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PRELIMINARY ASSESSESMENT ON THE EPIDEMIOLOGY AND PUBLIC HEALTH IMPLICATION OF CAMEL TUBERCULOSIS IN PASTORAL AREA OF ETHIOPIA

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ABSTRACT

Tuberculosis is a major health problem throughout the world causing large number of deaths both in humans and animals, more than that from any other single infectious disease. It is a highly successful intracellular pathogen that has developed strategies to survive even in the presence of high immune pressure. The usual site of entry into the human body is through the airways, beginning with the inhalation of infected droplets expelled from another infected individual through coughing. Although being caused by a quite simple microorganism, TB is a multifaceted disease with a spectrum of antimicrobial effector pathways at play during different stages of infection, ranging from early innate to late adaptive immune responses during acute and chronic infection. Even though both innate and adaptive immunity are coordinated to protect the body from this infection and disease development, Cell mediated adaptive immunity is the main one against MTB infection. Ethiopia ranks seventh in the list of 22 high burden countries. In camel it is chiefly caused by *M. tuberculosis* and *M. bovis*, even though a typical Mycobacterium species are occasionally responsible for the outbreak of the disease. Camel TB has worldwide distribution and present countries where camels are reared even if it is not well recognized and confirmed in many developing countries including Ethiopia. The disease is manifested the clinical signs of chronic weight loss or emaciation, weakness, dyspnea, cough and enlarged lymph node and lesions of caseous nodules in different organs. Camel TB has public health implication particularly in pastoral area of Ethiopia, nomadic

environment, where camel milk and its products are consumed as raw and in countries where camels are kept under intensive management system for racing purpose in which the etiological agents are transmitted to humans through aerogenous route from those animals with active cases in the herd.

KEYWORDS: Camel tuberculosis, Epidemiology, *M. bovis*, public health implication**.**

INTRODUCTION

Pastoral production system accounts for the livelihood of 50–100 million people in developing countries and 60% of this population lives in more than 21 African countries confined to the most arid and semi-arid regions of the continent (UNDP, 2007). In eastern Africa, Ethiopia has the largest pastoralist population (7–8 millions) representing around 20 ethnic groups (Markakis et al., 2004). Pastoralism and agro-pastoralism are the two major livelihood ways practiced in the region. Animal husbandry in pastoral region is characterized by extensive pastoral production system and seasonal mobility. Camel (Camelus dromedarius) is an important domestic animal species uniquely adapted to the hot and arid environment. The camel is an important animal in Ethiopia because of its adaptation to adverse climatic conditions and shortage of forage and water. It is also an indicator of social prestige and wealth (Bekele, 1999). About 11.5 million of camels are living in the eastern part of Africa (Djibouti, Eritrea, Ethiopia, Somalia and Sudan) representing over 80% of the African and two thirds of the world camel population (Bekele, 1999). In Ethiopia, an estimated 1.7 million camels are present which are mainly distributed in arid and semi arid areas of the country (CSA, 2004).

Camels (Camelus dromedaries) are a subset of the huge livestock resources in Ethiopia with the population estimated to be over one million. This number ranks the country third in Africa after Somalia and Sudan, and fourth in the world (India included).The arid and semi-arid areas of the country that constitute more than 60% of the total area and home of 7.8 million pastoral and agro-pastoral communities are suitable for camel production (Abebe, 2000). The eastern and southern parts of the country, namely Somale, Afar and Borena are the major areas where camel husbandry is widely practiced. In these areas, the livelihood of the pastoral communities is certainly ensured by dromedaries (Wossene, 1991). The one humped Camelus dromedarius has a special position in the life of many nomadic people of African countries, as it is the main supplier of meat, milk transportation and draft power. The camel has been quoted to be the most efficient domestic animal for converting vegetative

matter into work, milk and meat (Ramet, 2001).The love, affection and admiration that the nomadic peoples have for the camel are very deep. Additionally the camel plays an important role for the socio-cultural set up of the community (e.g. payment of dowry, settlement of fines (e.g. in tribal feuds, recreational activities). The pastoralists, especially the Somali who represent the largest and oldest camel keeping tribe, see camels as a banking system or security against drought, disease, and other natural disasters that affect smaller stock more seriously (Farah et al., 2004).

Pastoralists depend on livestock for their livelihood, moving seasonally from place to place in search of water and pasture for their animals (Nori et al., 2005). The dromedary camel (Camelus dromedarius), which is a versatile animal capable of living in harshly semi-arid and arid areas of the world, is extremely important for livelihood of pastoral communities through provision of milk, meat and draft power for transportation of goods. In these communities, camel milk is consumed raw, and this habit combined with close physical contact with their animals create a potential public health concern for transmission of zoonotic diseases such as tuberculosis (TB) from animals to the pastoralist (Getahun et al., 2002).

Tuberculosis (Tb) is a chronic, contagious, granulomatous disease caused by Mycobacterial species belonging to the Mycobacterium tuberculosis complex (MTC) (Thoen et al., 2006 37). Tuberculosis (TB) has been a major health risk of animals and humans for more than a century. It is a disease of worldwide distribution, attacking both animals and human, affecting all age groups, sparing no organs of the body and responsible for more deaths throughout the world than any other bacterial diseases ever today (Bhatia and Ichpujanti, 1994).

The disease affects many vertebrate animals and manifests particularly in lungs and lymph nodes but also in other organs. Camelids were not considered highly susceptible to TB (11 (Fowler et al., 2010), but in recent years serious concern has arisen about Tb in New World Camelids (NWCs), particularly llamas and alpacas, in some countries where they are reared (and not just countries in their native South America). For example, Tb is a serious emerging disease in the steadily increasing NWC population of the United Kingdom (UK) (Twomey et al., 2010). Tuberculosis also affects Old World Camelids (OWCs), including dromedaries and Bactrian camels (Mustafa et al., (1987).

Tuberculosis, as Zoonosis from camel to human also plays an important role among nomadic people where milk and milk products are consumed as raw especially in the pastoral and

agro-pastoral area of Ethiopia (Seifert, 1992). The principal agent of zoonotic tuberculosis is M. bovis (Krauss et al., 2003). Tuberculosis in humans remains one of the major global reportable diseases, and a rise in its incidence has caused the World Health Organization (WHO) to declare the disease as global emergency (Nakajima, 1993). The Zoonotic risk arising from camel milk should be considered because camel milk is usually consumed in its raw state. In particular in the pastoralists of the Horn of Africa where no treatment of milk is practiced either it is consumed raw or when it just soured (Zubier et al., 2004). Even though Ethiopia is a country where the impact of TB is particularly important and it is amongst the three African countries with highest burden of human TB cases, regrettably, in the pastoral production system in the low land areas. Despite the presence of huge livestock population, the actual prevalence of camel TB is not yet known. In this production system, the study process can be complicated by the frequent movement of animals for water (watering point) and the livestock markets. To this effect, animals come together from different direction and due to the enclosure of the animals overnight may expose to the increased transmission of the disease (Shitaye et al., 2007).Therefore, the objective of this manuscript is:

- To assess the existing research results of camel tuberculosis in relation to its etiology, pathogenesis and distribution.
- To assess the zoonotic importance of camel tuberculosis with emphasis to Ethiopia.
- To forward recommendations toward the future study and investigations of camel tuberculosis with respect to Ethiopian situations.

GENERAL CHARACTERIRISTICS OF MYCOBACTERIUM COMPLEX

The Mycobacterium tuberculosis complex comprises the closely related species M. tuberculosis, M. bovis, M. africanum, M. microti, and M. canetti. These species are the causative agents of tuberculosis (TB) in humans and animals (Van Soolingen et al., 1997). Routine identification of M. tuberculosis complex isolates can easily be performed with commercially available gene probes (Shinnick, 1994). Moreover, several repetitive elements like the Direct Repeat (DR) locus or the insertion sequence IS6110 have been found to be exclusively present in members of the M. tuberculosis complex (Liebana, 1996). However, differentiation among the most important Mycobacterial pathogens for humans, M. tuberculosis, M. Africanum, and M. bovis is based on several biochemical tests. M. tuberculosis is most easily identified by its special colony morphology (eugonic growth), by nitrate reduction, and by niacin accumulation. M. bovis shows dysgonic growth and is

negative for nitrate reduction and niacin accumulation (Wayne and Kubica, 1986). A major criterion for the differentiation of M. bovis is its intrinsic resistance to pyrazinamide (PZA). However, some studies report susceptibility to PZA among M. bovis isolates (Wayne et al., 2008). The different species of the Mycobacterium tuberculosis complex shows a 95-100% DNA relatedness based on studies of DNA homology and the sequence of the 16S rRNA gene are exactly the same for all the species. So some scientists suggest that they should be grouped as a single species while others argue that they should be grouped as varieties or subspecies of M. tuberculosis. (Brzostek et al., 2009).

Taxonomy

Mycobacteria belong to the kingdom bacteria; Phylum: Actinobacteria; Class: Actinobacteria; Order: Actinomycetales; family: Mycobacteriaceae; Genus: Mycobacterium (Quinn et al., 2002). The organism was named so because of the mould like peculiar growth of these organisms in liquid medium. "Myco" means fungus and "bacteriu" means bacteria.Teh clssic species of Mycobacterium that cause disease in man and animals includes M. bovis, M. tuberculosis, M. avium, M. leprae, and M. lepraemurium. (Bhatia and Ichhpupujani, 1994).

Species

The Mycobacterium tuberculosis complex (MTC) consists of Mycobacterium africanum, Mycobacterium bovis, Mycobacterium canettii, Mycobacterium microti, Mycobacterium tuberculosis (Quinn et al., 2002).

Characteristics of Mycobacterium tuberculosis

The Mycobacteria are thin rods of varying lengths from 0.2-0.6 by 1.0-10.0 micrometre (Quinn et al; 2002).Most of the members are slightly curved rods sometimes branching filamentous or mycelium type growth may occur. But usually gets fragmented into rods or coccoid cells. They are acid fast; non motile and do not form endospores and capsules. M.tuberculosis is straight or slightly curved rod; whereas M. bovis is usually straighter; stouter; and shorter (Gupte, 2006). Mycobacterium is rich in lipids (mycolic acids; waxes; and phosphatides) and is also composed of proteins and polysaccharides. The cell wall of Mycobacteria contains N-glycol muramic acid in place of N-acetyl muramic acid has (60%) lipid content (Sharma and Adlakha, 1996).

Virulence

Virulence of this organism appears to reside in the lipids of cell wall. Mycosides, phospholipids, and sulpholipids are thought to protect the tubercle bacilli against phagocytosis. Glycolipids cause granulomatous response and enhance the survival of phagocytised Mycobacteria wax D and various tuberculoproteins induce a delayed hypersensitivity reaction detected in the tuberculin test (Quinn et al; 2002).

Pathogenicity

Pathogenic Mycobacteria, including the causative agents of tuberculosis and leprosy, are responsible for considerable morbidity and mortality worldwide. A hallmark of these pathogens is their tendency to establish chronic infections that produce similar pathologies in a variety of hosts. During infection, Mycobacteria reside in macrophages and induce the formation of granulomas, organized immune complexes of differentiated macrophages, lymphocytes, and other cells (Travis et al., 1985).

Growth character

M. tuberculosis has very simple growth requirements and is able to grow slowly in harsh conditions. Their acid-fast property is the strongest when there is glycerol around. However, when glucose is the main source of nutrient, the utilization of glycerol by M. tuberculosis is inhibited. Therefore, it has been shown that glutatmate, and not glucose, is actually the main source of nutrient for initiating growth. (Uhia et al., 2011).

Biochemical character

Mycobacterium tuberculosis is an acid fast bacterium, which can form acid-stable complexes when certain aryl methane dyes are added. All species of mycobacterium have ropelike structures of peptidoglycane that are arranged in such a way to give them properties of acid fast bacteria (Uhia et al., 2011).

ETIOLOGY OF CAMEL TUBERCULOSIS

The causative agents of TB in dromedaries are broadly classified as typical and atypical. The two most common Mycobacteria causing TB in camels are M. bovis and M. tuberculosis. Some of atypical Mycobacteria rarely causing TB in camels are M. kansassi, M. aquae, M. aquae var. ureolyticum, M. microti, M. fortuitum and M. smegmatis. The atypical spcies of Mycobacvterium cause disease in camel when it becomes immunocompromised (Elmos-Salami et al., 1971 cited from Seifert, 1992, and Osman, 1974 as cited in (Allen et al., 1992).

Natural and experimental infections of TB have also been reported in the new world Camelids (Llamas) (Catsagnino Rosso et al., 1974 as cited in Kinne et al., 2006).The four major Mycobacteria, M. bovis, M. tuberculosis, M. avium and M. avium supsp paratuberculosis have been isolated from new world Camelids as well as some atypical Mycobacteria(M. kansassi and M. microti). Barolow and colleagues (1999) found tuberculosis in small llama herd near the border of England and Wales. The authors showed that M. bovis isolated from the llama was the same type as isolated from cattle and badgers of the area. In addition M. tuberculosis has been isolated in Bacterian camels in Russia (Kogramanov et al., 1977 as cited in Kinne et al., 2006).

EPIDEMIOLOGY OF CAMEL TUBERCULOSIS

There is little published information on the epidemiology of TB specifically relating to Camelids. After the first description of Tb in OWCs by Littlewood (1888), in the Egyptian Official Gazette in 1888, only sporadic reports were documented until Mason, in 1912, published his pathological observations on a series of 20 cases detected during a year's surveillance at Cairo abattoir. In 1987, Mustafa (Mustafa I.E. (1987 et al, 26) mentioned in a brief review that disease was more commonly observed in farmed camels and those in close proximity to cattle but appeared to be rare among nomadic camels, suggesting that close contact facilitates transmission between domesticated animals. In 1991, Abdurrahman and Bornstein (1991 (1) reported the disease to be relatively rare in Somalia, a country which at that time had one of the largest populations of OWCs in the world. (Teka et al., 1991(35). A recent study in Ethiopian abattoirs has suggested a prevalence of 10%, based on the identification of gross lesions in 906 apparently healthy camels (Mamo et al., 2011 (21).

Geographical Distribution of Camel Tuberculosis

Tuberculosis has been found worldwide. European Countries as well as the United States, Canada, Japan, and New Zealand reported a prevalence of bovine infection lower than 0.1%. A few countries including Australia, Denmark, Sweden, Norway, and Finland are considered to be free of bovine tuberculosis. However the disease is endemic in all most all countries of Africa. A large scale skin test in Uganda showed a BTB prevalence of 6% in cattle (Bernard et al., 2005). Furthermore 19 out of 61 abattoirs lesions (31%) were confirmed as being M. bovis (Oloya et al., 2007) and also 17% prevalence of BTB in Chadian livestock found to using the PPD tuberculin test (Schelling et al., 2000). In Ghana, an individual skin test prevalence of 13.8% was reported (Bonsu et al., 2000). In Sudan, 39.9% of abattoir lesions

are confirmed as M. bovis (Suleiman and Hamid, 2002). M. bovis isolated in livestock other than cattle. BTB reported in sheep in Sudan and Camels (Camelus dromedaries) in Mauritania (Chartier et al., 1991).

In Ethiopia, several prevalence studies have been conducted recently show that BTB is endemic in cattle; however, prevalence vary depending on the geographical areas, breeds and husbandry practices. Abattoir and dairy farm studies from central Ethiopia have reported prevalence between 3.5 and 13.5% and locally in peri-urban Addis Ababa up to 50% (A Regassa et al., 2010). Other livestock than cattle have also been investigated. Based on gross pathology, prevalence of 5–10% was reported in camels slaughtered at Dire Dawa abattoir in eastern Ethiopia and in Addis Ababa abattoir (Mamo et al., 2011). Hiko and Agga (2011) reported a 4.2% prevalence of bTB in goats slaughtered at the Mojo export abattoir in central Ethiopia. The observed variability of bTB disease frequency in Ethiopia might well be influenced by different livestock production systems (rural/pastoral/peri-urban) and different geographic and climatic contexts. Transmission of bTB seems to be higher in intensive peri-urban settings when compared to extensive rural and pastoral areas. Hence, a detailed understanding of BTB transmission requires field studies in a given social and ecological context.

Most of these studies focused on prevalence in cattle in the central highlands of Ethiopia. However, little data on human and animal TB is available from the major pastoralist areas in South-East Ethiopia, particularly from the Somali Region, which are often difficult to access also due to insecurity. Few studies have been conducted in southern Ethiopia. The abattoir bTB prevalence of Borana pastoralist cattle was 4% (Demelash et al., 2009), individual comparative intradermal tuberculin test prevalences were 0.8% in cattle of Hammer pastoralists in South Omo (Tschopp et al., 2010b) and 4.4% among Guji-Boran pastoralist cattle (Gumi et al., 2011). It appears that the prevalence of bTB in pastoral areas of Southern Ethiopia is relatively low. However, since pastoralists live in close proximity with their animals, animal-to-human transmission of bTB might still be significant. The potential of transmission of zoonotic TB in South-East Ethiopia was unknown. The objectives of this study were first to assess the presence of M. bovis among human TB patients and to describe Mycobacterial strains circulating in South-East Ethiopian pastoralists and their livestock using a “One health” approach, studying human and livestock hosts simultaneously (Zinsstag et al., 2009). Second, data from this study should then be compared with the overall epidemiological situation in Ethiopia.

SOURCE OF INFECTION AND TRANSMISSION

Camel under nomadic environment

Although TB is rare in camels under nomadic environment; they can contract the infection by different mechanisms. Some of the animals can acquire the infection when they come in contact with infected animals (camels or cattle).There is also other way to acquire the disease; for instance in the areas where dromedaries roam freely in the desert during day and return to their comps in evening; they can easily have contact with excretions of desert gazelles from which they contracted the infection. Several authors have reported tuberculosis in gazelles of the Arabian Peninsula (Ostrowski et al; 1998). It is also worthy of mention that dromedaries are coprophagus animals and this habit can expose them to the infectious agents.

Camel under intensive management system

There are different modes of spread of tuberculosis between Camelid herds under intensive management system. This is mainly occurred when infected animal is introduced into non infected herd (Bush et al; 1990). Animal with pulmonary lesions will excrete the organisms in exhaled air that can act as source of infection in those non-infected animals (Windser; 1999). Wernery described TB cases in dromedary in United Arab Emirates under intensive management system with typical lesion in both lungs and isolated M.bovis from the lesions (Wernery et al., 2007).

Susceptible host range and role of reservoirs

M. bovis has the widest host ranges of all pathogens (Coloston, 1996) with a complex epidemiological pattern which involves interactions of infections among human beings, wild and domestic animals, but cattle are within the most frequent affected animals. An extensive range of mammals including various domesticated and feral hoofed animals, and wide variety animals, primates, and a wide variety of exotic species both of captive and free living have been implicated (Theon et al., 1995). In Northern America, the bison herds (Bison bison) have long been known to maintain M. bovis, and with elk (Cervus Canadensis).They provide an important reservoir in certain extensive range of conditions. In New Zealand, the brush tail possum (Trichosuron Vulpecula), and in England and Republic of Ireland, the badgers (Meles meles), are implicated as significant reservoirs. In Africa, a reservoirs of M. bovis is known to exist in Cape buffalo (Syncerus caffert, Lewchwe), the Cape kudu (Strep sicercus species) and Cape duiker (Sylvica prospecies) (Pritchard, 1998).

RISK FACTORS

Animal risk factor

The host risk factor: all species including human beings, body conditions, sex and age groups are susceptible to M. bovis (Mamo et al., 2011). The occurrences of TB lesions in camels were relatively higher in the younger and older camels than other age groups. Other researchers have also reported in cattle particularly that older animals are affected by TB (Munyeme et al., 2008) which could be due to the fact that older animals have weaker immune system. The higher frequency of lesion in younger camels could be due to the less developed immunity (Menzies et al., 2000). Young camels can also be easily infected with higher doses of Mycobacteria via colostrums from infected camel in a similar way, as it occurs in cattle (Phillips et al., 2003 (29)). In connection with this, another report mentioned of vertical transmission of M. bovis from an infected dam to her calf through congenital infection in utero (Ozyigit et al., 2007(30)). It was observed that lesion was more frequently observed in female camels as compared to male camels. This could be due to the fact that female camels were brought for slaughter at their older age after completion of the reproductive age (Munyeme et al., 2008).

Pathogen risk factor

Also the pathogen risk factor: the causative organism is moderately resistant to heat, desiccation and many disinfectants; the virulence of M. bovis relates to its ability to survive and multiply in host macrophages (Quinn and Markey, 2003).

Environmental risk factor

The environmental risk factor includes housing, sharing the same shelter with humans and the stocking intensity of animals. (Quinn and Markey, 2003).

Global status of camel Tuberculosis

In the study conducted on 874 Bacterian camels in Russia they were 107 cases of tuberculosis resulting in 12.2% incidence rate, but only 68% of the camel with tuberculosis had positive tuberculin reaction. M. bovis strain was isolated from 46 pooled milk sample positive tuberculin reaction. M. bovis strains were isolated from 46 pooled milk samples from 712 lactating camel cows (kinne et al., 2006). Recently Wernery, (2006) described TB cases in dromedary in United Arab Emirates with typical lesion in both lungs. The outbreak in 58 camels of which 3 are infected with tuberculosis. The disease was confirmed at necropsy by finding gross lesion from M. bovis was isolated. Wernery, (2006) described TB cases in

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Status of camel Tuberculosis in Ethiopia

In general, there is scanty information on TB in camels. Nonetheless, there are few reports published on camel TB in Ethiopia as well as in other countries. The prevalence of camel TB currently recorded at Akaka and Metehara abattoirs was 10.04% (91/906) on the basis of pathology and it was significantly higher in females .The tropism of TB lesions was significantly different among the lymph nodes and lung lobes. Mycobacterium growth was observed in 34% (31/91) of camels with grossly suspicious TB lesions (Hussein, 2009).

A total of 276 dromedary camels slaughtered at Dire Dawa abattoir were examined for the presence of gross tuberculosis lesions and further cultured to isolate Mycobacterium bovis. Of the 276 camels examined 14 (5.07%) were positive in postmortem examination. From these 14 samples 4 confirmed the growth of Mycobacteria on pyruvate-enriched Lowenstein-Jensen medium indicating the presence of M. bovis. In relation to distribution of the tuberculosis lesions in body organs, 40% of the TB lesions were localized in the lungs, 38% in the mesenteric lymph nodes, 12.5% in mediastinal lymph nodes and 8.33% in retropharyngeal lymph nodes (Mamo et al., 2009). The occurrences of TB lesions in camels were relatively higher in the younger and older camels than other age groups. Other researchers have also reported in cattle particularly that older animals are affected by TB (Inangolet et al., 2008), which could be due to the fact that older animals have weaker immune system. The higher frequency of lesion in younger camels could be due to the less developed immunity (Menzies and Neill, 2000). Young camels can also be easily infected with higher doses of Mycobacterium via colostrums from infected camel in a similar way, as it occurs in cattle (Phillips et al., 2003). In connection with this, another report mentioned of vertical transmission of M. bovis from an infected dam to her calf through congenital infection in uterus (Ozyigit et al., 2007). It was observed that lesion was more frequently observed in female camels as compared to male camels. This could be due to the fact that female camels were brought for slaughter at their older age after completion of the reproductive age (Inangolet et al., 2008). The distribution, frequency, and severity of lesions recorded in different tissues of camels were similar with the reports of similar studies in grazing cattle in Ethiopia (Ameni et al., 2010). In these studies, the frequency and severity of

the lesions were higher in the mesenteric lymph nodes than the thoracic lymph nodes (Corner, 1994). Tuberculous lesions were subjected to bacteriological culture so as to identify and characterize the causative agents. However, culture positivity of suspicious tissues was 34%, which is lower than what have been reported previously from cattle (Ameni et al., 2010). The lower culture positivity might be related to the non-optimal condition of the culture for NTM which assumed to be the major isolates causing pathology in camel. Regarding culture positivity of each organ, the highest culture positivity was recorded in the retropharyngeal lymph node followed by mesenteric lymph node, which could suggest that oral route could be the main route of infection. In contrast, other authors have reported that culture positivity was higher in lung tissue and thoracic lymph nodes than in the head and mesenteric lymph nodes (Corner, 1994).

Table-1: Prevalence of Camel TB in Camels originating from six different sites bordering Dire Dawa city.

Origin	PM examination results		Total № of animal examined
	Positive n (%)	Negative n (%)	
Shinile	3(3.1)	156(97)	159
Lega Oda	10(10.4)	86(89.6)	96
Erer	7(13.4)	47(90.3)	54
Beshan Bahe	5(17.8)	23(82.1)	28
Mermersa	3(15.7)	16(84.2)	19
Dujuma	2(13.3)	13(86.6)	15
Unknown	3	24	27
Total	33	365(90.4)	398

Source

(Ashenafi et al., 2007/2008)

PUBLIC HEALTH IMPLICATION OF CAMEL TUBERCULOSIS

Human population encounters animal disease with varying frequency depending on their occupation, geographical location and the prevailing culture of the country. Weather living in urban or rural environment, animals constantly may have close contact with human on farm (food producing animals), at area of residence (dogs, cats, cage birds), through leisure activities (horse, wild life) or by virtue of the occupation of individual as veterinarians or animal nurses. This close contact can result in the occurrence and transmission of zoonotic disease, which is naturally transmitted between vertebral animal and man. Zoonotic tuberculosis is an infectious disease of domestic animals that can be transmitted from animal

to human through consumption of raw milk and meat from infected animals and directly through aerogenous route (Quinn et al., 1994).

According to Kleebebrg (1984), tubercle bacilli has been found in milk product such as yogurt and cheese made from non-pasteurized milk 14 days after processing and in butter as long as 100 days after processing. Tuberculosis as a Zoonosis plays an important role among nomadic people where milk and milk products are consumed in raw state. This is true for camel milk as M. bovis strain isolated from 46 pooled milk sample from 712 lactating camel in Russia. Other than uncooked, circus and zoo camels with active disease also present a danger to humans (kinne et al., 2006). Animals with pulmonary lesion will excrete the organism in exhaled air in the sputum in the faces, which can be a potential source of human infection through aerogenous route (Windson, 1999).Aerosol transmission may also occur as professional hazard in agriculture and workers as well as to buchers man, which may develop typical pulmonary tuberculosis. The incidence of pulmonary tuberculosis caused by M. bovis in man is significant in occupational groups in contact with infected animals or their carcass particularly in countries where animals kept in barns. The close contact between the owners and their animal could facilitate the transmission of the disease to man (Kleebebrg, 1984).

Ethiopia ranks seventh among the world's 22 countries with high tuberculosis (TB) disease burden and had an estimated incidence rate of 379 cases per 100,000 people per year. TB caused by M. bovis is clinically indistinguishable from TB caused by M. tuberculosis and can only be differentiated by laboratory methods (Cosivi et al., 1998). Specific data on zoonotic BTB transmission is very scarce in the developing world because the diagnosis of TB most often relays on sputum microscopy only. However, fairly recent molecular methods like spoligotyping and deletion typing allow for identification of M. bovis (Brosch et al., 2002). Although cattle are considered to be the main hosts of M. bovis, isolations have been made from many other livestock and wildlife species and transmission to humans constitutes a public health problem. In many developing countries, BTB remains endemic causing significant economic losses (Ayele et al., 2004). At Dire Dawa abattoir in eastern Ethiopia and in Addis Ababa abattoir (Mamo et al., 2011), the proportion of bTB in human TB is estimated to be less than 5% worldwide .But this figure is based on estimates and we lack empirical representative data on the proportion of human M. bovis among all TB patients at national level. This information would be important for the estimation of the societal cost of BTB (Michel et al., 2010). In Ethiopia, several prevalence studies have been performed

recently that show that BTB is endemic in cattle; however, prevalence vary depending on the geographical areas, breeds and husbandry practices. Abattoir and dairy farm studies from central Ethiopia have reported prevalence between 3.5 and 13.5% and locally in peri-urban Addis Ababa up to 50% (Regassa et al., 2010). In contrast, lower prevalence of 0.9% was reported in traditionally kept zebu cattle (Tschopp et al., 2010). Most of these studies focused on prevalence in cattle in the central highlands of Ethiopia. However, little data on human and animal TB is available from the major pastoralist areas in South-East Ethiopia, particularly from the Somali Region, which are often difficult to access also due to insecurity. Few studies have been conducted in southern Ethiopia. The abattoir BTB prevalence of Borana pastoralist cattle was 4% (Demelash et al., 2009), individual comparative intradermal tuberculin test prevalences were 0.8% in cattle of Hammer pastoralists in South Omo and 4.4% among Guji-Boran pastoralist cattle. It appears that the prevalence of BTB in pastoral areas of Southern Ethiopia is relatively low. However, since pastoralists live in close proximity with their animals, animal-to-human transmission of BTB might still be significant (Gumi et al., 2011). In general camel tuberculosis similar to bovine tuberculosis results a serious zoonotic impact especially in nomadic population where consumption of raw camel milk and animal products remain the common practice. Based on gross pathology, prevalence's of 5–10% were reported in camels' slaughtered (Mamo et al., 2011). The risk of being infected through aerogenous route is assumed to be high as there is a close association with camels since the livelihood of the over whelming nomadic population depend on camel especially in countries like Ethiopia. Camels in some countries (UAE) are no longer kept under nomadic management system and hence the risk zoonotic tuberculosis is increasing in those camels kept under intensive system of management (Wernery et al., 2002). According to WHO report of (1993), the following factors can affect the zoonotic aspects of M.bovis in Africa. The close physical contact between humans and potentially infected animals. The habit of consumption of raw milk, which is widely practiced. The increasing incidence of HIV infection which is closely linked with tuberculosis.

PATHOGENESIS

The extent and size of camel tuberculosis lesions vary. Lesions are found in the lung, liver, various organs, lymph nodes and skin but are rarely seen in muscles (Dungworth, 1985). Tuberculosis spreads in the body by two stages, the primary complex and post primary dissemination.The primary complex consists of the lesions at point of entry and in the local lymph nodes. A lesion at the point of entry (mainly ion respiratory tissue) is common when

infection is by inhalation. When infection occurs via the alimentary tract, a lesion at cite of is unusual although tonsillar and intestinal ulcers may occur. More commonly the only observable lesion is the pharyngeal or mesenteric lymph nodes. A visible primary focus develops within 8 days of entry being affected by the bacteria. Calcification of the lesions commences about two weeks later. The developing necrotic focus is soon surrounded by granulomatous tissue and lymphocytes and the pathognomonic tubercle or granuloma is established. The bacteria pass from this primary focus, which is the respiratory tract in 90-95% of the cases to regional lymph nodes and cause the development of similar lesions there (Radsstits et al., 1994).Post primary dissemination from the primary complex may take the form of acute military tuberculosis, discrete nodular lesions in various organs, or chronic organ tuberculosis caused by endogenous or exogenous re-infection of tissue rendered allergic to PPD (Radosstitis et al., 1994).

PREVENTION AND CONTROL

M. bovis is difficult to control because of the large number of susceptible species, the variation in pathogenesis, and the limited effectiveness of currently available method for wild animals. Effective control requires an understanding of epidemiology of infection within the ecological system that can include domestic as well as wild animal species (Cousins, 2001).

Test and slaughter policy

The test and slaughter policy is the only one assuring of eradicating TB and relies on the slaughter policy of reactors to the tuberculin test. In affected herd, testing every three months is recommended to rid the herd of individuals that can disseminate infection (Aiello et al., 1998).

Hygienic measures

Routine hygienic measures aimed at cleaning and disinfection of contaminated premises, food and water troughs are useful. Cattle under poor management were more likely to develop tuberculosis than cattle under good management system (Aiello et al., 1998; Kiros 1998). Feed troughs should be cleaned and thoroughly disinfected with hot 5% phenol or equivalent cresol as phenols (2-5%), hypochlorites (1-5%), alcohol (usually 70% ethanol), formaldehydes and iodophores (3-5%), and glutaraldehyde (WHO, 1998).

Vaccination

Vaccination against camel tuberculosis is likely to become an important disease control strategy in developing countries, which cannot afford a test and slaughter control program, or in countries which have a wild life reservoir of M. bovis infection. In the past decade, considerable progress has been made in the development and evaluation of TB vaccine for cattle and for a range of wild life maintenance hosts. Prospects for the development of improved vaccines against BTB are promising and vaccination approaches should become very valuable in control and eradication of BTB (Edelsten, 1999).

CONCLUSION AND RECOMMENDATIONS

Studies, which have been conducted in different regions of the world indicated clearly that the disease has significant effect both in animals and humans in areas where control of the disease is not implemented and consumption of uncooked products of camel is adopted. Nomadic people who are closely tied with rearing of camels are at risk of being infected with zoonotic disease such as camel tuberculosis. Moreover, the zoonotic significance of the disease is increasing where camels are managed under intensive systems that fever the transmission of agents to humans through aerogenous route. In Ethiopia, the status of the disease is not known and people have little or no awareness on the potential risk of the disease as zoonosis. In addition to contracting the infection by consumption of raw infected camel milk, people having close association with infected animals have high probability of being acquiring the infection.

Based on the above conclusive remarks, the following recommendations are forwarded:

- In countries such as Ethiopia where camel tuberculosis is not well-studied priority should be given towards researches that help in understanding of its epidemiological status so as to design a control strategy.
- Educating peoples in camel rearing areas about the zoonotic impact of camel TB should be initiated to reduce the risk of transmission and infection of humans by M. bovis.
- In areas where camels are kept under intensive management system for circus or racing activities, close and regular monitoring of camel TB in the herds should be practiced to reduce the potential source of infection from infected camels to human.

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