemnationsand their economic importance

2.1 Major parasitic causes of organ condemnationsand their economic importance

2.1.1 Fasciolosis

Fasciolosis is an important parasitic disease of domestic ruminants, which is caused by digenean trematodes of the genus *Fasciola*that migrate in the hepatic parenchyma, and develop in the bile ducts (Bowman, 2003). *Fasciola* is commonly recognized as liver flukes and they are responsible for wide spread of morbidity and mortality in cattle characterized by weight loss, anemia and hypoproteinemia. The two species most commonly implicated as the etiological agents of fasciolosis are *Fasciola hepatica* (*F.hepatica*) and *Fasciola gigantica* (*F.gigantica*)

(Walker *et al.,* 2008). Evidence suggests that sheep and cattle considered the main reservoir host species, pigs and donkeys being secondary (Mas-Coma *et al.,* 1999).

In tropical regions, fasciolosis is considered the single most important helminth infection of cattle with prevalence rates of 30-90% in Africa, 25-100% in India and 25-90% in Indonesia (Spithill, *et al.,* 1999). *F. hepatica* has a worldwide distribution but predominates in temperate zones and in cooler areas of high altitude in the tropics and subtropics. *Fasciola hepatica* is found at altitude between 1200-2560 m.a.s.l. while *F. gigantica* is found at altitudes below 1500 m.a.s.l. In between these altitude limits, both species coexists where ecology is conductive for both snail hosts, and mixed infections prevailed (Yilma and Malones, 1998). In Ethiopia,Prevalence of fasciolosis ranges from 11.5 to 87% has been reported by several researchers in different part of the country (Mihreteab *et al.*, 2010; Genet *et al.*, 2012; Alembrhan and Haylegebrieal, 2013).

Fasciolasis is an economically important disease of domestic livestock, in particular cattle and sheep and occasionally man (Mungube *et al.*, 2006). Fasciolasis is a major disease, which imposes direct and indirect economic impact on livestock production (Sphithill *et al.*, 1999; Mungube *et al.*, 2006). It responsible for considerable economic losses in the cattle industry, mainly through mortality, liver condemnation, reduced production of meat, milk, and expenditures for anthelmintics (Urqauhrt *et al.*, 1996). The worldwide losses in animal production due to fasciolosis were estimated at USD 200 million per annum, to rural agricultural communities and commercial producers, with over 600 million animals infected (Mas-Coma *et al.*, 2005; Charlier *et al.*, 2007).

Economic loss due to fasciolosis in cattle indicates a reduction in production efficiency by 5% and over 10% in mild and severe infection, respectively (Mungube *et al.*, 2006). Acute losses associated with fasciolosis have also been recorded in East Africa and it causes a substantial economic loss, which include death, loss of carcass weight, reduction in milk yield, condemnation of affected livers, decline in production (reproductive) performance, predisposition to other diseases and cost of treatment (Charlier *et al.*, 2007). Prevalence of the disease is variable in terms of species of animals, seasons and climatic conditions. High

prevalence of fasciolosis being detected towards the end of the dry season and early part of the rainy season and it may be associated with climate changes, which affect field conditions and influence the frequency of cattle/water contact (Keyyu *et al.*, 2005).

Overall, condemned edible liver due to all causes and fasciolosis was 1,169 and 993 kgs, respectively. Corresponding carcass weight loss was 3,902 kgs. The respective financial loss due to liver condemnation as a result of all causes and fasciolosis was USD 2,096 and USD 1,780 respectively, whereas carcass weight loss was valued at USD 5,943 (Swai and Ulicky, 2009). The evidence collected from meat sailors, traders and public health experts revealed that partial rejection of liver tissue often reduces the market value of the remaining liver to about half of its original value as consumers see such tissues as being inferior and so offer less price for it (Swai and Ulicky, 2009).

The price of a kilogram of bovine liver tissue ranges from USD 4.25 to 5.95 and normal liver tissues weigh between 3 and 5kg (average 4kg) (Swai and Ulicky, 2009). Several studies have been conducted in different abattoirs of Ethiopia revealed that the economic loss due to fasciolosis arrives up to 3,000,488 Ethiopian birr (Mhreteab *et al.*, 2010; Dechassa *et al.*, 2012).

2.1.2. Hydatidosis

Hydatidosis/cystic echinococcosis (CE) is a severe zoonosis caused by the larval stages of a cyclophyllidean cestode called *Echinococcus granulosus (E. granulosus)* (Craig *et al.*, 1996; Cringoli *et al.*, 2007). The disease has a worldwide distribution and is endemic in many countries of the Mediterranean basin, North and East Africa, Western and Central Asia, China, South America and Australia (Jenkins, 2005; Romig *et al.*, 2006). However, even if the distribution of *E. granulosus* is considered worldwide, it is higher in developing countries, especially in rural communities where there is close contact between dogs and various domestic animals (Eckert and Deplazes, 2004).

Two hosts are involved in the completion of the life cycle of *E. granulosus*. The definitive hosts are carnivores such as dog which harbor mature tape worms in the intestine (Zhang *et al.*, 2003) while, livestock and human are the main intermediate hosts for whom the outcome of infection is

the development of hydatid cysts in lung, liver or other organs (Budke *et al.*, 2006).Transmission and maintenance of hydatidosis is dependent on complex interactions of several factors, including environmental, host and pathogen factors (Bhatia, 1997).

The absence of proper meat inspection procedures and the presence of large stray dog population are thought to contribute significantly to the prevalence of the disease. In Ethiopia, a number of researchers reported high prevalence of hydatidosis in different parts of the country and its prevalence ranges from 15 to 72% (Endrias *et al.*, 2010; Kebede *et al.*. 2011; Zelalem *et al.*, 2012; Alembrhan and Haylegebriel, 2013;Miheret *et al.*, 2013).

Also the hydatidosis has considerable socioeconomic impact in both human and animal health in different countries (Rkia Azlaf, 2006). In humans, after a long latency period, the disease consequences may include; poor quality of life; costs of medical treatment, lost opportunity for income generation and mortality in some cases (Budke *et al.*, 2006) while in animals there is reduced productivity and monetary losses due to abattoir condemnations (Scala *et al.*, 2006).

Hydatidosis in humans and animals is both an economic and public health problem in many parts of the world. For example, in the North African countries, the cost to human health treatment and animal losses was estimated at USD 60 million per year (Budke *et al.*, 2006). In Uruguay, the annual losses were estimated at USD 6.2 million from the organs seizure and the loss of livestock productions (Torgerson *et al.*, 2000). In Queensland Australia, hydatid disease was thought to cost the meat industry, conservatively about USD 2.7 million annually through lost offal sale (McManus and Thompson, 2003).

The economic importance of hydatidosis in livestock is due to the condemnation of the whole edible carcasses and offal such as liver, lung and heart (Torgerson *et al.*, 2000). In severe infection, the parasite may causes retarded performance and growth and reduced quality and yield of meat and milk (Getaw *et al.*, 2010). For instance, in Yugoslavia, a 10% reduction in milk yield and 5% in carcass weight due to hydatidosis has been described (Torgerson, 2003; SarIözkan and YalçIn, 2009). In abattoirs of various locations, researchers indicated that hydatidosis is widespread in Ethiopia with great economic and public health significance (Jobre *et al.*, 1996; Kebede, 2010). Economic losses due to hydatidosis were estimated in the country

arrives up to 1,167,512 USD (Endrias *et al.*, 2010; Getaw *et al.*, 2010; Melaku *et al.*, 2012; Terefe *et al.*, 2012).

2.1.3. Cysticercosis

Bovine cysticercosis is a muscular infection of cattle by the larvae of the human intestinal cestode, *Taenia saginata (T. saginata)*. The adult Taeniainfection in man is referred to as Taeniasis and that due to the larval stage cysticercosis (Hancock *et al.*, 1989). The parasite is cosmopolitan in its distribution (Minozzo *et al.*, 2002) with varying of prevalence (Doyle *et al.*, 1997). Highly endemic areas include Central and East African countries, Argentina, Caucasian and South Central Asian republics of the former USSR and in the Mediterranean Region (Syria, Lebanon and Yugoslavia) (Florova, 1982). In some parts of Serbia and Montenegro, up to 65% of children have been reported to harbor *T. saginata* (Florova, 1982). Moderate prevalence is encountered in South East Asia (Thailand, India, Vietnam and Philippines), Japan as well as countries of Western Europe and South America while Canada, the USA, Australia and some countries of the Western Pacific have low prevalence (Harrison and Sewell, 1991).

In developing countries, cattle are reared on extensive scale, human sanitation is of comparatively lower standards and the inhabitants traditionally eat raw or insufficiently cooked or sun-cured meat (Minozzo, *et al.*, 2002). The prevalence of Taeniasis is over 20% in certain areas of these countries. Based on routine carcass inspection the infection rate of bovine cysticercosis is often around 30-60% although, the real prevalence is considerably high (Tembo, 2001).

T. saginata infections also occur in developed countries, where considerable "rare" (i.e. undercooked) beefsteak is consumed. Taeniasis/cysticercosis spreads in developed areas of the world through tourists enjoying the consumption of lightly grilled meat, mass migration of labor and the export of meat unreliably passed by ''eye or knife'' inspection or from live animals imported from endemic areas (Mann, 1984). Prevalence in these parts of the world is less than 1%. Occasionally, however, cysticercosis "storms" have been reported on particular farms. The cause of the storm has been attributed to the use of human sewage on pasture and the use of

migrant labor (O.I.E., 2000). In developed countries, cattle of any age, are susceptible to infection since they generally possess no acquired immunity (Yoder *et al.*, 1994).

In Africa, inadequate health education and low availability of taenicides are the major obstacles for the control of the disease (Pawlowski, 1996). The variations in the epidemiological patterns of Taeniasis /Cysticercosis throughout Africa are a reflection of the numbers and distribution of human and cattle populations (Harrison *et al.,* 1996). Florova in 1982 reported a prevalence of 100% which is the highest in Africa and also in the world. In East African countries prevalence rates of 30 to 80% in different agro-climatical zones have been reported this associated with the habit and/or culture of eating raw or undercooked beef (Tembo, 2001).

The prevalence of *C. bovis* in cattle reported by different individuals in different part of Ethiopia was 2.2-13.3% in Addis Ababa Abattoir (Tekka, 1997; Nigatu *et al*, 2009;Nuraddis and Frew, 2012), 26.25% in Southern Nations Nationalities People's Region (Fufa *et al.*, 2008), 18.5% in Amhara regional state (Nigatu, 2008), 4.4% in Jimma Bekelle *et al* (2010), 6.7% in Kombolcha Jemal and Haileleul (2011), 3% in Zway Hussein *et al.* (2011) and 2.59% in Wolaita Soddo Dawit *et al* (2012). In some parts of Ethiopia, due to the habit of eating raw beef dishes such as *kourt* and *kitffo* that are served in raw or undercooked are the source of *T. saginata* infection in man (Teka, 1997).

An annual financial losses due to taeniasis South America arrives to USD 428 million (Fan, 1997), in South Africa USD 428 million (Abdusslam, 1975). In Kenya and Botswana bovine cysticercosis resulted in annual losses of USD 4 million and USD 2 million respectively (Grindle, 1978). Evaluation of the economic impact of taeniasis/cysticercosis is very difficult particularly in developing countries like Ethiopia, where necessary information is so scant and considerable proportions of infected people treat themselves with traditional herbal drugs like "*kosso*" and others. (Fufa *et al.,* 2007). However, country's high cattle population, poor hygiene, and common occurrence of bovine cysticercosis reflect heavy losses.Several studies have been conducted in different abattoirs of the Ethiopia revealed that the financial loss due to

cysticercosis is very high and arrives up to 222,706.00 ETB (Hussien *et al.*, 2011; Bekelle *et al.*, 2010).

2.2. Bacterial causes of organ condemnationsand their economic importance

2.2.1. Bovine Tuberculosis

Bovine tuberculosis (BTB) is a chronic infectious disease of animals characterized by the formation of granulomas in tissues and organs, more significantly in the lungs, lymph nodes, intestine and kidney including others (FAO, 1972). BTB is caused by slowly growing non-photochromogenic bacilli members of the *Mycobacterium tuberculosis* complex: *M. bovis* and *M. caprae* species. However, *M. bovis* is the most universal pathogen among mycobacteria and affects many vertebrate animals of all age groups including humans although, cattle, goats and pigs are found to be most susceptible, while sheep and horses are showing a high natural resistance (Radostits *et al.*, 2000; Thoen *et al.*, 2006).

BTB has been significantly widely distributed throughout the world and it has been a cause for great economic loss in animal production. In developed countries, BTB in animals is a rarity with occasional severe occurrences in small groups of herds. In developing countries such as 46% of African, 44% of Asian and 35% of the South American and the Caribbean countries, sporadic occurrences and (particularly in Africa 11%) enzootic occurrences of BTB have been reported (Cosivi *et al.*, 1998). BTB, apart from being the most important disease of intensification with a serious effect on animal production, also has a significant public health importance (O'Reilly and Daborn, 1995).

In the tropical countries including Ethiopia, BTB has been found to affect a higher proportion of exotic breeds than local zebus, which has been conferred through prevalence studies of BTB in different parts of Ethiopia (Kiros, 1998; Ameni *et al.*, 2001). Most of the surveys carried out in Ethiopia have been based on tuberculin skin testing and abattoir inspection reports of animals in a particular locality and it is one of the endemic infectious disease that have long been recorded in the country (FAO, 1967; Hailemariam, 1975).

According to the studies conducted in different part of Ethiopia, the prevalence rate of BTB ranges from 3.4% in a small holder production system to 50% in intensive dairy productions (Ameni and Roger, 1998; Ameni *et al.*, 2003; Asseged *et al.*, 2001; Regassa, 2005). Recently, a cross sectional study on bovine tuberculosis was conducted in Northwest Ethiopia, Gondar and Dembia districts revealed that the prevalence In the outdoor and indoor management system individual animal was 4.5 and 8.1, respectively (Mohammed *et al.*, 2012) and Lackech *et al.* (2012) from Akaki municipal abattoir reported that from a total of 720 slaughtered cattle 42 (5.83%) had lesions of tuberculosis.

The economic importance and public health significance of tuberculosis has been established in many countries (Jaumallyand Sibartie, 1983). *Zinsstag et al.* (2006) reviewed the economic effects of BTB on cattle productivity, the burden of disease in different settings and at different stages of public health development and the trans-sectoral (Public health, Agricultural, Environment) economic analysis of BTB control. However, in Ethiopia, the economic impact of BTB on cattle productivity, BTB control programmes and other related economic effects of the disease are not yet well documented or studied. Few abattoir meat inspection surveillances have shown the condemnation rate of the total or partial carcass and organs.

With this respect, Abel (1989) reported that out of 29, 956 slaughtered cattle in Dire-Dawa city abattoir, a total of 31.2% and partial of 16.4% condemnation rates that may result in economic losses significantly. Gezahegne (1991) demonstrated that from 1.2 million slaughtered cattle in eight export abattoirs had an estimated cost of more than 600, 000 ETB resulted due to condemned carcasses and organs. Asseged *et al.* (2004) demonstrated that, based on the ten years retrospective analysis of the detection of BTB lesions in the Addis Ababa abattoir, there was a cause of 0.024% for whole carcass condemnation. Shitaye *et al.* (2006) indicated that, in both Addis Ababa and Debre-Zeit abattoirs tuberculous lesions that, causes condemnation of carcasses and/or organs have also been found to be highly significant economically.

2.3. Abnormalities causes of organ condemnationsand their economic importance

In addition to the parasitic and bacterial diseases, there are different abnormalities that were unknown specific causative agent that responsible for mortality and high economic loss of cattle such as emphysema, pneumonia, hydronephrosis, cirrhosis and abscission and these abnormalities have worldwide distribution (Yifat *et al.*, 2011; Hassan et *al.*, 2012; Asmare *et al.*, 2012).

2.3.1. Emphysema

Emphysema is a progressive respiratory disease characterized by coughing, shortness of breath, and wheezing, develops into extreme difficulty in breathing, and sometimes resulting in disability and death. Although the exact cause is unknown, bronchial spasm, infection, irritation, or a combination of the three seem to be contributory. In recent years emphysema has become a serious public health problem in terms of rapidly increasing numbers of disabilities and deaths. In the course of the disease the passages leading to the air sacs of the lungs become narrowed. Air is trapped in the sacs, and the tissues of the lungs lose their natural elasticity and undergo destructive changes. As the disease progresses the volume of residual air trapped in the lungs increases, and the volume of each breath decreases.The lungs increase in size, and in severe cases the patient develops a characteristic "barrel chest." The lungs become unable to supply enough oxygen to the body tissues. This reduction in oxygen intake causes the heart to pump faster; consequently, the heart becomes strained. Excessive carbon dioxide in the blood gives the patient a bluish skin color (Shegaw *et al.*, 2009; Yifat *et al.*, 2011; Asmare *et al.*, 2012).

2.3.2.Pneumonia

Pneumonia is inflammation of one or both lungs. In animals with pneumonia, air sacs in the lungs fill with fluid, preventing oxygen from reaching blood cells and nourishing the other cells of the body. Sometimes the inflammation occurs in scattered patches in the tissue around the ends of the bronchioles, the smallest air tubes in the lungs. This is known as bronchopneumonia. In other cases the inflammation is widespread and involves an entire lobe of the lung. This condition is called lobar pneumonia (Cadamus, and Adesokan, 2010).

2.3.3. Cirrhosis

Cirrhosis, irreversible liver damage characterized by scarring, or fibrosis, and widespread formation of nodules in the liver. If left untreated, the liver becomes unable to carry out its

functions, resulting in complications that affect many different systems of the body. It can result from virtually any chronic liver disease(Budke *et al*., 2006).

2.3.4. Liver abscesses

Liver abscesses in animals are formed as the result of entry, growth, and establishment of pyogenic bacteria (Nagaraja and Lechtenberg, 2007). Prevalence of liver abscesses varies with Cattle type, age and season (Tehrani *et al*, 2012). Cattle fed diets containing large amounts of highly fermentable non-structural carbohydrates (concentrates) are at risk for developing ruminal acidosis due to the large quantity of organic acids (VFA and lactate) produced as a result of ruminal fermentation. Factors including lack of adaptation to a high concentrate ration, as well as variations in feed intake patterns and feeding behavior, and low amounts of physically effective fiber in the ration increase the risk of the development of ruminal acidosis. As a result of ruminal acidosis, the ruminal epithelium is exposed to a high concentration of hydrogen ions (low pH) and the epithelial layers which normally serve to protect the underlying portal circulation (the keratinized stratum corneum, stratum granulosum, and stratum spinsosum) from ruminal metabolites and microbes are injured (Purvis, 2006).

The breach in integrity of the epithelium allows microbes which are normally commensal in the ruminal microbiome to colonize the ruminal wall and elicit a host immune response. Once access to the ruminal wall is gained, they may form an abscess or emboli which can enter the portal circulation and translocate to hepatic capillaries where subsequent colonization and abscessation occurs within the liver parenchyma. *Fusobacterium necrophorum* was considered to be part of the ordinary intestinal flora, has been involved as primary cause of hepatic abscesses in cattle. Bacterial agents such as *Streptococcus, Staphylococcus, Trueperellapyogenes, Bacteroides spp*. and members of the *Enterobacteriaceae,* with being of secondary importance (Nagaraja and Lechtenberg, 2007;Tadepalli*et al*, 2009).Clinical diagnosis of liver abscesses in cattle is uncommon. Abscesses of the liver in cattle may be found in varying numbers and sizes; from 1 to over 100, and from < 1 cm to > 15 cm. Liver abscess ends in calcified centers due to caseous necrosis surrounded by polymorph-nuclear neutrophils and some mono nuclear cells**.** However, liver fatty changes develop when liver, in response to acute infections, tends to isolate and neutralize pathogens to prevent their further entry and minimizes tissue damage. Liver ictrus and

congestion is sequel for liver damage and reflect liver failure in bilirubin and internal blood passage**,** these changes in liver tissue result in liver cirrhosis (Tehrani *et al*, 2012).

2.3.5. Hydronephrosis

Hydronephrosis is the inflammatory disease of the kidney. The distribution of the abnormalities is common in developing countries including Ethiopia and several studies have conducted in different abattoirs of Ethiopia revealed that, these abnormalities are responsible to organs condemnation and casues for huge financial loss (Genet *et al.*, 2012; Asmare *et al.*, 2012). Studies conducted in Jimma and Adigrat municipal abattoirs reported that the financial loss due to these abnormalities arrives up to 16,588 ETB (Amene *et al.*, 2012 and Alembrhan and Haylegebriel, 2013).

3. Conclusion and Recommendation

Diseases are the major concern to the livestock industry as they cause extensive public and economic losses. The major livestock health problem that causes organ and carcass condemnations in abattoir such as *C. bovis*, fasciolosis, hydatidosis and tuberculosis and other abnormalities like emphysema, pneumonia, calcification, hydronephrosis, abscession and cirrhosis. Therefore, the current review may be valuable for the developing country by providing data for monitoring disease conditions and management practices of animals that have public health hazard and aesthetic value. Thus, to reduce the transmission of the diseases and financial loss due to organ condemnation, public education to avoid eating of raw meat, use of latrines and improved standards of human hygiene,promoting construction of abattoir with their appropriate disposal pits and proper disposal of condemned organs, establish policy on dog keeping and elimination of stray dogs, cattle management system, treatment of animals with anti-helminthes drugs and grazing management of animals during dry season to avoid access of the animals to the parasites eggs are important. In addition to this proper and detail meat inspection at the abattoirs are also recommended.

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