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International Journal of Livestock Production

ARTICLES

Review

Challenges and opportunities of milk, meat and live animal marketing in Ethiopia: A review

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As a result of population growth, urbanization and others, the demand for animal product have substantially increased in Ethiopia. The performance of livestock product marketing was poor in the last decade showing less accessibility to both consumers and other market due to number of constraints particularly in milk, meat and live animal marketing. The common milk market constraint includes: lack of clear milk marketing system, cultural and religion factor, inaccessible market and lack of transport, poor extension service and practice, lack of market information, and localized market. The opportunities in milk marketing sector include: population growth, infrastructure development, government focus and trained manpower. Meat and live animal marketing constraint include: lack of clear marketing channel and market information, seasonal based demand, long market chain, lack of market oriented production, poor market infrastructure, informal cross border trade, low quality product, trend and preference of the product. Some golden opportunities in meat and live animal marketing include: change in domestic and export demand, clear government policies, infrastructure development and accessible technology. Therefore, it is very critical to effectively exploit the opportunities in the sector and overcoming limitation in the milk, meat and live animal marketing is highly vital to bring sustainable economic development.

Key words: Live animal, marketing, meat, milk.

INTRODUCTION

Ethiopia holds the largest livestock population in Africa which is estimated to be about 43.1 million heads of cattle, 23.6 million sheep, 18.6 million goats, 4.5 million donkeys, 1.7 million horses, 0.33 million mules, 34.2 million chicken and 4.9 million beehives (Central Statistical Agency (CSA), 2013). The livestock production sub-sector has an enormous contribution to national economy and generating income to farmers, creating job opportunities, ensuring food security, providing services, contributing to asset, social, cultural and environmental values, and sustain livelihoods (Solomon, 2003; Sintayehu et al., 2010; CSA, 2013). The subsector is mainly of smallholder farming system having multipurpose use and contributes about 16.5% of the national Gross Domestic Product (GDP), 35.6% of the agricultural GDP, 15% of export earnings and 30% of agricultural employment (Duressa et al., 2014; Metaferia et al., 2011).

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The performance of livestock product marketing was poor in the last decade, despite some improvement in recent years, especially in terms of aggressive policy and strategy on livestock and livestock products export, indicating that the sector is still underexploited (Demissie et al., 2014; Duressa et al., 2014). On the other hands, the current knowledge on livestock marketing systems, market routes, challenge and opportunities are inadequate for designing systems and institutional innovation to overcome perceived problems in the livestock and livestock product marketing (Ayele et al., 2003; Sintayehu et al., 2010; Ameha, 2011). Different scholars suggest that detail, recent and research based scientific data are highly important to clearly sketch inclusive master plan on livestock and livestock product marketing in Ethiopia (Anteneh et al., 2010; Tegegne et al., 2013; Asegede et al., 2015). Therefore, regaining the common constraint and potential opportunities in livestock product marketing are tremendously important to keep product quality, market competitiveness, institutional flow, economic contribution, rules and regulations governing the market in all levels (Ayele et al., 2003; Sintayehu et al., 2010). Therefore, this paper reviews common constraint and opportunities in milk, meat and live animal marketing sector in Ethiopia.

Sources of information

Recent scientific findings, journals published by different scholars, government policy, second growth and transformation plan related to livestock production of the country and other documents were assessed critically to examine the current trends for the challenges and opportunity to show boldly, the present scenario and future direction in this sector.

MILK MARKETING CONSTRAINTS AND OPPORTUNITIES IN ETHIOPIA

Common milk marketing constraints in Ethiopia

System of milk marketing

In Ethiopia, fresh milk, butter, fermented or soured whole milk (ergo), cottage cheese (ayib) and buttermilk (arera) are both formally and informally marketed. The informal milk marketing system is dominant, accounting for 95% of the milk marketed in the country. Producers directly sell their products to consumers or unlicensed traders or retailers through mutual price negotiation (Anteneh et al., 2010). There is no license to operate and no checks on quality in the informal system (Yilma et al., 2011). The formal marketing system prevails in peri-urban and urban areas. Milk is collected from producers by cooperatives and private collecting and processing plants, which channel the products to consumers, caterers, supermarkets and retailers (Tegegne et al., 2013;

Anteneh et al., 2010). Under the formal system, the quality of the milk is tested on delivery (Yilma et al., 2011). In some urban areas where milk collecting cooperatives or milk processing plants are absent, such as Bako and Nekemte towns of Oromia in western Ethiopia, the marketing system is informal (Geleti et al., 2014a). In pastoral and agro-pastoral areas of eastern Ethiopia, milk from both cows and camels is sold in raw form through the informal marketing system (Demissie et al., 2014). In these areas, cow milk is processed to butter, and sale of soured milk and butter account for about 10% of the total milk market, while camel milk processing to other dairy products is less common. Besides raw milk, soured milk is also marketed in pastoralist areas like Borana in Oromia. Milk and other dairy products are generally marketed in towns and market places. Season and distance from the main towns affect the price, with the price being higher during dry season and closer to towns where demand is high (Anteneh et al., 2010; Geleti et al., 2014b; Tegegne et al., 2013). Milk is transported from the local market places to the nearby towns by donkeys and light truck (Tolera and Abebe, 2007).

Factors of culture and religion

In some communities, selling liquid milk is a taboo, while marketing of butter, local cheese and whey is acceptable. In the Ethiopian highlands, there is a general perception that milk is a baby food (AGP-LMD, 2013b). The demand for dairy products decreases during fasting seasons, particularly in the Orthodox Christian dominated highlands (Anteneh et al., 2010; Tegegne et al., 2013). There are 250 fasting days per year, during which observant Christians abstain from consumption of any sort of animal-origin food (Ayenew et al., 2009; Yilma et al., 2011).

Inaccessibility of markets and lack of transport

The demand for milk is high in urban areas; however, given the short shelf life of raw milk and the lack and/or unaffordable price of transportation, accessibility to the markets is difficult for many rural milk producers. This problem is more pronounced in pastoral areas (Tolera and Abebe, 2007). In Mieso, a district dominated by the pastoral production system, women travel 1 to12 km (mean = 5.89 km) to reach market places or nearby towns (Hussen et al., 2008).

Lack of effective extension service to promote new technologies and practices

Government has deployed agricultural development agents in rural areas to render extension service to the

rural communities. Four livestock development packages have been formulated to be adopted by farmers. These packages include technologies that support dairy for milk production. However, the recent national agricultural sample survey has revealed that less than 1% of households have adopted the packages (CSA, 2015). The report of Tegegne et al. (2013) indicated that poor accessibility of extension services and inadequacy of practical demonstrations are the causes of poor performance of the livestock extension service among small dairy holders. A study conducted in Jimma zone of Oromia indicates that men have easier access to extension services, training and other technologies than women (Yisehak, 2008). The position of men as heads of households, men's greater access to off-farm mobility, and cultural and social limitations for women were discussed as main reasons for men's easier access, but the case of women-headed households was not discussed in the study (Yisehak, 2008).

Lack of market information

Sources of market information are government, dairy cooperatives and unions, and traders (Yilma et al., 2011). The market information from dairy cooperatives and unions, however, is only distributed to their members (Yilma et al., 2011).

Lack of holistic intervention

In Ethiopia, dairy development is controlled and guided by the Ministry of Livestock and Fisheries (formerly part of the Ministry of Agriculture). The ministry provides extension services to smallholder dairy producers on available improved livestock technologies, builds the technical capacity of producers, promotes collective action (e.g., formation of cooperatives and unions), and facilitates linkages with other national, regional and international organizations engaged in dairy research and innovation development (Yilma et al., 2011). The Ethiopian Meat and Dairy Industry Development Institute (EMDIDI) under the Ministry of Industry provides all round support for investors engaged in the production, supply, processing and marketing of dairy products, as well as monitor quality of dairy products.

Localized markets

In Ethiopia, almost all milk and milk products are domestically marketed and there is no substantial export market. Indeed, dairy products are imported from abroad, and in the years 2005 to 2009, import values increased from about $5.6 to 10.3 million (Yilma et al., 2011). Imported dairy products were powdered milk, ghee (clarified butter), and different varieties of cheeses. In addition to formal imports, there is minor, predominantly informal, cross-border trade at the Metema-Sudan route, Dire Dawa Djibouti route and Jigjiga-Togochalle-Somaliland route (Agricultural Growth Program - Livestock Market Development (AGP-LMD), 2013a).

Other factors

Shortage of adequate market information, lack of cold storage facilities, adulteration of dairy products, and frequent interruptions of electric power also affect the milk market (Geleti et al., 2014b). Although, 81.5% of households in Gursum and Babille were reported to have market information prior to selling their milk, the information system was unorganized and inaccurate because the sources of information are traders, personal observations and friends (Demissie et al., 2014). Additionally, the price for milk is too high for many Ethiopians to frequently buy it (AGP-LMD, 2013a).

Opportunities of milk marketing in Ethiopia

Dairy production is a critical issue in Ethiopia, a livestock-based society, where livestock and its products are important sources of food and income (Tegegne et al., 2013). However, dairying has not been fully exploited and promoted. Due to the low disease pressure and conducive agro-climatic conditions for cultivation of feed, the greatest potential for dairying is expected in the highlands of Ethiopia (Duressa et al., 2014). High population densities and animal stocking rates, as well as easy access to markets, also make it attractive to invest in market-oriented dairy production in peri-urban areas of these regions (Tangka et al., 2002).

According to the findings of Walshe et al. (1991), there is access to market; dairying is preferred to meat production in the highlands because it makes more efficient use of feed resources and provides a regular income to the producer. It is labor intensive and supports substantial employment in production, processing and marketing (Tegegne et al., 2013). Higher levels of production whether from cattle, camels or small ruminants, often require the introduction of specialized dairy breeds and increased level of inputs (nutrition and health care) and good linkages to market both for milk and input acquisition (Tegegne et al., 2013). The increment in food of animal product by the alarmingly increasing population puts pressure on the future milk production, bringing clear opportunities to the sector (Demissie et al., 2014). Intensification of smallholder dairy production in the different parts of the country provides substantial opportunities to the sectors (Demissie et al., 2014). In addition to this, tremendous expansion of infrastructure both physical and other types provide real opportunities to the dairy production

sector in the country (Walshe et al., 1991; Duressa et al., 2014).

MEAT AND LIVE ANIMAL MARKETING IN ETHIOPIA

Meat and live animal marketing constraints

Lack of clear marketing channels

As in the case of milk, meat and live animals are channeled through both formal and informal marketing systems, the latter system is dominant. There are three channels in the domestic market, that is, consumers buy live animals from a market and slaughter themselves, or consumers purchase meat from a market or butcher shops (Alemayehu, 2011). The actors in the live animal trade are producers, local traders, middle or larger scale traders, butchers and consumers (Alemayehu, 2011). The main animal collection points for most export abattoirs and live animal exporters are purchasing agents assigned in major marketing areas, small and large scale traders, and livestock trading cooperatives (Getachew et al., 2008; Asegede et al., 2015).

Lack of inclusive market information

The Ethiopian Livestock Market Information System (LMIS) provides regular livestock prices and volume information to producers, middle men and traders in most of the major livestock markets in the country. Information from LMIS is available on request via text messaging, email and the Internet (Alemayehu, 2011).

Seasonal based demand

Beef, mutton, goat and camel meat are sold in market places and butcher shops. The domestic demand for meat increases during traditional and religious festivities. On the other hand, demand sharply declines during the fasting seasons of orthodox Christians, particularly in the 55 days before Easter festivities (AGP-LMD, 2013a). Meat and live animals are exported to the Middle East and some African countries. Exports have dramatically increased in the last decade, and currently there are about 11 meat export abattoirs in the country (AGP-LMD, 2013a). Chilled/frozen beef, goat meat, mutton, chilled veal, chilled camel meat, and red offal are mainly exported to the United Arab Emirates (UAE), Saudi Arabia, Angola, Egypt, Bahrain, Turkey and Kuwait (Alemayehu, 2011). One hundred percent of the exported meat is sold through formal channels, due to regulations of the importing countries (Alemayehu, 2011). Live animals are exported to Somalia, Kenya, Sudan, Djibouti, Egypt, UAE, Saudi Arabia and Yemen. Informal cross-border trade mostly consists of live animals (Alemayehu, 2011; AGP-LMD, 2013a).

Long market chain

The live animal market chain is long. There are four major marketing levels: farm, primary, secondary and tertiary/terminal markets (Anteneh et al., 2010). At the farm level, trade is carried out between producers and local traders. The subsequent markets involve the smaller rural traders, larger traders, butchers and consumers (Alemayehu, 2011). The presence of these complex marketing channels similarly affects meat and live animal exports. The participating actors are producers, middlemen, livestock trading cooperatives, traders and meat or live animal exporters (Getachew et al., 2008).

Lack of market-oriented production

The absence of a market-oriented production system results in inconsistent and uneven supply of animals to markets (Anteneh et al., 2010). Large ruminants are mostly sold when they are old, culled or unproductive, or when cash is required for unforeseen expenses. Producers of beef animals and small ruminants often target their production towards cultural or religious festivities (Anteneh et al., 2010; Ethiopia Sheep and Goat Productivity Improvement Program (ESGPIP), 2011).

Lack of market information and poor market infrastructures

Producers lack market information and fail to respond to price changes (Anteneh et al., 2010; Alemayehu, 2011). A study in Tigray region pointed out that, the information barrier creates a mismatch between the demand of the export abattoirs and the production of suppliers (Asegede et al., 2015). Furthermore, poor market infrastructure limits the efficiency of livestock marketing. In Ethiopia, about 120 market centers are recognized by the government, but these centers are not well organized to provide watering, feeding, resting and quarantine facilities; the situation is worse in pastoral areas (Anteneh et al., 2010).

Informal cross-border trade

There is informal marketing of beef animals, sheep, goats and camels at border areas with Somalia, Kenya, Sudan and Djibouti (Solomon, 2003). The informal marketing, in general, accounts for 80 to 90% of the county's export of live animals (AGP-LMD, 2013), and the Ethiopian government losses about US$300 million per annum (Anteneh et al., 2010) from such illegal marketing.

Inadequate supply of the required quality

Inadequate supply of good quality live animals into the

formal market occurs because of illegal cross-border trade, poor livestock market linkages, and lack of infrastructure (Ayalew, 2006; Filip, 2006; Asegede et al., 2015). The informal cross-border trade results in an inadequate supply of the required quality animals for meat processing plants or abattoirs, which cause below potential performance (Alemayehu, 2011; Asegede et al., 2015).

Domestic trends and preferences

According to the Agricultural Sample Survey carried out by the Central Statistical Agency (2015a), 52.93% of beef and 90.04% of mutton/goat meat are consumed in the household, and 33.18 and 3.42% are sold, respectively. With the fast growth of Ethiopian economy and population, the domestic demand for meat is increasing; however, the average per capita consumption of meat is 9 kg per year, below the average for developing countries of 25 kg (Alemayehu, 2011). This is due to low per capita income, prohibitive domestic meat prices, and the many fasting days of the Orthodox Christian calendar (Ayenew et al., 2009; Yilma et al., 2011; AGP-LMD, 2013a, b). Traditionally, meat is purchased from butcher shops for fresh cuts, while live animals are purchased and slaughtered for religious holidays. Meat from high-fat female and castrated male sheep and goats, highland cattle, and young Boran bulls is preferred by most Ethiopians (AGP-LMD, 2013a).

Export trends and preferences

The required age and live-weight categories for animals vary depending on the requirements of the countries to which the exports flow into. Black head Somali and Afar sheep breeds, and Borana/Somali and Afar goat breeds are preferred lambs/kids for Middle East markets (Asegede et al., 2015). Meat and live animal exporters prefer local breeds from the lowlands as well-fed, young male lambs/kids aged one to two years with a live weight of 13 to 24 kg (Getachew et al., 2008; Asegede et al., 2015). For the export cattle markets, Boran bulls are highly preferred, followed by cattle from Bale areas and cattle younger than five years are preferred (AGP-LMD, 2013a). In the past decade (since 2005), the export of meat and live animals has been increasing (ESGPIP, 2011; AGP-LMD, 2013a).

Other factors

There is poor linkage between abattoirs and animal fattening enterprises (Asegede et al., 2015). About 95% animals destined for meat or live animal export originate from the lowlands; however, recurring drought and ethnic conflicts in these areas affect the livestock marketing system (Getachew et al., 2008). Livestock trade is also limited by lack of transporting capabilities. Animals are taken by foot to market centers and slaughterhouses, which lead to considerable loss of weight and exposure to physical injuries and illness (Anteneh et al., 2010). In addition, infectious diseases, poor veterinary support services, and inadequate application of hazard analysis and critical control points (HACCP) food safety protocols in export markets and abattoirs negatively affect the meat and livestock market potentials (ESGPIP, 2011).

Meat and live animal market opportunities

Domestic demand

The domestic meat demand is believed to increase with increasing literacy and family income. Meat consumption is often an indicator of economic status of a country or an individual. People with a higher social or economic status demand a greater amount of high-quality meat products. The per capita consumption of meat in developed/industrialized countries is much higher than in developing countries. Countries whose population consumes the least amount of meat are located in Africa and Asia. Developed countries consumed a consistent level of 77 kg of meat per capita annually, while developing countries struggled to maintain a diet with only 25 kg of meat per capita annually. Ethiopians remain slightly below in the meat intake of all low income countries and consume 9 kg per capita annually (Abbey, 2010).

Exports demand

There are few legal exporters engaged in the export of live animals and meat in the country. These exporters secure livestock from pastoral areas by themselves or through agents for export in live or meat form (chilled mutton, goat meat and beef). The annual potential for export of 72,000 metric tons of meat identified by the Middle East and North African countries are considered important for the country's export in LLP to Saudi Arabia, United Arab Emirates, Bahrain, Yemen, Jordan, Kuwait, Oman, Qatar, Iran, Syria and Egypt (NEPAD-CAADP, 2005). The annual demand of these countries is estimated to be 206,846 tons of meat and 12 million heads of live animals (cattle, sheep and goats) (Workneh, 2006); the estimated national off take rates of 10% for cattle, pastoral areas of the country alone, could produce 734 000 heads of beef cattle per annum (Daniel, 2008).

The export abattoirs are required to ensure a consistent and continuous supply of meat in order to meet the demand of the customers in the importing countries. Thus, there is an urgent need for export abattoirs to

devise alternative strategies to ensure adequate market supply of quality live animals to meet their processing needs, in order to improve their efficiency and competitiveness. There are seven abattoirs in Ethiopia which process canned meat products mainly for the army, domestic market and some exports. These abattoirs are located in Addis Ababa, Melge Wondo, Dire Dawa, Kombolcha, Gondar and Debre-Zeit. Of these, Melge Wondo to some extent, prepare frozen beef and Debre-Zeit abattoir produce chilled beef, sheep and goat meat for both domestic and export markets (Agriculture Cooperative Development International and Voluntaries in Overseas Cooperative Assistance (ACDI/VOCA), 2008).

CONCLUSION

Livestock production in Ethiopia contributes about 16.5% of the national Gross Domestic Product (GDP), 35.6% of the agricultural GDP, 15% of export earnings and 30% of agricultural employment. The performance of livestock product marketing was poor in the last decade, despite some improvement in recent years, especially in terms of aggressive policy and strategy on export of livestock and livestock products, indicating that the sector is still under-exploited. There is need to promote the market oriented production of milk, meat and live animal both for domestic and export, knowing the common challenges and opportunities are very much important in designing smart livestock and livestock product marketing system in the country.

The common milk market constraints in Ethiopia includes: lack of clear milk marketing system, factors of culture and religion, inaccessibility of market and lack of transport, lack of effective extension service to use newer technologies and practices, lack of market information, lack of holistic intervention and localized market. On the other hand, some of the opportunities in milk marketing include alarming population growth, infrastructure development, government focus, accessible technology for intervention, modern input and educated manpower. Meat and live animal marketing constraints include: lack of clear marketing channels, lack of inclusive market information, seasonal based demand, long market chain, lack of market oriented production, lack of market information and poor market infrastructure, informal cross border trade, inadequate supply of the required quality, domestic trends and preferences and export trends and preferences. In addition to these, there are some golden opportunities in meat and live animal marketing in Ethiopia, that is, increased domestic demand, increased export demand, clear government policies, infrastructure development and accessible technology. Therefore, it is very critical to recommend effective utilization of the golden opportunities in the sector and overcome the common bottle necks and limitation in the milk, meat and live animal marketing. These measures are very vital to

benefit from the sectors and to bring sustainable economic development to Ethiopia and other East African countries.

CONFLICT OF INTERESTS

The author has not declared any conflict of interests.

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Full Length Research Paper

Prevalence of equine strongyle infection and its associated risk factors in Jimma Town, Southwest Ethiopia

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This cross-sectional study was carried out from November, 2015 to May, 2016 to determine the prevalence of equine strongyles and associated risk factors in Jimma town. Fresh faecal samples were obtained from 384 randomly selected horses (n= 287), donkeys (n= 67) and mules (n= 30). Coprological examination for the detection of strongyle eggs was performed using floatation technique. The overall prevalence of strongyle infection in all species of animals was found to be 26.56% (102/384). The infection rate was 24.74% (71/287), 38.81% (26/67) and 16.67% (5/30) in horse, donkey and mules, respectively. The prevalence of strongyles in Jimma town was 35.72%, 27.27 and 23.2% in animals at ≤3, 4-10 and ≥10 years of old animals, respectively. However, in terms of age sex and body condition score, no significant differences were found between infected animals (P > 0.05). In conclusion, equine strongyle infection was found to be important in the area hence; regular deworming and pasture management are recommended to reduce the worm burden of equine in the study area.

Key words: Jimma, coprology, equine, prevalence, strongyles.

INTRODUCTION

Equine endoparasites may be divided into three categories: nematodes or roundworms; cestodes or tapeworms and trematodes or flukes. Parasites are assigned to these categories according to their morphology or structure. Growth and life cycles of parasites within each group are generally distinct from those of the other groups. The roundworms are by far the most economically important internal parasites of equines (Yanzhen et al., 2009). They cause various degrees of damage depending on the species and number at present, nutritional and the immune status of equids. They decrease the performance, production and productivity in the animals mainly in the reduction of body weight or failure to gain weight or even increase the mortality in acute case (Asefa et al., 2011). A number of studies conducted to detect association between poverty and animal diseases identified gastrointestinal parasitism as one of the most important problems for equids in

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developing countries (Perry et al., 2002; Fikru et al., 2005; Valdez-Cruz et al*.,* 2006). Internal parasites continue to be a significant threat to the health of equines. Even under proper management equines will become infested with internal parasites. Internal parasites of equines are of veterinary importance in many countries, where current methods of control rely almost entirely on the use of anthelmintics (Chapman et al., 2002).

Studies and observations conducted in the last two decades have pinpointed helminth parasites as being a major health hazard, limiting the overall performance of equines (Hinney et al., 2011). Equids are hosts to a great number of gastrointestinal parasite species, of which nematodes of the family Strongylidae, commonly called strongyle nematodes or strongyles, are the most important. These parasites are ubiquitous and live as adults in the large intestine of equids. Strongyle nematodes of equids (horse, donkey and zebra) are classified into the subfamilies Strongylinae and Cyathostominae, sometimes categorized as large and small strongyles, respectively. Among the helminthes, large strongyles are most devastating parasites of equines (Pandit et al., 2008). These large strongyles are cosmopolitans in distribution. Again, of the three strongylus species, *Strongylus vulgaris* is the most important where the prevalence of this infection with one or more of these parasites approach 100% in foals (Kharchenko et al*.,* 2009). *S. vulgaris* and *S. edentatus* are relatively common and *Streptococcus equinus* seems to have more sporadic distribution.

These parasites are important because they migrate in the circulation and vital organs and can cause severe damage that is fatal in some instances (Yanzhen et al., 2009; Ramsey et al*.,* 2004). Diagnosis is based on the grazing history and clinical signs of loss of condition and anemia. Although oval, thin shelled strongyle eggs on fecal examination may be a useful aid to diagnosis (Shite et al*.,* 2015). Despite the huge numbers of equine population and the increasing importance of equines (donkeys, horses and mules) in the Ethiopian economy, very little research relating to equine strongyle infection has been carried out. High and low prevalence of equine strongyle infection was reported by Haimanot et al. (2015), Molla et al. (2015), Getachew et al*.* (2010), Alemayehu, (2004) and Feseha et al. (1999) from Dangila Town, Menz Keya Gerbil District, east shewa and Adaa, Akaki of East Shewa that revealed 5.73, 64.61, 100, 99 and 100%, respectively. Apart from these studies in other parts of Ethiopia, there has not been enough previous information on this infection in Jimma town, where equines are back bone of the economy of the study area. Therefore, the objective of this study was to determine the prevalence of equine strongyle infection in naturally infected horse, donkey and mule and to assess the associated risk factors of strongyle infection in Jimma town.

MATERIALS AND METHODS

Study area

The study was conducted at Jimma town, located 350 km south-west of Addis Ababa, capital city of Ethiopia. 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 to 2,400 m above sea level) which is considered ideal for agricultural activities. The town is generally characterized 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 to 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 and 26.7°C, respectively. The equine population of the area were found to be 2463 (1892-horses, 324- donkeys and 247-mules) (Adere and Tilahun, 2016).

Study design and animals

A cross-sectional study was conducted from November, 2015 to May, 2016 on equines by collecting their faeces to estimate the prevalence of strongyle parasites in Jimma town. Fecal samples were directly collected from the rectum of 384 equids (horses = 287, donkeys = 67 and mules = 30) 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.

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.

$$N = \frac{(1.96)^2 Pex(1 - Pex)}{d^2}$$

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

Sampling and coprological examination

The samples were collected directly from the rectum of the animals (equines) in to the disposal labeled container and transported to JUCAVM Veterinary Parasitology laboratory soon after collection. During sample collection the identity number, body condition score, age and sex for individual animals were recorded. The floatation technique (Shite et al., 2015) was employed to concentrate parasite eggs in the faeces and examined microscopically (10x and 40x) for presence of parasite ova following procedures described previously. Identification of the eggs was made on the basis of their morphology (Soulsby, 1986).

The age of the selected equines were determined by inspecting and estimating the incisor eruption times (Crane, 1997; Svendsen,

Table 1. Mean prevalence of strongyle infection according to different equine species.

Species	Total examined animals	No of positive animals	Prevalence (%)	P-value
Horse	287	71	24.74	0.028
Donkey	67	26	38.81	
Mule	30	5	16.67	
Total	384	102	26.56	

Table 2. The prevalence of strongyle infection in equines with respective categories of the risk factors in the study area.

Risk factors	No of examined animals	No of positive animals	Prevalence (%)	P-value
Age				
≤3years	28	10	35.72	0.37
4-10years	231	63	27.27	
≥10years	125	29	23.2	
Sex				
				0.79
Female	48	12	25	
Male	336	90	26.79	
BCS				
Poor	85	23	27.06	0.96
Medium	114	31	27.19	
Good	185	48	25.95	

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 Adere and Tilahun (2016).

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 strongyle nematodes 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.

RESULTS

Prevalence of strongyle parasites in equine species

Out of 384 examined samples, 102 were positive for strongyle eggs. The overall prevalence for all horses, mules and donkeys was 26.56% (102/384). The infection rates were 24.74% (71/287) in horse, 38.81% (26/67) in donkey and 16.67% (5/30) in mules with a statistical

significant difference in prevalence among them (P = 0.028) (Table 1).

Prevalence of strongyle parasite according to age, sex and body condition score bcs of animals

The infection rates of strongyles in Jimma town were 35.72, 27.27 and 23.2% in animals at ≤3, 4-10 and ≥10 years of old animals, respectively, while in female and male animals the rates were 25 and 26.79%, respectively. The body condition of all species was also classified as poor, medium and good body condition scores. The prevalence according to body condition score was found to be 27.06, 27.19 and 25.95% in poor, medium and good body condition, respectively. However, in terms of age, sex and body condition score no significant differences were found among infected animals (P > 0.05) as indicated in Table 2.

DISCUSSION

In the current study the overall prevalence of strongyle infection was found to be 26.56%. The current finding was in agreement with Singh et al. (2015) reported as 27.33% in Punjab, India. It was higher than the reports of Haimanot et al. (2015) from Dangila Town which was

5.73%. In contrary the result was much lower than Molla et al. (2015), Getachew et al. (2010), Alemayehu (2004) and Feseha et al. (1999) from Menz Keya Gerbil District, east shewa and Adaa, Akaki of East Shewa that revealed 64.61, 100, 99 and 100% prevalence, respectively. This may be due to the presence of different geographical and climatic conditions and availability of anthelmintics between the study areas (Haimanot et al., 2015).

According to the current study the prevalence of strongyles in horses, donkeys and mules were 24.74, 38.81 and 16.67%, respectively. Based on this, strongyle infection is slightly higher in donkeys than mules and horses with a statistical significant difference (P<0.05) in the prevalence of strongyle infections among study animals. This result is relatively similar to the reports of Feseha et al. (1999) and Ayele et al. (2006) who reported higher prevalence of strongyles in donkey with a prevalence of 100 and 87%, in Menagesha and Boset, Central Shoa, Ethiopia, respectively. Moreover, Zerihun et al. (2011) in Ethiopia and Seri et al. (2004) also, in Sudan reported a higher prevalence of strongyle infection about 99.15 and 70.1% in donkeys, respectively. The higher prevalence in donkey was may be because of their low economic value and the poor conditions of housing and management and lack of deworming practices. In the current study the prevalence of strongyle infection in mules (16.67%) was lower than donkeys (38.81%) and horses (24.74%). This result disagree with the works of Basaznew et al. (2012) who reported higher strongyle infection in mules (85%) than in donkeys (82.7%) but the data analysis showed no statistical significant difference in the prevalence of strongyle infections between mules and donkeys. This difference may be attributed due to the difference in equine management and agro-climatic conditions between the study areas.

Horses were highly susceptible for GI strongyles but in this study the prevalence of equine strongylosis in horses was low as compared to donkeys. The result was in agreement with Haimanot et al. (2015) and Samrawit (2016) who reported lower prevalence of strongyle infection in horse in Dangila Town, Northwest Ethiopia and Mersa town, respectively. The lower prevalence in horses seems to be attributed to a reduced possibility for grazing and thus contact with the infective stages of parasites or intermediate hosts. Further, as the horses are valuable, maintained under appropriate hygienic conditions and receive periodical veterinary care, this might also play a significant role in reduced parasitism as compared with donkey (Singh et al., 2015).

Data on age related prevalence of equine strongyle infection was 35.72, 27.27 and 23.2% in animals at ≤3, 4-10 and ≥10 years of old animals, respectively, with no statistical difference (P>0.05) among various age groups. Similarly no effect of age for the strongyle infection could be detected in other studies (Saeed et al., 2008; Francisco et al., 2009; Basaznew et al., 2012; Samrawit,

2016). This result disagree with works of Chitra et al. (2011) who reported that the level of strongyles and Ascarids increased when the donkeys became older, but then decreased. It may be due to the development of age immunity to strongyles and Ascarids in adult donkeys.

The present study reported that prevalence of equine strongylosis (25% in female and 26.79% in male) was not influenced by sex. It indicates lack of any statistical difference among the two groups (P > 0.05) and gender does not seem to play a role in this regard. This phenomenon is also observed by other workers under different management and climatic conditions (Jemal, 2008; Basaznew et al., 2012). The current study also revealed that the prevalence was 5.64, 4.35 and 8.33% in poor, medium and good body conditioned equines, respectively, with no statistical significance difference (P>0.05) among these groups. This indicates that there is no relationship between BCS and strogyle infection in equine. Similar result was reported by many authors (Fikiru et al., 2005; Haimanot et al., 2015).

Conclusion

The present study indicated that equine strogyle infection to be the major problem in the study area being highest in donkeys followed by horses and mules. Hence this disease is an important health problem of the equines which is speculated to cause enormous economic losses through poor weight gain, reduce working ability, low performance and short life expectancy of working equines. The occurrence of stronyle infection was observed in different sex, age and body condition score of equines in this study. The climatic condition of Jimma town of Oromia region where rainfall is frequent and temperature is mild also favors the development and survival of infective larvae for most part of the years. Owing to the huge equines population in the study area considerable contamination to the communal pasture grazing system could be the other factor which favors the survival of the parasite. Animals of different age and sex group usually graze on communal pasture facilitated easy transmission of this parasitism. However, the problem due to strongyle nematodes of equines in the study area was given less attention because of its sub clinical nature. Hence, strategic deworming using full dose broad spectrum anthelminthic drugs and rotational grazing program should be implemented to reduce pasture contamination and infection. Further research should have to be conducted to identify the degree of drug resistance pattern and feaces should be cultured to identify the species of strongyle parasite present in the study area.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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