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One Health: An Integrated Approach for Disease Prevention and Control in Pastoral Areas of Ethiopia

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Abstract

The human, animal and environment interface has made the routine disease prevention and control process difficult and unsuccessful. This condition created a new concept, one health, in which the health of each group is interconnected and dependent. This concept is based on the collaborative efforts and communication of multiple disciplines working together to attain optimal health of people, animals, and the environment. Therefore, the objective of this review is to show how an integrated work between concerned bodies mainly animal and public health is helpful for better health in the pastoral areas of Ethiopia through one health approach. The emergence and re-emergence of pathogens due to various factors will threaten the health and well being of people and animals throughout the globe. Pastoralism refers to a livelihood based on livestock rearing which involves sedentary or mobile communities. Zoonotic infections, transmissible between humans and animals, are closely associated with pastoralism. 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. There are many authors who reported various zoonotic diseases such as tuberculosis, brucellosis, hydatidosis, toxoplasmosis etc in the pastoral areas of Ethiopia. There is a knowledge gap both in the pastoralists and health professionals about zoonoses. There is no collaborative work between animal and human health professionals to create awareness about zoonoses to the community. Traditional husbandry and poor management practices, mixing of wild animals with farm animals and unrestricted movement of pastoralists with their animals, consumption of raw milk and meat together with handling of sick animals and animal products with bare hand facilitates transmission of zoonotic diseases to pastoralists. Therefore, capacity building training to health professionals, awareness creation to the community through health extension workers and promoting collaborative health programs in one health approach is very important for successful and sustainable disease prevention and control in the pastoral areas of Ethiopia.

Keywords: Pastoralism, Zoonoses, One health, Ethiopia

Background

The convergence of human, animal and environment has made the routine disease prevention and control process difficult and unsuccessful. This condition created a new concept, one health, in which the health of each group is interconnected and dependent (Coker *et al.*, 2011). This new concept is the function of the collaborative efforts and communication of multiple disciplines working to attain optimal health of people, animals, and the environment. One health is an integrated strategy which involves the cumulative works of Veterinary medicine, human medicine, environmental science and public health (Samuel *et al.*, 2013; Carol, *et al.*, 2013).

Even though there are challenges and limitations to come to the mind set of one health, various opportunities have emerged to promote health in the continuously changing human, animal and environment interface (Gebreyes *et al.*, 2014). The success that can be achieved on improving the health and well being of human and animals will be based on the works accomplished in an integrated approach in all interrelated areas (Schelling *et al.*, 2005; Graham, *et al.*, 2008; Rock *et al.*, 2009). This task starts with the understanding of the profound interdependence among human, animals and the larger ecological system, exquisitely and obviously connected (Gebreyes *et al.*, 2014).

The concept of One Health is mainly focuses on control of various infectious diseases that can be transmitted among and between animals, human and the environment. There are different indications that show the occurrence of infectious diseases in different forms will continue to be significant global event (Graham, *et al.*, 2008). The emergence and re-emergence of pathogens due to various factors will threaten the health and well being of people and animals throughout the globe (Taylor *et al.*, 2001; Coker *et al.*, 2011). A large majority of these infectious diseases are caused by microbes which have zoonotic importance. At the same time the ever changing environmental conditions will continue to create favorable conditions for the development of new infectious diseases as well as an expanding number of non-infectious and chronic diseases and disorders (Kahn, 2006). Therefore, the objective of this review is to show how an integrated work between concerned bodies mainly animal and public health is helpful for better health in the pastoral areas of Ethiopia through one health approach.

Emerging and re-emerging zoonotic diseases

The occurrence of newly emerging and re-emerging diseases is due to simultaneously happening multi-factorial

cause. The causes may be associated with the behavior of the pathogens such as adaptation and resistance or it could be host susceptibility. The other most contributing factors include climate change, global travel and transportation, economic development, overgrowing human population and feeding behavior, interaction with wild life, and absence of public and animal health infrastructures, poverty and illiteracy (Taylor *et al.*, 2001; Patel and Burke, 2009). Most of these factors have contributed in establishing a suitable condition and possibilities to the microbes to flare up every time and create new niches. These microbial, environmental, natural and manmade changes are occurring very quickly worldwide and established new beachheads in the populations of people, animals and are also invading our environment where they are inducing new pathogenic conditions (Patel and Burke, 2009; Coker *et al.*, 2011).

Food borne infection and intoxication due to exposure of food of animal origin to different physical, chemical and biological contaminants is creating a serious problem in the health of human being. The food hygiene and safety problems occurring along the whole food chain are producing a food borne zoonotic diseases (Kahn, 2006; Newell *et al.*, 2010). Trans-boundary animal diseases, international livestock trade, interaction of wild animals with animals and humans and new behavior of feeding both in animals and human favors the occurrence of newly emerging and re-emerging infectious diseases. Health of the animals, hygiene and safety of food of animal origin represent growing and difficult challenges which clearly fall into a new global health agenda for animal production and food supply (Taylor *et al.*, 2001; Gebreyes *et al.*, 2014).

Pastoralism and the health issue

Pastoralism refers to a livelihood based on livestock rearing which involves sedentary or mobile communities. Traditional pastoral production systems of Africa may be classified (in order of increasing mobility) as agro pastoralism, sedentary pastoralism, semi-sedentary pastoralism (transhumance) and nomadic or migratory pastoralism. Nomadic pastoralism refers to an extensive form of pastoralism with a high degree of mobility (Schwartz, 1993).

The nomadic or transhumant way of life of pastoralists is the mode of production best suited to an unstable environment, enabling strategic exploitation of seasonally available water sources and pasture. The arid climate in the lowlands is characterized by periodic droughts that may be increasing in frequency. A substantial portion of the pastoral populations, however, are food insecure even in normal rainfall years. Environmental degradation, water scarcity, increasing human and livestock population, and expanding areas under cultivation have contributed to a reduction in the quantity and quality of productive rangeland, which, combined with poor animal and human health, place enormous stress on the traditional pastoral and land management practices. These tensions increasingly result in conflicts between groups competing over scarce resources (Admasu, 2003; Zinsstag *et al.*, 2006).

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).

The pastoral area of Ethiopia is characterized by large size, limited development and inadequate supply of health care materials. The human population tends to be small, highly mobile, and difficult to reach, and derive their food and income from their livestock. The main concerns of the pastoral people are livestock diseases and water supply which contributed to the occurrence of different infectious diseases (Abebe, 2003; Zinsstag and Tanner, 2008).

Zoonoses and Food safety

Zoonoses and communicable diseases common to man and animals continue to have high incidence rates and to cause significant morbidity and mortality worldwide (Acha and Szyfres, 2003; Kahn, 2006). Zoonotic infections, transmissible between humans and animals, are closely associated with pastoralism (Schelling *et al.*, 2007). 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). Rabies is one of the zoonotic diseases which have been recognized since early history and others such as BSE (Bovine Spongiform Encephalopathy) are recognized as emerging ones (Hugh-Jones *et al.*, 2008). 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. Transmission of pathogens from livestock to pastoralists may occur through consumption of raw milk and meat or through obstetric work (Kahn, 2006).

Food borne diseases are caused by a wide range of agents; and can result in mild disease or life-threatening illnesses. There are more than 250 known food borne diseases. Biological contaminants are the main causes of food borne diseases and are responsible for a wide range of illnesses (Newell *et al.*, 2010). Diseases such as salmonellosis, shigellosis, brucellosis, amoebiasis, campylobacteriosis and poisoning by toxin-producing microorganisms such as staphylococci and *Clostridium botulinum* are considered as food borne zoonotic diseases. Parasitic diseases such as toxoplasmosis and trichinosis are a problem throughout the world, while in developing countries taeniasis and cysticercosis are also have importance. Some plants such as mushrooms and fish carry harmful toxins. Chemical Hazards includes intoxication due to chemical contamination of food, residues on food or food contact surfaces, pesticides and metal residues, cleaning compounds and metal residues. Besides to this physical hazard such as metal shavings packing staples, pins, glass, hair, fingernails, wood, stones and toothpicks involve in injuries caused by chewing or ingesting foreign objects in food (Acha and Szyfres, 2003).

Food poisoning can occur within the home, at work or in public eating places (restaurants). Within the home there are numerous interconnections and interactions among water, sanitation, flies, animals, personal hygiene and food that are responsible for diarrhea transmission. The temperature and time of cooking and the storage of food are important factors (Acha and Szyfres, 2003; Newell *et al.*, 2010).

In sub Saharan Africa, millions of small-scale farmers efficiently supply the great majority of the meat, milk and fish market. Animal products have a high nutritional value which enhances public health, while the production, transportation, processing and retailing of these products provide income and employment to millions. On the other hand, animal source foods are single most important source of food borne disease (Newell *et al.*, 2010).

Majority of the animal source foods are distributed through informal markets without adequate safety inspection, and as a result, most of the people living in the region are exposed to a variety of food-borne agents which can cause diarrhoea, fever, chronic wasting, abortions, or even epilepsy and cancer. These infections can have severely negative impacts on the population, including a higher infant mortality, and may contribute significantly to area poverty (Kahn, 2006; Patel and Burke, 2009; Newell *et al.*, 2010). These conditions show that current food safety management seems to be neither effective nor efficient. Moreover, there is a tendency to adopt international food quality standards without considering local contexts with the result conventional food safety policies often try and ban any product with hazards in it. Small-scale farmers have difficulties to comply with these standards and could therefore be prevented from marketing their products (Graham, *et al.*, 2008).

Current practice and disease status in pastoral areas of 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 issues is very critical. The livelihood of pastoral community of Ethiopia is mainly dependant on livestock production (Abebe, 2003; Admasu, 2003). This condition made the pastoralist to have an intimate relationship with animals (Zinsstag *et al.*, 2006).

There is a knowledge gap not only in the pastoralists but also in the human health professionals about the zoonotic infection in the rural areas (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 and to formulate strategies. 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).

Traditional husbandry and poor management practices, mixing of wild animals with farm animals and unrestricted movement of pastoralists with their animals are thought to support spread of the disease such as rabies. 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) etc to the pastoralists.

Food borne diseases status in Ethiopia

According to the Ethiopian regional health offices reported to Ministry of health, the major food borne syndromes found were mainly diarrhea, gastro intestinal parasitism, dysentery, typhoid and gastro enteritis which ranges from 1.2% prevalence due to Amoebiasis in Afar region to 14.6% due to internal parasites in Gambella region (CSA, 2008).

Even though no association have been established between the pathogens isolated from food of animal origin and their occurrence in humans, researchers in veterinary science have been able to isolate different types of pathogens from different types of food animals and food samples. The most important food borne pathogens isolated from humans includes *Salmonella thyphi*, non typhoid *Salmonella* species (Molla *et al.*, 2003), *Campylobacter jejuni* (Tesfaye *et al.*, 2005), *Toxigenic E.coli* (Heiko. *et al.*, 2008), *Staphylococcus*

aureus (Mezgebu *et al.*, 2010) and *Toxoplasma gondii* (Tilahun *et al.*, 1998; Yibeltal, 2008).

Zoonotic diseases status in Ethiopia

According to the studies conducted in Ethiopia, many food borne 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. *Campylobacter* 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). Survey conducted on food animals, before their slaughter at Addis 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; Belay, 2006).

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 to 7.96% in Woliata Sodo. *M. bovis* causes extra pulmonary tuberculosis in humans and most of the infection is due to ingestion of unpasteurized or not properly boiled milk and milk products (Teshome, 1986; Kiros, 1998; Kife and Eshetu, 2005). The sero prevalence of brucellosis in food animals lies between 0.49% in bovine in Bahir Dar Ethiopia (Tadesse and Girma, 2008) and 9.2 % in camels in Fentalie district (Mekonen *et al.*, 2010).

Bovine cysticercosis is highly prevalent in Ethiopia in which human acquire the infection through consumption of raw meat of animal origin. 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. The serological studies conducted in Addis Ababa (76.5%) and north Wollo, Ethiopia (80%) revealed that HIV/AIDS patients are susceptible to *toxoplasma* infection (Tilahun *et al.*, 1998; Yibeltal, 2008).

Conclusion

The emergence and re-emergence of pathogens due to various factors will threaten the health and well being of people and animals throughout the globe. Zoonotic infections, transmissible between humans and animals, are closely associated with pastoralism. Proximity to animals, food consumption behavior, problems related to milk and meat contamination, inadequate supply of treatment drugs, harsh environment, and socioeconomic and cultural practices are the main factors that expose the pastoralists of Ethiopia to different zoonotic diseases. The livelihood of pastoral community of Ethiopia is mainly dependant on livestock production which made them to have an intimate relationship with animals and the occurrence of zoonotic diseases very critical. There is a knowledge gap not only in the pastoralists but also in the medical professionals about zoonoses. 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. Traditional husbandry and poor management practices, mixing of wild animals with farm animals and unrestricted movement of pastoralists with their animals are thought to support spread infectious diseases such as rabies. 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, brucellosis, hydatidosis, toxoplasmosis etc to the pastoralists. 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 rather integrated. Therefore, capacity building training to health professionals, awareness creation to the community through health extension workers and promoting collaborative health programs in one health approach is very important for successful and sustainable disease prevention and control in the pastoral areas of Ethiopia.

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