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Community Based Intervention for Zoonotic Diseases Prevention and Control in Ethiopian Pastoral Areas

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Abstract
The livelihood of pastoral community of Ethiopia is mainly dependant on livestock production which made the pastoralists to have an intimate relationship with their animals and zoonotic infections, transmissible between humans and animals, are closely associated with Pastoralism. According to the various studies conducted in Ethiopia, different types of zoonotic diseases are reported from different areas of the country including anthrax, brucellosis, rabies, tuberculosis etc. Therefore, objective of this paper is to show the importance of community based intervention for zoonotic disease prevention and control in Ethiopian pastoral areas. There are common practices such as traditional husbandry and poor management practices, mixing of wild animals with farm animals and unrestricted movement and living of pastoralists together with their animals are thought to support spread of zoonotic diseases. In addition to this, consumption of raw milk and meat together with handling of sick animals and animal products with bare hand facilitates transmission of zoonotic diseases. There is a knowledge gap about zoonoses not only in the pastoralists but also in the medical professionals found in the pastoral areas of the country. There is community health extension program in Ethiopia which is launched to educate the community about primary health care but it lacks a discipline related with zoonoses. Therefore, preventing the diseases before occurrence using community based intervention programs such as prevention package, awareness creation programs and controlling the transmission of the diseases and strengthening integrated and collaborative work between all concerned bodies are help full for better health in the pastoral areas of Ethiopia.
Keywords: Ethiopia, Livestock, Pastoral community, Zoonoses.

Introduction

Zoonoses are defined as infections that are transmissible between animal and humans. Such diseases which are common to man and animals will continue to have high incidence rates and to cause significant morbidity and mortality cases worldwide (Acha and Szyfres, 2003; Kahn, 2006). Zoonoses have important impacts on public health and livestock economies representing 61% of all infectious organisms known to be pathogenic to humans (Taylor *et al*., 2001).

Vertebrate animals including humans are the reservoirs of zoonotic infections, and the disease agents are transmitted directly or indirectly between them. Infection as a result of contact with an infected animal host represents a direct mode of transmission, whereas infection as a result of contact with a vector or vehicle is an indirect mode. In countries that have a pastoral community, transmission of pathogens from livestock to pastoralists may occur through consumption of raw milk and meat or through obstetric work and other husbandry practices (Kahn, 2006).

Zoonotic diseases can be emerging, re-emerging which cause significant human morbidity and mortality that affect poor and marginalized communities. These diseases are massively misdiagnosed and underreported but impose a dual burden on human and animals. They affect poor and marginalized people in developing countries who live in close contact with animals, often in unsanitary conditions, where health services coverage is inadequate. These diseases tend to be overlooked by clinicians as well as policy-makers and are hence under-diagnosed and hence underreported. They often share clinical features, particularly fever, with other more common diseases or require complex diagnostic tests to confirm their presence (WHO, 2010). Therefore, the general objective of this review is to show the importance of community based intervention programs for prevention and control of diseases transmitted from animal to human in the pastoral areas of Ethiopia.

Zoonotic diseases status in Ethiopia

According to the various studies conducted in Ethiopia, different types of zoonotic diseases are reported from different areas of the country. Among this, sporadic occurrence of anthrax in cattle and other domestic animals including man has been reported in different parts of the country (Shiferaw, 2004). *Salmonellae* have been isolated from different types of food of animal source in different parts of the country. Out of 1856 beef and 714 camel carcasses examined in the country, 79 (4.2%) and 116 (16.2%) were contaminated with salmonellae, respectively (Molla *et. al.,* 2003). Around 14.4% of 160 minced beef, 14.1% of 85 mutton and 16.4% of 55 pork samples tested were found *salmonellae* positive (Ejeta.*et. al.,* 2004). *Campylobacte*r has been isolated from cattle, sheep, goats, swine and chicken. The frequency of isolation from live chicken and swine was higher than the other food animals (Tesfaye *et. al*., 2005). Surveys undertaken have shown that carcasses and meat were contaminated with *E.coli* at different level throughout the food value chain (Heiko. *et. al*., 2008).

Survey conducted on food animals, before their slaughter at Addis Ababa Abattoir has shown that cattle, sheep and goats harbor *Listeria* in their gastro intestinal tract with the potential to contaminate carcasses during dressing operation (Molla *et al*., 2004). Study on different types of raw and processed foods sampled from different supermarkets in Addis Ababa also revealed that pork, minced beef, chicken and ice cream were contaminated with *Listeria* revealing relatively higher rate of contamination (Belay, 2006). Milk and milk products are the most frequently food items contaminated with *Staphylococcus aureus*. The prevalence of *Staphylococcus aureus* in raw milk in Ethiopia ranges between 10 % (Mekonen *et al*., 2011) and 42. 6 % (Getahun *et al*., 2008). *Staphylococcus aureus* was also isolated from miller's palms and, milking and milk collecting equipments (Mezgebu *et al*., 2010).

Bovine tuberculosis is widely spread all over the country in cattle managed under extensive and intensive management system with higher prevalence in extensive system. Abattoir survey showed that the prevalence ranges between 0.02 % in Gondar to7.96% in Woliata Sodo. The infection in lactating cows and camels is of public health concern, while tuberculosis can be acquired through consumption of raw milk derived from these animals (Shitaye, *et. al*., 2007).

M. bovis causes extra pulmonary tuberculosis in humans and most of the infection is due to ingestion of unpasteurized or not properly heated milk and milk products. The isolation of *M. bovis* from raw milk (Teshome, 1986; Kiros, 1998; Kinfe and Eshetu, 1987) confirms the significance of raw milk as a major source of human infection with M. bovis. Kiros, (1998) demonstrated that out of 7138 human TB patients, 38 % were found with extra pulmonary tuberculosis. Regassa (2005) also found that out of 42 human TB patients, 16.7% were due to infection with M. bovis (Shitaye, *et. al*., 2007). Sero prevalence studies carried out in the whole country indicate that bovine, caprine and camel brucellosis is prevalent in the country, with prevalence varying from region to region and within region. The sero prevalence in food animals lies between 0.49% in bovine in Bahir Dar Ethiopia (Tadesse, 2008) and 7.6 % in camels in selected districts of Afar region (Zewolda *et al*., 2012). It should be noted that Brucella was not isolated from food of animal origin; only serological studies were conducted both in animals and humans who might have acquired the infection through other routes other than consumption of food of animal sources.

Bovine cysticercosis is highly prevalent in Ethiopia. Human acquire the infection through consumption of traditional raw meat of animal origin. The consumption of raw types of meat preparations particularly poses serious food borne hazards in Ethiopia. The majority of the public is found of eating raw beef and its consumption results in infection with beef tape worm characterized by abdominal pain, nausea, and loss of appetite, loss of weight and stomach unrest. Study carried out in different parts of Ethiopia showed that the prevalence of the disease in bovines ranges from 4.4% in Jimma (Megersa *et al*., 2010) to 26.5% in Awassa (Abuna *et al*., 2008).

Infection of food animals and humans with *Toxoplasma gondii* has been confirmed through serological studies. Among food animals, sheep and goats seem to be more infected with toxoplasmosis than beef. The serological studies conducted in Addis Ababa (76.5%) and north Wollo (80%) revealed that HIV/AIDS patients are susceptible to *toxoplasma* infection (Woldemicheal *et al*., 1998; Yibeltal, 2008).

Another important zoonotic disease common in Ethiopia is rabies which is caused by animal bite. Annual estimated rabies incidence of 2.33 cases per 100,000 in humans, 412.83 cases per 100,000 in dogs, 19.89 cases per 100,000 in cattle, 67.68 cases per 100,000 in equines, and 14.45 cases per 100,000 in goats has been recorded. Dog bite was the source of infection for all fatal rabies cases. Around 89% of questionnaire respondents were familiar with rabies and mentioned dog bite as a means of transmission (Jemberu *et al*., 2013).The aforementioned studies and reports have shown that food borne pathogens occur in food of animal origin and are prevalent in humans. However, there is a need to establish an association between the isolation of the pathogens from food of animal source and their detection in humans.

Pastoralism and the issue of zoonoses in Ethiopia

In developing countries, particularly Ethiopia has a great coverage of pastoral areas with inadequate veterinary and health infrastructures and facilities, low number of health professionals and less supply of medical inputs, the zoonosis issue is very critical. The livelihood of pastoral community of Ethiopia is mainly dependant on livestock production (Admasu, 2003; Aweke *et al*., 2013). This condition made the pastoralists to have an intimate relationship with their animals and zoonotic infections, transmissible between humans and animals, are closely associated with pastoralism (Zinsstag *et al*., 2006; Schelling *et al*., 2007).

Proximity to animals, food consumption behavior, problems related to contamination of milk and meat, inadequate supply of treatment drugs, harsh environment (hot, dry and dusty zones), and socioeconomic and cultural practices are the main factors that expose the pastoralists to different zoonotic diseases (Swift *et al*., 1990; Zinsstag *et al*., 2006). Human behavior and level of education are further factors that may influence health status (Defo, 1996; MacPherson, 1994). Migration may put nomadic pastoralists at periodical risk of infection, especially around water points (Rahmann, 1996). Since the animal and human interface is very intimate and common event in the pastoral areas of Ethiopia, it is very difficult to address the health of animals and humans separately but better if integrated (Schelling *et al*., 2007; Zinsstag and Tanner, 2008).

There is a knowledge gap about zoonoses not only in the pastoralists but also in the human health professionals found in the pastoral areas of the country (Angesom, 2015a). Even though the animal health assistants had better awareness about zoonoses, they did not collaborate with human health professionals to create awareness to the community. Moreover, those medical professionals who have a limited awareness on zoonotic diseases have never been diagnosed such diseases due to lack of diagnostic and therapeutic facilities in the health centers (Angesom, 2015b).

Major zoonotic diseases that occur in pastoral areas of Ethiopia

There are many diseases occurring in the livestock keeping communities throughout the globe. Some of these diseases that occur in the pastoral areas are anthrax, rabies, hydatidosis, bovine tuberculosis, brucellosis, toxoplasmosis, leptospirosis, leshmaniasis, fasciolosis, sleeping sickness, rift valley fever etc (WHO, 2010).

In Ethiopian pastoral areas, the major zoonotic diseases reported by different authors so far are but not limited to bovine tuberculosis, brucellosis, hydatidosis and toxoplasmosis. There is a report of 8.3% bovine tuberculosis in camels in the pastoral areas of eastern Ethiopia (Ashenafi *et al*., 2014). The isolation of *Mycobacterium tuberculosis* in goat suggests a potential transmission of the causative agent from human and warrants further investigation in the role of small ruminants in epidemiology of human tuberculosis in Afar region with 0.5% prevalence of small ruminant tuberculosis (Gezahegne *et al*., 2012). There is also a report of 11% prevalence of bovine tuberculosis in Afar region (Gezahegne *et al*., 2013). Another study done in bovine tuberculosis in Ethiopian Somali region showed that a prevalence of 10%, 1.9% and 0.7% in camel, goats and cattle, respectively (Gumi *et al*., 2011) and 5.5% and 7% in cattle in two districts of southern Ethiopia (Gumi *et al*., 2012).

A study done on brucellosis showed that a seroprevalnce of 5.71% in camels (Balcha and Fentie, 2011), 0.48% and 3.09% in sheep and goats, respectively in pastoral areas of Ethiopia (Tsehay *et al*., 2014). According to the study done on human brucellosis, 34.1% patients from Borana, 29.4% from Hamer, 3% from Metema tested positive in brucella IgM IgG^{-1} lateral flow assay (Genene *et al*., 2009). In addition, a seroprevalnce of 40.49% and 68.2% of camel toxoplasmosis has been reported in Fentale district of eastern Ethiopia and central Afar region of north eastern Ethiopia, respectively (Gebremedhin *et al*., 2014; Hadush *et al*., 2015).

The studies done on hydatidosis in Ethiopian pastoralist areas revealed 20.05% occurrence of hydatidosis based on the postmortem examination of cattle in eastern part of Ethiopia (Miheret *et al*., 2013), 65.47% and 23% in camels slaughtered in Addis Ababa (camels originated from Ethiopian pastoral areas) and Jigjiga manucipal abattoirs, respectively (Bayleyegn *et al*., 2013; Etana *et al*., 2014).

Exposure means to zoonotic diseases in pastoral areas of Ethiopia

There are common practices such as traditional husbandry and poor management practices, mixing of wild animals with farm animals and unrestricted movement and living of pastoralists together with their animals are thought to support spread of zoonotic diseases. In addition to this, consumption of raw milk and meat together with handling of sick animals and animal products with bare hand facilitates transmission of zoonotic diseases such as tuberculosis (Mengistu *et al*., 2010), brucellosis (Angesom, 2015a), hydatidosis (Dawit *et al*., 2013), toxoplasmosis (Angesom, 2015b; Hadush *et al*., 2015) etc to the pastoralists.

. In Ethiopian pastoral areas, traditional type of food animal slaughtering and selling milk and milk products in non hygienic methods are common practices which defiantly downgrade the hygiene, safeness and wholesomeness of food of animal origin. Consumption of such contaminated food which may contain biological, chemical or physical agent or hazards has the potential to cause on adverse health effect. Carcasses of dead animals remain in and around villages. This creates problems in terms of human and animal health by contaminating soil and drinking water (Philpott *et al*., 2005).

There are no adequately established municipality abattoirs generally in the pastoral areas of the country. All animals used for human consumption are slaughtered in traditional (backyard) method in the absence of professional supervision. All hotels and restaurants slaughter food animals in their home without inspection. Besides, the pastoral communities have the habit of consuming raw milk and undercooked meat. Consumption of uninspected raw or undercooked animal origin foods may favor the transmission of disease from animal to human (Acha and Szyfres, 2003; Philpott *et al*., 2005).

Knowledge, attitude and practice of pastoral community towards zoonoses

Majority of the pastoral community have no knowledge about the major zoonotic diseases and its method of transmission to human such as tuberculosis (Mengistu *et al*., 2010; Ashenafi *et al*., 2014), brucellosis (Angesom, 2015a), toxoplasmosis (Angesom, 2015b; Hadush *et al*., 2015), hydatidosis (Dawit *et al*., 2013) etc. In addition, they live together with their animal which is the major means of transmission of zoonotic diseases through respiratory route, excreta and contact. They have pet animals such as dog and cat in their homes which are the main means of zoonotic disease transmission to humans. Majority of the community consume raw meat and

unpasteurized milk, handle aborted fetus with bare hands and dispose birth or aborted materials by throwing it in the field (Bekele *et al*., 2013; Angesom, 2015a).

Different studies on pastoralist areas showed that, majority of the community has no detailed and accurate knowledge on zoonotic importance of animal diseases. This low awareness is a limiting factor if prevention and control strategies are to be implemented and it also predisposes the community for the disease (Bekele *et al*., 2013; Angesom, 2015a). In addition, the community is highly exposed to these diseases because of high probability of acquiring the disease from different sources such as untreated water, raw meat, unpasteurized milk and handling birth materials in bare hand (Dubey, 2010; Dehkordi *et al*., 2013) which are the major means of transmission of the disease to human being.

Awareness and practice of health professionals towards zoonoses

Most of the animal health professionals have knowledge on source of infection, transmission, treatment, control and prevention of zoonotic diseases of animal origin. However, all of them had never diagnosed the disease in animals and never tried to teach the community because of lack of collaborative works and programs with the medical professionals. On the other hand, majority of the medical professionals have limited knowledge of zoonoses and none of them had ever diagnosed zoonotic diseases such as brucellosis, toxoplasmosis, hydatidosis etc in humans and the reason for the diagnosis problem was lack of facility and no attention was given to the diseases next to lack of awareness (Dawit *et al*., 2013, Angesom, 2015b).

Community based health care in Ethiopia

Ethiopia has launched the Health Extension Program with the objectives of reaching the poor and delivering preventive and basic curative high-impact interventions to all of the Ethiopian population. The program is a government-led community health service delivery program designed to improve access and utilization of preventive, wellness, and basic curative services. At this program, there are front-line community health workers. These health extension workers are posted to rural communities across the country, where they provide better and more equitable access to health services for the poor, women, and children in a sustainable manner (Ghebreyesus, 2010).

Health extension workers are recruited from the communities in which they will work for the community by its own local language. Selection is done by a committee made up of members nominated by the local community and representatives from the district health office, the district capacity building office, and the district education office (FMOH 2007b). Upon completion of training, the health extension workers are assigned as salaried government employees to the villages, where they staff health posts and work directly with individual households. Health extension workers are trained to manage operations of health posts; conduct home visits and outreach services to promote preventive health actions; refer cases to health centers and follow up on referrals; identify, train, and collaborate with voluntary community health workers; and provide reports to district health offices (Bilal *et al*., 2011).

The basic philosophy of the program is to transfer ownership of and responsibility for maintaining their own health to individual households by transferring health knowledge and skills to households. Health extension workers spend most of their time visiting families in their homes and performing outreach activities in the community. The house-to-house activity starts by identifying households to serve as role models. These households have earned the respect and credibility of the community because of their extraordinary performance in other social aspects, such as agricultural production. They are willing to change and, upon completion of the training, are able to persuade and convince other households to follow appropriate health practices. The model households are considered early adopters of health practices in line with heath extension packages. They help diffuse health messages, leading to the adoption of the desired practices and behaviors by the rest of the community (Bilal *et al*., 2011).

Even though zoonotic diseases are found in a significant rate in pastoral communities, there is often a general lack of focus with a subsequent failure to prioritize their control by human and animal health sectors. These diseases affect the health and livelihood of the livestock keepers by hampering the health and productivity of livestock by causing infertility, morbidity, mortality, low milk yields and rendering inedible meat. Control of these diseases is usually possible which is best undertaken and feasible in terms of cost through the domestic animal reservoir. Control and elimination, however, may require other interventions in humans (using preventive chemotherapy or case management), increased public awareness to reduce contacts between humans and animals and/or modification of the environment to eliminate populations of intermediate or definitive hosts (WHO, 2010).

The program focuses on four major areas and provides 17 different packages to reach the poor and address inequities. As preventive program, the four areas of care are Disease Prevention and Control, Family Health, Hygiene and Environmental Sanitation, and Health Education and Communication. The disease prevention and control area focus mainly on HIV/AIDS, TB and malaria. The training package of the community health extension program in Ethiopia lacks a discipline related with zoonoses/prevention and control of diseases transmitted from

animal and their products to human (FMOH, 2005).

Conclusion

Traditional husbandry and poor management practices, mixing of wild animals with farm animals and unrestricted movement and living of pastoralists together with their animals are common practices that thought to support spread of zoonotic diseases. Consumption of raw milk and meat together with handling of sick animals and animal products with bare hand facilitates transmission of many zoonotic diseases to the pastoralists. There are no adequately established municipality abattoirs and no hygienic milk supplying centers generally in the pastoral areas of the country. All animals used for human consumption are slaughtered in traditional method in the absence of professional supervision. There is a knowledge gap about zoonoses in the pastoralists and health professionals found in the pastoral areas of the country. Even though the animal health professionals had better awareness about zoonoses, they did not collaborate with human health professionals to create awareness to the community. Moreover, those medical professionals who have a limited awareness on zoonotic diseases have never been diagnosed such diseases due to lack of diagnostic and therapeutic facilities in the health centers. There is community health extension program in Ethiopia which is launched to educate the community about primary health care. However, the training package given to the pastoral community lacks a discipline related with zoonoses/prevention and control of diseases transmitted from animal to human. Therefore to fill the identified gaps, the following points are important:

- Since controlling of zoonotic diseases at human level requires huge investment and mostly not successful, it is better to prevent the diseases before their occurrence using community based intervention programs such as prevention package, awareness creation programs and controlling the origin, source and vehicles of transmission of the diseases
- In the pastoral areas of the country, there is a need to fill the knowledge gap by creating awareness on zoonotic disease prevention and control mechanisms in the community through health extension workers
- There is a need to mainstream the issue of zoonoses to the training package given to health extension workers under the care area of disease prevention and control
- Delivering capacity building and awareness creation training to medical and other related professionals working in health centers (mainly to those who work in the pastoral areas)
- Establishing diagnostic and therapeutic facilities of zoonotic diseases in the health centers
- Establishing municipality abattoirs and hygienic milk distributing centers in cooperatives supported by enforcing legal matters
- Creating and strengthening integrated and collaborative work between veterinarians, medical professionals and other concerned bodies for better health in the pastoral areas of Ethiopia.

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