KNOWLEDGE, ATTITUDES AND PRACTICES OF WOMEN ON LOCAL CONTROL MEASURES FOR BRUCELLOSIS IN KILOSA DISTRICT, MOROGORO - TANZANIA

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A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN PUBLIC HEALTH AND FOOD SAFETY OF SOKOINE UNIVERSITY OF AGRICULTURE. MOROGORO, TANZANIA.

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ABSTRACT

Women's major responsibilities in agricultural and family welfare increase their roles in transmission of diseases hence making them vulnerable to many diseases including zoonoses. Knowing appropriate local control measures to control brucellosis would help improve disease situation at family level and communities in general. This cross sectional study, conducted from November 2013 to September 2014 at Kilosa District, aimed at assessing women's knowledge, attitudes and practices towards control of brucellosis. A total of 260 respondents were interviewed and five focus group discussions were conducted. In women's perspective, zoonotic diseases identified were bovine tuberculosis, Foot and Mouth disease, brucellosis and Anthrax. Majority of women had poor knowledge on the identified zoonoses and very few 37% and 1% had fair knowledge of bovine tuberculosis and Foot and Mouth Disease respectively. Risk behaviors that were known to drive brucellosis transmission are consumption of raw animal products, direct contact with animals and animal products especially blood, aborted fetuses and after birth materials, and movement of animals in large groups. The local measure for controlling brucellosis was boiling of milk (though its effectiveness was below 50%). To control other diseases, they lower the temperature of milk by keeping it in gourds with a smoke of *Msisiri* tree; lower the p^H by fermenting milk; treat infected animals with several antibiotics and practicing personal hygiene by washing hands with water and soap immediately after touching animals and animal secretions. For repeated fever (Undulant fever) they drink animal fats made from milk or meat. Local control measures such as proper boiling of milk, thorough cooking of meat and proper handling of animals, their products and by-products should be adopted to reduce transmission of brucellosis from animals to humans. The community should be educated on brucellosis to enhance control of the disease.

DECLARATION

I, Witness Bashaka, do hereby declare to the Senate of Sokoine University of Agriculture that, the research work reported in this dissertation is my own original work done within the period of registration and it has neither been nor being concurrently submitted for any other institution.

Witness Bashaka (MSc. PH & FS candidate)	Date

The declaration above is confirmed by

Prof. Rudovic R. Kazwala (Supervisor)	Date
Dr. Helena Ngowi (Supervisor)	Date

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This work is dedicated to my parents, my husband and my lovely daughter. I love you all.

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LIST ABREVIATIONS AND SYMBOLS

CI	Confidence interval
CO_2	Carbondioxide
DALYs	Disability Adjusted Life Years
DNA	Deoxyribonucleic acid
et al	and others
FAO	Food and Agriculture Organization of the United Nations
FDG	Focus Group Discussion
FMD	Foot and Mouth Disease
GPS	Global Positioning System
ICONZ	Integrated Control of Neglected Zoonoses
KAP	Knowledge Attitude and Practice
NBS	National Bureau of Statistics
OIE	Office International des Epizooties
OR	Odds Ratio
PCR	Polymerase Chain Reaction
pH	Hydrogen ion concentration
spp	Species
SUA	Sokoine University of Agriculture
USA	United States of America
WHO	World Health Organization
YLDs	Years of Life lived with Disability
YLLs	Years of Life Lost

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

Brucellosis is a bacterial zoonotic disease which causes serious public health concerns and economic losses to communities (Araj, 2010; Matope *et al.,* 2010). Brucellosis is the collective name used for the animal and human infections caused by several species of the genus *Brucella. Brucella* species are small, facultative, intracellular Gram-negative coccobacilli that lack capsules, flagellae, endospores or native plasmids (Alton *et al.,* 1988; Bret *et al*., 2008).

Brucellosis is worldwide distributed and afflicts people's economy and health in many geographical regions (Araj, 2010; Lopes *et al*., 2010; Matope *et al.,* 2010; Mukhtar, 2010). Pappas *et al.* (2006) in the new global map of human brucellosis pointed out the most affected regions worldwide to be Texas, California, Mexico, the Mediterranean basin and several Middle Eastern and Asian states, such as Syria, Turkey, Iraq, Afghanistan, parts of Oman, Saudi Arabia and Mongolia. Brucellosis also exists throughout sub-Saharan African countries (Pappas *et al.,* 2006; WHO, 2006). Countries reported by OIE with brucellosis cases are Mali, Burkina Faso, Ghana, Togo, Nigeria, Cameroon, Republic of Congo, Chad, Eritrea, Ethiopia, Namibia and Swaziland (McDermott and Arimi, 2002; OIE, 2003; OIE, 2004; Pappas *et al*., 2006). Some East African countries like Tanzania, Kenya and Uganda were also reported to have brucellosis (OIE, 2003; OIE, 2004).

Brucellosis in Tanzania was first reported in 1927 when an outbreak of abortion in cows was reported in Arusha region (Shirima, 2005). Since then, many surveys have been conducted especially in cattle showing disease seroprevalance with varying range.

Majority of these studies were often conducted purposely in parastatal farms and in indigenous traditional cattle herds (Swai and Schoonman, 2010). The prevalence of 1.0-30.0% were reported in Northern zone (Shirima, 2005; Swai *et al.,* 2005; Kunda *et al.,* 2010); 12.0-14.0% in Eastern zone (Weinhaup *et al.,* 2000); 2.0-90.5% in Coastal zone (Minga and Balemba, 1990; Weinhaup *et al.,* 2000); 4.0-22.5% in Lake zone (Msanga *et al.,* 1986); 15.2% in Southern zone (Otaru, 1985) and 2.0-10.6% in Central zone (Kitaly, 1984). Recent studies conducted in Morogoro region reported the prevalence of the disease in animals being 14.3%, 0.5%, 0.6% and 13.6% in cattle, goats, sheep and buffaloes respectively (Temba, 2012), whereas human brucellosis in Morogoro was 21.0% (James, 2013).

Humans acquire infection mainly through consumption of unpasteurized animal products such as milk, cheese, butter and raw meat (Alsubaie *et al.,* 2005; Sofian *et al.,* 2008; Julio *et al.,* 2011); and direct contact with infected animals and their secretions or carcasses (Mishal *et al.,* 1999; Refai, 2002; Alsubaie *et al.,* 2005; Fatima Mukhtar, 2010).

Conventional control measures of brucellosis are vaccination (Schurig *et al.,* 2002), slaughtering the infected animals (Minas *et al.,* 2006), stamping out and control of movements. However these methods are difficult to conduct in most developing countries (McDermott and Arimi, 2002) and therefore local control measures should be adopted.
Women play an important role in caring for families where they prepare food, and they are the primary carers of family members including educating the family, identifying illness in the family and seeking care; therefore, they can act as instrumental persons in implementing local control measures due to their roles in families and communities. This study focused on assessing women's knowledge, attitudes and practices on local control measures for brucellosis at Kilosa District where high brucellosis rate has been observed.

1.2 Problem Statement and Justification of the study

Brucellosis as a contagious zoonotic disease, has been reported in different regions of Tanzania with varying prevalence (Swai and Schoonman, 2010). Kilosa District is among the districts of Morogoro region with wildlife, domestic animals and human interactions as it is situated along Mikumi-Selous wildlife ecosystem where high prevalence of brucellosis has been observed (Temba, 2012 ; James, 2013). However studies conducted at Kilosa District by Sokoine University of Agriculture Students (SUA) in collaboration with Integrated Control of Neglected Zoonosis (ICONZ) project found high brucellosis prevalence to be attributed to several factors such as consumption of raw or undercooked animal products example milk and meat, consumption of blood as traditional feature and direct contact with animals (Temba, 2012; James, 2013).

Traditionally, women's roles are caring for families where they prepare food (milk, cheese, butter, meat dishes) and they are the primary carers of family members including educating the family, identifying illness and seeking care. This makes women among the risk groups for brucellosis infection.

Though several studies have been conducted in Tanzania concerning this zoonotic disease, none have been done on knowledge, attitudes and practices of farmers including women as well as local control measures adapted to control the disease.

Knowing the role of women in the community, this study provides information on women's knowledge and attitudes toward the disease, practices influencing disease prevalence and potential contributions from women on control measures of brucellosis in the area that may guide planners in planning effective control measures taking into account women as key players in the success of control programmes.

1.3 Objectives of the study

1.3.1 Overall objective

To assess knowledge, attitudes and practices of women on local control measures for brucellosis in Kilosa District, Morogoro-Tanzania.

1.3.2 Specific objectives

i. To assess women's knowledge on zoonoses in general.

ii. To assess women's knowledge, attitudes and practices in relation to brucellosis in Kilosa District.

iii. To identify local control measures undertaken by women to control brucellosis and assess their effectiveness.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Definition of brucellosis

Brucellosis is the collective name used for the animal and human infections caused by several species of the genus *Brucella.* Historically several names have been used to describe the disease in human (Gibraltar fever, Cyprus fever, Napolitan fever, intermittent typhoid fever, typho-malarial fever, undulant fever, Mediterranean fever, and Malta fever) (Raquel Conde Alvarez, 2013; personal communication) while in animals the disease is named as contagious abortion, abortus fever and epizootic abortion. David Bruce, a military medic first isolated the microorganism from the spleen of dead serviceman in 1887 but the infection could not be traced to human-to-human transmission despite intensive research (Graig, 1903; Wyatt, 2000). The reservoir continued to be a mystery until Zammit and Horrock found the connection with goat milk in 1894, and demonstrated the infection in apparently healthy goats in 1905 (Wyatt, 2010).

Brucellosis is one of the most widespread zoonoses in the world, and is responsible for devastating, economic losses and significant public health problems (Basilkovski *et al.,* 2009). Although there has been great progress in eradicating the disease in many countries there still remain regions where the infection persists in domestic animals and consequently transmitted to human population (WHO, 2006). Brucellosis is a disease of domesticated animals mainly sheep, goats, cattle, pigs, dogs, wildlife animals and humans as accidental hosts (WHO, 2006).

2.2 Aetiology

Brucellosis is a disease caused by members of the genus *Brucella*, a facultative intracellular bacterium, affecting many animal species including humans (Hesterberg *et*

al., 2008). *Brucella* species are small, facultative intracellular Gram-negative coccobacilli, non-motile, non-sporulating, non-toxigenic, non-fermenting, aerobic microorganisms that may base on DNA morphology (Doganay and Aygen, 2003; Bret *et al*., 2008). They do not grow well on media commonly used in microbiology laboratories, and growth is best on trypticase soy agar, *Brucella* agar or serum dextrose agar at 37%, especially if abiphasic culture system is used. B. *abortus* and B. *suis* require supplementary CO_2 for growth, especially for primary isolation. This conventional culture method requires prolonged incubation (up to 3 weeks) and the use of blind subcultures (Doganay and Aygen, 2003).

Currently, six terrestrial and three marine *Brucella* species have been recognized: *B. melitensis* (preferred hosts for goats, sheep, camels), *B. abortus* (cattle, buffalo), *B. suis* (swine and a range of wild animals), *B. canis* (dogs), *B. ovis* (sheep), *B. neotomae* (desert and wood rats) and *B. delphini*, *B. pinnipediae* and *B. cetaceae* from marine mammals (e.g. seals, whales, dolphins) (WHO, 2006; Xavier *et al.,* 2010). Species reported to cause infections to humans are *B. melitensis*, *B. abortus, B. suis* and *B. canis* (Foster *et al.,* 2007; Whatmore, 2009); as well as the three marine spp (WHO, 2006; Xavier*et al.,* 2010; Elschner *et al*., 2012). *B. ovis* and *B. neotomae* have never been reported to cause disease to human beings (WHO, 2006).

Brucellosis caused by *B. melitensis* remains one of the most common zoonotic diseases worldwide because of its pathogenicity (WHO, 2006; Coelho *et al.,* 2007; Seleem *et al.,* 2010; Julio *et al.,* 2011); and it is the most important causal disease in humans and is the one usually associated with occupational exposure or consumption of poorly prepared dairy products, followed by infection with *B. abortus* and *B. suis* (Kunda *et al.,* 2007). *B. ovis* and *B. neotomae* have never been reported to cause disease to human being however

Brucella spp associated with marine animals have been reported to cause disease in humans (WHO, 2006; Xavier*et al.,* 2010; Elschner *et al*., 2012).

2.3 Transmission of Brucellosis

2.3.1 Animals

Brucellosis being a contagious zoonotic disease, its transmission occurs as a result of direct contact between animals and other sources of infection within and between herds (Karimuribo *et al.,* 2007). Bacteria are excreted with the foetus, placenta and the uterine fluid and therefore animals can acquire infection through ingestion of contaminated pasture, water and feeds, licking infected placenta, young stock, foeti or genitalia of infected animals soon after abortion or normal delivery (Mangen *et al.,* 2002; Shirima, 2005). After abortion or parturition, organisms also continue to be excreted mainly in the milk of infected cows initiating the disease to calves (Mangen *et al.,* 2002). Artificial insemination and sexual contact with infected bulls can also transmit infection to cows at the time of service (Lim *et al.,* 2005; Temba, 2012). Brucellosis transmission in animals is facilitated by the presence of infected animals in the surrounding area, hence movements with infected animals leads to disease persistence and sometimes outbreaks. *Brucella melitensis* is a major human and animal pathogen with a wider host range that includes all domestic ruminant species (Refai, 2002; Julio *et al.,* 2011); therefore having infected sheep and goat flocks in the area can transmit the disease to other animals as well as humans.

2.3.2 Humans

Human acquire infection through consumption of unpasteurized milk and other dairy products in the form of meat, milk, cheese and butter (Alsubaie *et al.,* 2005; Sofian *et al.,* 2008; Julio *et al.,* 2011). Also direct contact with infected animals, their secretions or

carcasses may lead to infection through inhalation or accidental skin and mucous membrane penetration leading to disease revelation among different occupational groups such as veterinarians involved in calf deliveries who have contact with blood and placenta of infected animal (Mishal *et al.,* 1999; Lim *et al.,* 2005); laboratory workers (Staszkiewicz *et al.,* 1991; Refai, 2002; Roushan *et al.,* 2004); slaughter house, butchers, abattoir workers and meat inspectors, meat packing and dairy processing industries through cuts and wounds, splashing of infected fluids in the conjuctiva and inhalation of aerosols in their working areas (Alsubaie *et al.,* 2005; Fatima Mukhtar, 2010).

Farmers especially of rural areas are also known to be at a greater risk due to ways they handle their animals. Most farmers touch infected animals, aborted materials, placenta and other dangerous materials after abortion or normal delivery directly without preventive equipment (Refai, 2002). Brucellosis transmission through sexual intercourse between patients was also reported in Gyeongsangbuk-do (Lim *et al*., 2005). Blood transfusion, tissue transplantation and bone marrow transfer can also initiate the disease to a person (Akcakus *et al.,* 2005; WHO, 2006). Infection through breast milk (Tikare *et al.,* 2008) and having an infected household member in the family (Almuneef *et al.,* 2004; Sofian *et al.,* 2008; Earhart *et al.,* 2009) are other transmission routes, although person-to-person transmission is extremely rare. Brucellosis is also transmitted by travellers and immigrants who move from endemic to brucellosis free areas (Pappas *et al*., 2006).

2.4 Clinical Manifestation

2.4.1 Animal

Once the animal is infected with the disease, the infection usually establishes itself in the reproductive tract and typically produces placentitis followed by abortion in pregnant animal usually during the last third of pregnancy and epididymitis and orchitis in the male

animals (WHO, 2006). Apart from abortion, infertility, retention of placenta, stillbirth or birth of weak offspring may occur (Karimuribo *et al*., 2007). In some parts of Africa, hygromas and abscesses are the major clinical signs in nomadic or semi-normadic cattle herds infected with *B.abortus* biova 3. There is lower milk production due to premature births resulting to economic losses (Mangen *et al*., 2002; WHO, 2006).

The udder is often permanently infected, especially in the case of cows and goats. Shedding of organisms in milk is frequent. Localized infections in sheep result in orchitis or epididymitis in case of *B. melitensis* and *B.ovis.* Arthritis may also be a rare sign in *B. melitensis* infected sheep and goats. In horses, local abscess formation in bursae may be the only clinical sign and infection in this species is often asymptomatic. Clinical signs in camels appear to be very rare, but camels infected with *B. melitensis* shed the organisms in milk and in some countries this is a serious public health problem (WHO, 2006).

2.4.2 Human

The clinical features of brucellosis depend on the stage of the disease and organs or systems involved; and may range from acute to chronic state (Doganay and Aygen, 2003). Human brucellosis is disreputably a multisystem disease with diverse manifestations and the onset may either be acute or insidious (McDermott and Arimi, 2002; Cetinkaya *et al.,* 2005). Brucellosis is a febrile disease capable of masquerading as a myriad of entities, both infectious and non-infectious. The disease has a tendency towards chronicity and persistence, becoming a granulomatous disease capable of affecting any organ or system. Clinical manifestations vary and are non-specific. Studies have shown that fever is the most common feature of brucellosis (Araj, 2010). Other features are fatigue, malaise, anorexia, weight loss, headache, joint pain, waist pain and backache (Mukhtar, 2010;

Kunda *et al.,* 2007; WHO, 2006). Although brucellosis in human beings is rarely fatal, it can be severely debilitating and disabling (Franco *et al.,* 2007; Kunda *et al.,* 2007).

2.5 Diagnosis of Brucellosis

2.5.1 Understanding clinical signs

Any disease has its clinical manifestation. Sick animals normally show certain abnormalities or clinical signs that farmers can notice (Radostits *et al.,* 2000). Farmers can use clinical signs such as abortion, retention of placenta, still birth or birth of weak offspring, infertility and milk drop to identify the disease in the area. People especially in rural areas live very close to their livestock (McDermott and Arimi, 2002), they identify diseases and mostly treat them by themselves. Therefore, it is important that farmers are educated on different diseases, and should be involved in several local intervention and control programs (Catley *et al.,* 2011).

In human diagnosis has been differently done because of multisystem involvement and overlapping clinical features; brucellosis has been poorly diagnosed as it is done based on features presented. Brucellosis is commonly diagnosed after failure to respond to malaria, typhoid or tuberculosis treatments (Kunda *et al.,* 2007).

2.5.2 Laboratory investigation

Diagnosis of brucellosis is confirmed by isolation and identification of the causative organisms (Kunda *et al.,* 2007). These can be isolated from blood, body tissues like retained placenta and aborted materials, body discharges and milk. Laboratory methods used in identification of brucellosis are microbiological tests (culture), *Brucella* serology tests and Molecular assays such as polymerase chain reaction (PCR) and real-time PCR) (WHO, 2006; Franco *et al.,* 2007; Kunda *et al*., 2007; Araj, 2010). Developments in

culture and serological methods, and the availability of advanced molecular detection and typing methods have contributed to improved laboratory diagnosis. These molecular methods serve as alternatives to culture methods for the confirmation of the disease and may also provide valuable epidemiological tools to trace sources of infection (Doganay and Aygen, 2003; Franco *et al.,* 2007).

Each of these tests has advantages and limitations, thus knowledge on advantages and limitations of each test is warranted for their appropriate application and interpretation (Araj, 2010).

2.6 Impact of Brucellosis

2.6.1 Animal health

Brucellosis is an important reproductive disease of livestock; the disease induces abortion or premature calving which can lead to temporary sterility, infertility, delayed heat, interrupted lactation, loss of calves and sometimes death from acute metritis (Renukaradhya *et al.,* 2002; Mangen *et al*., 2002; Karimuribo *et al.,* 2007). Due to its effects on multiple animal species and humans, the impact of brucellosis is considered great in sub-Saharan Africa; however valuing these impacts across species is complicated (McDermott and Arimi, 2002). Few studies like that of McDermott *et al.* (1987b) and Mangen with colleagues (2002) assessed the direct or indirect losses associated with brucellosis in livestock in sub-Saharan Africa. In infected populations it leads to losses due to abortion, diminished milk production, cull and condemnation of infected animals due to breeding failure (WHO, 2006).

2.6.2 Human health

The impact of brucellosis and other zoonoses affecting livestock production are considerably magnified by their consequences in humans as the global scale does not rank

brucellosis among the top diseases (McDermott and Arimi, 2002). Brucellosis cause direct (morbidity and mortality) and indirect losses (cost of ineffective control measures) Mangen *et al*., 2002; Franco *et al.,* 2007). Duration of illness and its long convalescence leads to weakness of the patient hence reducing his or her working capacity, also medical problems due to treatment costs may affect the livelihood of the affected family (WHO, 2006). To avoid the financial valuing human mortality and morbidity complications, the disability-adjusted life years (DALY) are applied (Murray and Lopez, 1996). This help assessing the impact of control programs on human brucellosis, cost-effectiveness analysis and ranking programs based on their costs.

DALY calculations combine two sources of burden: years of life lost (YLLs) and the years of life lived with disability (YLDs). For brucellosis, years of life lived with disability will be the major impact. Also, it is important to assess the costs to local health services, particularly because brucellosis is a chronic and relatively difficulty infection to treat (McDermott and Arimi, 2002).

2.6.3 Economically

From the economic point of view, the impact of brucellosis can be estimated, although data is lacking. Prices can be estimated for direct losses due to morbidity and mortality and indirect losses due to treatment costs (McDermott and Arimi, 2002). Estimates of costs associated with brucellosis infections remain limited to specific countries. Data suggest that worldwide economic losses due to brucellosis are extensive not only in animal production (reduced milk, abortion and delayed conception), but also in public health (cost of treatment and productivity loss) (Seleem *et al.,* 2010). For example, in Latin America the official estimates put annual losses due to bovine brucellosis at approximately $600 million. Although brucellosis eradication programs can be very expensive, they are estimated to save $7 for each $1 spent on eradication. In India, the output value from

livestock sector contributes about one fourth of the gross domestic product from the agricultural sector (Rs. 827 billion out of Rs. 3150 billion), therefore any fault such as disease occurring into their animals may have an impact on the economy of their country (Renukaradhya *et al.,* 2002; FAO, 2009).

Animal brucellosis also poses a barrier to trade of animals and animal products and this could extremely affect the socio-economic development of livestock owners, who represent vulnerable people in many rural populations (Benkirane, 2006). Livestock are critical resources for livelihood of the majority of Africans; they produce meat, milk, skin and nutrients for crops (manure) where farmers earn income, so brucellosis can be considered as a constraint to future trade. Indirect losses to brucellosis have not been estimated in sub-Saharan Africa and therefore key economic information is required for disease control decisions (McDermott and Arimi, 2002).

A study conducted by Roth with his colleagues analyzed the economic costs and benefits of brucellosis, their analysis combines both economic impacts in animals, DALY losses in humans and costs to the health system. Their work was excellent and their information was used to evaluate the benefits of different vaccination strategies under varying efficacy assumptions (Roth *et al.,* 2003). If this methodology was to be adopted to other countries, decision makers could get key information required for animal and public health policies in relation to brucellosis prevention or eradication.

2.7 Treatment

2.7.1 Animal brucellosis

The real treatment for animal brucellosis is not known, more emphasis is directed on control and prevention of the disease in animal population (Animal Health Australia, 2005). An attempt to use antibiotic such as oxytetracycline and penicillin causes L-

transformation on the cell wall creating carrier animals hence affecting future serological detection (Bishop *et al.,* 1994 cited by Temba, 2013).

2.7.2 Human brucellosis

The optimal treatment for brucellosis in human is a combination regimen using two antibiotics since monotherapies have been associated with high relapse rates (Seleem *et al.,* 2010). The WHO oral regimen consists of 200 mg doxycycline plus 600–900 mg rifampicin daily for a minimum of 6 weeks, and the alternate oral/parenteral scheme replaces rifampicin with 15 mg/kg streptomycin daily for the first 2–3 weeks of treatment. Although this regimen is based on results of many clinical and in-vitro studies, much debate remains regarding the ideal treatment (Franco *et al.,* 2007).

The combination of doxycycline with streptomycin (DS) is the best therapeutic option with less side effects and less relapses, especially in cases of acute and localized forms of brucellosis (Doganay and Aygen, 2003; Alp *et al.,* 2006; Seleem *et al.,* 2009). Although DS combinations had been considered by the WHO to be the standard therapy against brucellosis for years, the Joint FAO/ WHO Expert Committee on Brucellosis changed their recommendations for treatment of adult acute brucellosis to rifampicin (600–900 mg/day orally) plus doxycycline 200 mg/day orally) DR for 6 weeks as the regimen of choice. However a study by Solera *et al.* (1997) on the safety and efficacy of DR regimen for human brucellosis for 30 and 45 days consecutively concluded that, the combination of doxycycline for 45 days and gentamycin for 7 days is an effective and well-tolerated therapy for human brucellosis than doxycycline treatment for 30 days. When considering the treatment failure, relapse, and fear of emerging rifampicin resistance in areas endemic to tuberculosis, triple-drug combinations have been suggested. Mantur and colleagues (2004) treated 93 patients with gentamycin-doxycycline-rifampicin triple therapy and they

did not observe any relapse among them. Extending the antibiotic treatment also appears to have a positive effect on relapse and failure rates in all treatment regimens (Doganay and Aygen, 2003).

Treatment of brucellosis in children, pregnant and lactating women requires special attention and insufficient data are available to give specific recommendations (Franco *et al.,* 2007). Co-trimoxazole and rifampicin are the drugs generally recommended for treating brucellosis in pregnant women, neonates and children less than eight years of age (Temba, 2012).

2.8 Control of Brucellosis

2.8.1 Control in animals

Control of animal brucellosis has been successful achieved by combination of vaccination and test-and-slaughter programs in many developed countries (Karimuribo *et al.,* 2007; Godfroid *et al.,* 2011).

2.8.1.1 Vaccination

B. abortus strain 19 and Rev.1 vaccination are the vaccine commonly used and adopted in many developed countries. Schurig with colleagues (2002) gave an intense description of vaccine; *B. abortus* strain 19 is mostly used to prevent bovine brucellosis whereas Rev.1 vaccine is a live, attenuated *B. melitensis* strain used to prevent brucellosis in small ruminants. Several problems have been associated with these vaccines, these include induction of abortions when used to pregnant cows; and their effectiveness depends on several variables, including age of vaccination, dose, route and prevalence of brucellosis in vaccinated herds. Rev.1 as a smooth organism it induces positive serology which

interferes with the diagnosis. The use of Rev.1 in cattle has been investigated and results indicate that it gives better protection than strain 19.

Other vaccine studied to prevent brucellosis in animals are M vaccine (a mucoid derivative of *B. suis*); 104-M vaccine (a derivative of *B. abortus*); *B. suis* strain 2 (of biovar 1) and *B. melitensis* strain 5; DNA vaccines and Vaccines made from killed Brucella cells or antigenic fractions (killed field isolates, *B. abortus* strain 45/20, *B. melitensis* strain H38 and Pilet–Bonneau vaccine). Several reasons have contributed for them not to be adopted, which include production costs, poor protection and serological problems.

Vaccination of animals has a direct impact on the incidence of brucellosis in both animals and humans (Minas *et al.,* 2004: Seleem *et al.,* 2010). This was proven in Greece where vaccination of young animals with Rev-1 vaccine for 15 years had decreased abortions in sheep and goats and reduced incidence of brucellosis. In 1994, the vaccination program stopped and its impact was observed as the prevalence of brucellosis in animals and incidences in humans quickly increased (Minas *et al.,* 2004).

Examples of countries which succeeded to control brucellosis through vaccination are Botswana, Namibia, South Africa, Zimbabwe, Lesotho, Egypt and Palestine (McDermott and Arimi, 2002; Mukhtar, 2010). In developed countries, vaccination in dairy herds is done at least once a year and cows that are confirmed to be infected are often killed (Heather Simmons, 2013; personal communication; Minas *et al.,* 2004) followed by compensation. Vaccines are also provided to all young stock, thereby further reducing the chances of zoonotic transmission (Refai, 2002; Fathey and Monhney, 2004; Mohamed *et al.,* 2010).

In Tanzania, vaccination for bovine brucellosis using *Brucella abortus* S19 was previously practiced in state-owned dairy farms, but this stopped in 1980s due to resource constraints (Shirima 2005). Vaccination against brucellosis has not been offered by Tanzania government to both traditional and smallholder dairy sub-sectors, only private sectors and government-owned ranches have practiced this (Karimuribo *et al.,* 2007).

2.8.1.2 Test-and-slaughter

Bovine brucellosis caused by B. *abortus* has been successfully eradicated by test-and-slaughter strategies in many developed countries (unlike B. *melitensis* infection, which cannot be eradicated from small ruminant flocks with same procedure) (Minas *et al.,* 2006). The experiences gained from many countries suggest that the feasibility of brucellosis eradication by implementing test-and-slaughter strategy appears to depend largely on the conditions under which they are kept. The chances of success are high if the flocks are small, isolated and kept under close control especially when they are in close contact with other flocks, with common grazing and transhumance practiced (WHO, 1986).

Before a test-and-slaughter strategy for eradication of brucellosis launches, it is necessary to ensure that the epidemiological situation is favorable, the necessary facilities and financial resources are available, a pool of healthy replacement animals is available and the resources and ability for continuing surveillance would be existing for a considerable period. The full support of farmers is also essential, as slaughter of seropositive animals can be resisted by owners because of lack of clinical signs, inadequate compensation or lack of replacement animals (Minas *et al.,* 2006). It is usually considered that a brucellosis eradication programme by test-and- slaughter policy is justified on economic grounds only when the prevalence of infected animals in an area is 2% or below and the flocks are

maintained under closely controlled conditions and protected efficiently against re-entry of infection (Nicoletti, 1993).

For these reasons, several countries especially the developing ones cannot control brucellosis by test-and-slaughter method, this method is not feasible due to lack of financial support hence control can only base on other programs.

2.8.1.3 Other methods

Other control activities reported in developed countries include: control movements (either at international borders or to prevent spread within a country) and stamping out (localized measures to eliminate disease cases) (Renukaradhya *et al.,* 2002; Julio *et al.,* 2011). Very few countries have national control and eradication programs (McDermott and Arimi, 2002).

Control of animal movement, fulfilment of brucellosis policy and good husbandry practices are essential in brucellosis control (García and Coelho, 2013). In Namibia, apart from vaccination, testing and movement controls, stamping out activities with the slaughter of positive herds was implemented with good results; and in Lesotho apart from vaccination they included testing and slaughter of positive animals and the program turned up to be successful (McDermott and Arimi, 2002).

2.8.2 Control in human

Prevention of brucellosis in humans still depends on the eradication or control of the disease in animal hosts. Control of human brucellosis by control or eradication of the disease in animals and adequate heat treatment of potentially contaminated food products has resulted to positive results (WHO, 2006).

A derivative of strain 19, strain 19-BA given intradermally by scarification was formerly used in the Asian republics of the former USSR and *B. abortus* 84-C and 104-M given intradermally or as aerosols were used in USSR and China. These vaccines gave limited protection for a relatively short duration and re-immunization was necessary, but also they incited severe reactions if not administered correctly or if given to sensitized individuals, and they appear to be no longer in routine use. Other vaccines were the SDS-insoluble peptidoglycan fraction of *Brucella melitensis* M15 which was used in France though its efficacy was not obtained, similarly, an acetic acid extracted polysaccharide-protein fraction developed in the USSR was reported to have low reactogenicity in vaccinated individuals.

The World Health Organization has indicated the need for further study in this field. A difficulty thing in the development of a vaccine against human brucellosis has been the absence of well-established correlates of protection. Although it's not only a dangerous infection but performance of challenge experiments in human subjects is likely to encounter ethical objections (Schurig *et al.,* 2002).

In many developing countries, control of brucellosis by conventional methods has been a great challenge (McDermott and Arimi, 2002). Therefore local control measures such as proper boiling of milk, thorough cooking of meat and proper handling and disposal of animals and their secretions or carcasses can be adopted to reduce the incidence of brucellosis to human.

2.9 Gender Roles in Livestock Management

A gender role is a set of social and behavioral norms that, within a specific culture, are widely considered to be socially appropriate for individuals of a specific sex. The

perception of gender roles includes attitudes, actions, and personality traits associated with a particular gender within that culture. Both men and women work together in the field of livestock management though the participation of women and men in animal husbandly varies across regions depending on the farming systems and socio-economic factors such as religion, culture and development gradient (Tangka *et al.,* 2000).

Men are primarily managers and supervisors; in livestock issues they gather the necessary information on range conditions, water availability and marketing. They also make the initial decision on residence location, decide on herd movement and splitting, on the watering location, and daily path of grazing (Grandin *et al.,* 1991). Women do the milking and have all rights on milk and its products such as yoghurt, butter and animal fats, they also move around looking for markets for milk and their products through formal and informal markets (Coopock, 1994). Both men and women inspect animals as they return home to make sure none are lost, to determine whether animals have grazed enough, whether any are about to give birth or are sick (Grandin *et al.,* 1991). In some societies, women also own animals and through sells of animals and milk together with other milk products, they earn income which help improve their livelihood (Grandin *et al.,* 1991).

Gender is a key to understanding all dimensions of health including health care, health seeking behaviour and health status, and how a gender analysis can contribute to improved health policies and programming (Vlassoff and Moreno, 2002). Therefore, both men and women should be involved in decision making especially the local intervention and control programs (Catley *et al.,* 2011).

CHAPTER THREE

3.0 MATERIALS AND METHODS

3.1 Description of the Study Area

The study was conducted at Kilosa District in Morogoro Region, the eastern part of Tanzania mainland. Kilosa District lies between latitude 5 °55′ and 7°53′ to the South of the Equator and longitude 36°30′ and 37°30′ east of Greenwich meridian (Itika and Makauki, 2007; Lindi, 2010). According to the 2012 National census, Kilosa District had a population of 438 175 people (218 378 male and 219 797 female) (NBS, 2012).

Kilosa District has 9 divisions, 46 wards and 164 villages (Fig. 1). There are 16 wards with high livestock intensity, with 22 villages of pure pastoralist farmers and pastoralists estimated to be 31 661 in the whole district (Msungu A, 2012 personal communication). The area has semi humid climate and is predominantly populated by maasai pastoralists and sukuma agro pastoralists; and has intense interface between domesticated and wildlife animals as it borders Mikumi National park (MNP) and Selous Game Reserve (SGR) the so called Mikumi-Selous wildlife ecosystem (Temba, 2012).

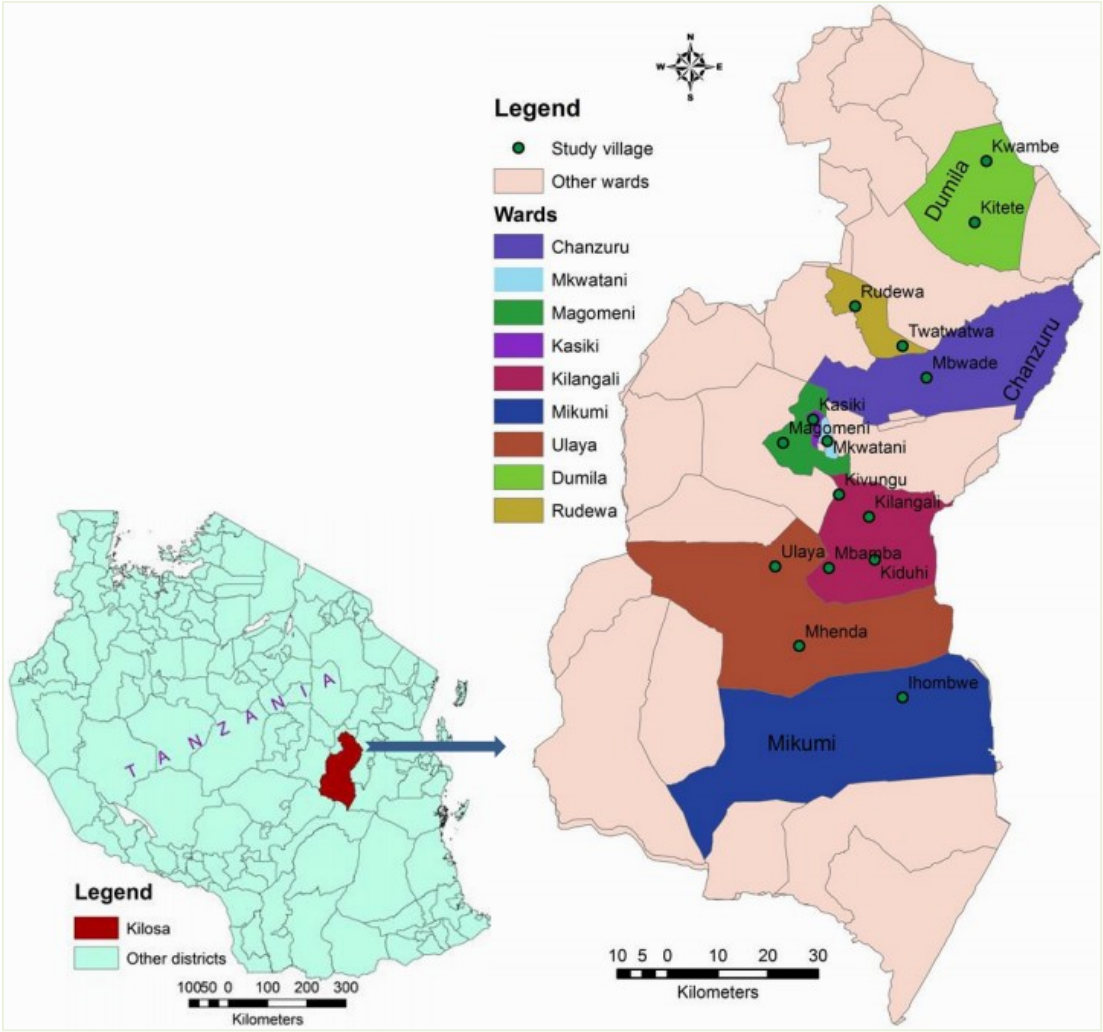

Figure 1: A map of Kilosa District showing study villages. Insert is a map of Tanzania showing location of Kilosa District

Kilosa District was selected because preliminary studies showed high prevalence of animal and human brucellosis (Temba, 2012; James, 2013). Moreover, a pilot study conducted at Kilosa District by Masters students from Sokoine University of Agriculture (SUA) in collaboration with Integrated Control of Neglected Zoonosis (ICONZ) project experts found several factors contributing to high brucellosis prevalence been consumption of raw or undercooked animal products, direct contact with animals and poor health services provided to livestock as well as human subjects.

3.2 Study Design

A cross sectional study was carried out from November 2013 to September 2014. For accuracy and precision, both qualitative and quantitative research approaches were adopted (Kimbler and Ferrell, 1995). Qualitative research approach was applied in this study to gather an in-depth understanding of human behavior and the reasons that govern such behavior (Launiala, 2009; Ngowi, 2012). This method also helps to investigate why and how people make decisions as a result of a certain behavior. On the other hand, quantitative research approach was adopted in the study to enable the researcher to quantify the behaviors of interest and more importantly to arrive at information that would represent the target community.

3.3 Study Population

The population from which the sample for this study was drawn involved women from three groups such as pastoral, agro-pastoral and food vendors residing in Kilosa District.

3.4 Sample Size Determination

To get the number of participants for one to one interview, a formula by Kothari, (2004) for unknown population was used. The prevalence of knowledge for brucellosis controlling among women in Kilosa District is estimated to be 20% (Pilot study, SUA students and ICONZ experts, 2013). Where, N= desired sample size, t= standard normal deviate set at 1.96 corresponding to 95%Confidence interval, p= proportion in the target population estimated to have particular characteristics (prevalence), q=1-p (expected population not having particular characteristics (1- prevalence)and d= degree of accuracy set at 0.05.Estimation of sample size was calculated using the following formulae.

$$N = \frac{t2\,(pq)}{d2} \quad \text{.....(1)}$$

$$No = \frac{(1.96)^2 * (0.20)(0.80)}{(0.05)2} \quad \text{.....(2)}$$

No = 246

Due to research or participant constraints 10% (25) households had to be added to cover any fault that could arise in the research. But due to poor infrastructure and logistics in the study area, time and budget constrain, only 6% (14) participants were added. Therefore, a total of 260 participants were involved in this study.

3.5 Selection of Study Units and Sampling Methods

3.5.1 Selection of study villages

The study involved treatment and control groups. Treatment group (seven villages) were villages studied under ICONZ project in the year 2012-13; activities done in treatment villages were determination of seroprevalence for bovine brucellosis and bovine Tuberculosis, administration of questionnaire on risk factors and group discussions on risk factors for disease transmission. Control group (seven villages) were villages not involved in ICONZ project. In these villages nothing was done before regarding bovine brucellosis and bovine Tuberculosis issues.

The two groups were compared in assessing knowledge, attitudes and practices on local control measures towards brucellosis control because the researcher had an assumption that, villages involved in ICONZ project could have been exposed to knowledge on brucellosis hence being aware of risk factors, clinical signs and probably control measures, while those not studies could not have those information.

For this matter, villages with pastoralists and agro pastoralists were assessed relying on eligibility criteria. The inclusion criteria were; keeping livestock, logistic feasibility and willingness to participate in the study.

The treatment groups (seven villages) were automatically involved in the study, but for a control group a total of 15 villages were assessed as they met the first group of criteria, they were then assessed for a second set of criteria and remained with 12 villages. For the purpose of this study only 7 villages were selected out of 12 villages. Simple random sampling without replacement was used, where names of 12 villages were listed each on separate pieces of paper. Those papers were then folded, shuffled and picked at random without replacement and 7 villages were obtained.

3.5.2 Selection of households

All households keeping livestock in each village were identified. In each village, names of livestock keepers were listed on pieces of paper and random sampling was done to acquire 15 to 25 households. Willingness of participants was also considered as participants who refused to participate were not forced, instead another household was recruited to cover the loss.

3.5.3 Selection of food vendors

Food vendors were identified in each hamlet to participate in questionnaire survey. Only food vendors selling food especially of animal origin (milk and meat) were included in this study.

3.5.4 Selection of villages for focus group discussion

Five villages were randomly selected for focus group discussion. Members to be included were selected by village leaders following criteria given; One should be a member of the

respective village, must have participated in face to face interview, she is a good representative person (can understand a concept and share views) and can disseminate information to others.

3.6 Pre-testing of the Research Tool

Pre-testing of questionnaires was done in order to test clarity, sequence of the questions and estimate the duration for completion of each questionnaire. A total of 19 respondents were interviewed from two villages (Kimamba A and Kondoa). Results of pilot study are not included in this study and the interview took an average of 40 minutes. After testing of the questionnaires, they were revised and arranged in a better chronology. The revised version of the questionnaires that was used in the pilot study was translated into 'Kiswahili', the National language understood by majority of Tanzanians.

3.7 Data Collection Tools and Methods

A structured questionnaire (Appendix 1) was administered to all selected women in the study area. Both closed and open- ended questions were structured and the questionnaire had five sections. For focus group discussion, an interview guide was designed to obtain reasons for behavior and practices on risk facrors for brucellosis and how they locally control it (Appendix 3). On the other hand, a checklist (Appendix 5) was prepared to assess the feature of interest in the study area.

3.7.1 Administration of questionnaires

The questionnaires were administered through face to face conversation where only the interviewer and the interviewee are present. Face to face interview gains insight of people's perceptions, understandings and experiences of a given phenomenon. However, the interview is more than a conversational interaction between two people and requires considerable knowledge and skill on behalf of the interviewer (Ryan *et al.,* 2009). In this

study, a face to face interview was conducted to discover information on zoonotic diseases in general to understand the situation, assess zoonotic diseases in the area, clinical signs known, route of transmission and animals affected; information on participants Knowledge, Attitudes and Practices specifically on brucellosis were learned. Also behavior done in relation to locally appropriate control measures undertaken by women was assessed.

3.7.2 Focus Group Discussion (FDG)

A focus group is a form of qualitative research in which a group of people are asked about their perceptions, opinions, beliefs, and attitudes towards a certain concept (Kitzinger, 1995). Focus group discussion was guided by the researcher whose task was to create a group of conversational partners, listening with non-judgmental interest while keeping the discussion focused and moving (Ulin *et al.,* 2005). Focus group discussion was adopted in this research to gain an understanding on people's attitudes, experiences, perception and opinions in social world (Silverman, 2011). A total of five (5) focus group discussions were conducted in this study. The researcher guided conversations in 'Kiswahili', the National language of Tanzanians, each taking an average of 150 to 180 minutes. Data were transcribed on the same date and after all conversations they were analyzed through ATLAS.ti software version 7.

3.7.3 Direct observation

In qualitative research, direct observation enables the researcher to watch certain things of interest, hence further probing of issues that were not covered in the structured questionnaire and focus group guide. The researcher does not try to become a participant in the context; however, she or he strives to be unobtrusive as possible to avoid bias (Ngowi, 2012). Direct observations were done in each village. A researcher observed

features of interest (Appendix 5) and they were very useful in this study as some women in the study area could not disclose some issues especially categories and number of anamals they owned.

3.8 Ethical Consideration

Research permit was provided by the Vice Chancellor Sokoine University of Agriculture (Appendix 7) and permission letters were obtained from the Executive Director of Kilosa districts (Appendix 8). Research permits (Photocopy) were shown to ward, village and hamlet leaders and the importance of this research was orally explained. Verbal consents were obtained and always a leader of each respective hamlet accompanied the researcher to households visited. In each household, self-introduction was done and permission was requested from men (head of the family) as well as a participant (woman) but for widows' permission was requested directly to participant (woman) and assurance of confidentiality of data was ensured.

3.9 Data Processing and Analysis

3.9.1 Analysis of Quantitative data

All questionnaire data were coded and entered into Microsoft Excel worksheet (Office 2010). They were carefully compared with the paper questionnaire and carefully checked. Errors were corrected, and data were immediately imported to Epi Info^{TM} Version 7 (Centre for Disease Control, Atlanta, USA) software for analysis. Descriptive statistics mainly frequencies, percentages and Confidence Intervals were analyzed hence determining distributions and magnitudes of variables among the respondents.

3.9.2 Respondent's knowledge on zoonotic diseases

In evaluating respondents knowledge two factors were considered, one was clinical signs and another one was mode of transmission of the mentioned disease. Respondent's

knowledge were categorized into high, fair, poor and illiterate based on the number of clinical signs mentioned by respondent out of common signs described by Radostits *et al.* (2000) in the textbook of the diseases of cattle, horses, sheep, pigs and goats. Since the basic clinical signs for bovine tuberculosis, FMD and Anthrax are about six, then in this study those who mentioned five or more clinical signs and at least one related mode of transmission of the disease were classified as highly knowledgeable, while those who mentioned three to four plus at least one related mode of transmission of the disease are considered to have fair understanding contrary to those who mentioned about two and one and/or related mode of transmission of the disease were considered poor and illiterate in zoonotic diseases respectively. Brucellosis clinical signs were categorized into three groups, clinical signs in female animal, clinical signs in bulls in relation to reproductive systems and those relating to inflammations such as metritis, hygroma and arthritis. Those who mentioned correctly at least one sign in all groups and one mode of transmission were classified as highly knowledgeable; at least one in two groups and one mode of transmission as fair; at least one in any group and/or mode of transmission as poor; and those who failed to mention correctly any sign and mode of transmission as illiterate.

3.9.3 Multiple regression analysis

Multiple regression analysis was done to see the association between variables that contribute to high rate of brucellosis infection between treatment and control group. The association of particular variables was attained at 95% confidence interval (CI) and a two-tailed P value of 0.05 or less was considered statistically significant.

3.9.4 Qualitative data

Qualitative data were analyzed qualitatively using ATLAS.ti software version 7. Information obtained from focus group discussions particularly on local control measures

was involved in this part. Data were firstly organized into main themes (important ideas identified by participants). Among the five groups enrolled in this part, the cut-off point was set at >60% (Ngowi, 2012), so any idea identified in 3 to 5 groups was considered to be a main theme. Verification of main themes was related to information obtained in face to face interview and was found to be valid. In ATLAS.ti software, main themes were quoted and coded on family bases, run in the software and finally counts of quotations and codes of each family was obtained in excel worksheet for interpretation.

3.9.5 Effectiveness of local control measure

Appropriate local control measure identified for brucellosis control was boiling of milk, where respondents were asked to explain how they know that milk is well boiled. Points mentioned were formation of foams, putting kitchen equipment's such as spoon or plate while boiling, and observing cream appearance on milk. Odds Ratio (OR) for those boiling of milk was calculated under Multivariate analysis of risk factors for transmission of brucellosis and it was used to calculate the effectiveness by the formula of Weinberg and Szilagyi, 2010.

Effectiveness = (1- OR) x 100 …….(3)

Where,

OR = Odds Ratio

The interpretation was made by comparing the findings with standards (Halloran *et al.,* 1992). The upper bound (above 50%) assumes that everyone is equally affected by the control measure, and the lower bound (below 50%) assumes that some are completely protected while others have no protection.

CHAPTER FOUR

4.0 RESULTS

4.1 General Results

This chapter presents results on knowledge, attitudes and practices of women towards brucellosis control. A total of 14 villages were involved in the study where 260 respondents were interviewed and 5 focus group discussions were conducted. Villages involved in the study are Mbwade, Twatwatwa, Rudewa gongoni, Kilosa centre (Kasiki and Mkwatani), Magomeni, Kilangali, Kivungu, Mbamba, Kidui, Mhenda, Ulaya kibaoni, Kitete, Kwambe and Ihombwe. The population studied is women belonging to three groups namely; pastoral, agro-pastoral and food vendors. The results are grouped under the following subsections: Socio-demographic characteristics**,** farm characteristics, gender roles towards livestock activities, veterinary services, zoonotic diseases in the area, brucellosis status in the area, risk factors for brucellosis transmission, measures suggested to prevent abortions as a sign of brucellosis and human diseases in the area. Lastly, results from focus group discussion on local control measures are presented.

4.1.1 Socio-demographic characteristics of the respondents

The socio-demographic characteristics of the respondents are presented in Table 1. Majority of respondents (62.3%) were in the middle age i.e 25-39 years. Most of the respondents in the study areas were agro-pastoralists (66.2%) especially the Maasai (51.2%) whose main occupation is livestock keeping.

However, some of them have started crop production which was said to be due to changes in weather condition and economic situation. They currently produce food crops to support their living rather than depending on livestock keeping only. Education wise, most respondents (64.2%) had no formal education and only 5.4% went to secondary school.

Table 1: Socio-demographic composition of study population (n=260)

Parameter	Category	Number of respondents	Percentage
Age (years)	15-24 years	26	10.0
	25-39 years	162	62.3
	Above 40 years	72	27.7
Setting	Pastoral	49	18.8
	Agro pastoral	172	66.2
	Food vendors	39	15.0
Ethnic group	Masai	133	51.2
	Sukuma	60	23.1
	Kaguru	17	6.5
	Gogo	7	2.7
	Chaga	6	2.3
	Mang'ati	5	1.9
	Mbulu	5	1.9
	Others*	27	10.4
Education level	Informal education	167	64.2
	Primary education	79	30.4
	Secondary education	14	5.4

Others* means: yao, nyilamba, ngoni, luguru, sambaa, makonde, nyamwezi, kutu, nyakyusa and zigua

4.1.2 Farm characteristics

Farm characteristics of the studied population are presented in Table 2. Livestock found in the area were cattle, goat, sheep, and very few chicken, duck, swine and horse. Livestock are inherited generation to generation; however herd size increases naturally (born in the boma) and through selling of old animals and buying younger ones. Very few people initially purchase animals but majority (96.8%) of respondents had animals originating from the same herd. Few respondents (2.3%) separate animals into groups searching for pasture and water and sometimes fearing of disease outbreak. Taking care of animals was an obligation of both men and women in most households visited.

Table 2: Farm characteristics (n=221)

Parameter assessed	Category	Number of respondents	Percentage
Source of animals	Born within the boma	1	0.5
	Purchased	6	2.7
	Some animals born within the boma and others purchased	214	96.8
Herd size (number of animals)	1-50	35	15.8
	51-100	171	77.4
	More than 100	15	6.8
Ownership of herds	Have other herd elsewhere	5	2.3
	Have no other herd elsewhere	216	97.7
Responsible person for animal caring in the herd	Men	44	19.9
	Women	21	9.5
	Both men and women	156	70.6

4.1.3 Gender roles towards livestock activities

Both men and women work together in the field of livestock management. There are obligations dominantly done by men or women. Women dominate milking while men dominate treating animals, grazing and spraying. Slaughtering is a men's obligation. Other activities such as handling of materials after delivery and/or abortion, and inspecting or observing animals are done nearly equally. Table 3 indicates gender division of work in livestock care.

Table 3: Gender division of work in livestock management

Activities	Female	Male
Milking	++	+
Inspecting	+++	+++
Grazing	+	++
Treating	+	++
Spraying	+	++
Handling materials after delivery/abortion	+++	+++
Slaughtering	-	++

Key: +++ = Shared activities, ++ = Majority, + = Fair involvement, - = Not involved

4.1.4 Veterinary services

Over half of farms (86.0%) had no veterinary technical support, livestock keepers are so many as compared to the number of veterinary officers available in the area. Even the few veterinary officers available face several challenges such as transport and working equipment that make them not work efficiently (Plate 1).

A veterinary officer inspecting meat without protective gears

A veterinary officer injecting a cow without protective gears

Plate 1: Veterinarians working without protective gears

Many livestock keepers treat animals by themselves without consulting veterinary officers; only 14% of respondents consult veterinary officers when they see problems in their animals. Majorities (86%) of respondents buys animal drugs in public market and keep them at their homes. Whenever they see an animal sick they treat it themselves. According to District Veterinary Officer (DVO) of Kilosa, brucellosis vaccines have never been used in the area.

4.2 Zoonotic Diseases in Kilosa

4.2.1 Common zoonotic disease identified by respondents

In women's perspective zoonotic diseases identified with their prevalence included bovine tuberculosis (84.2%), Foot and Mouth disease (52.0%), brucellosis (3.2%) and Anthrax

(0.9%). Other diseases identified (beyond this scope) were trypanosomiasis, east coast fever, heart water disease, lumpy skin disease and worms.

4.2.2 Respondents' knowledge on zoonotic diseases

Generally, women had poor knowledge on zoonotic diseases. Diseases mentioned by respondents were said to be transmitted within animals and none was mentioned to be transmitted from animal to human. Bovine tuberculosis was mentioned by 30 women whom 63% of them could only mention two clinical signs among six common signs and 37% had fair knowledge as they mentioned at least three or four clinical signs. Foot and Mouth Disease (FMD) were mentioned by 12 women, only 8% had fair knowledge and 92% had poor knowledge. Brucellosis and anthrax was mentioned by seven and two women respectively and all had poor knowledge on respective diseases.

4.3 Brucellosis

4.3.1 Brucellosis situation in Kilosa

Among all respondents recruited for this study, 14.2% had never heard of a disease known as brucellosis (locally known as '*ugonjwa wa kutupa mimba or homa ya nyama na maziwa*') and among those who heard about the disease only 0.4% knows that the disease is zoonotic. Respondents mentioned that, the disease affects cow, goat and sheep. Some respondents (63.75%) believed that this problem (abortion) is caused by diseases such as bovine tuberculosis, trypanosomiasis and foot and mouth disease when not treated or controlled to a pregnant animal. This kind of belief dictates pastoralists to treat their animals with some animal drugs present in the area instead of applying correct measures. Results in Table 4 show the situation of brucellosis among respondents and how it is treated.

Table 4: Brucellosis information in Kilosa

Parameter	Category	Number of respondents	Percentage
Have heard of brucellosis (n=260)	Have heard brucellosis before	223	85.8
	Have never heard of brucellosis	37	14.2
Brucellosis being a zoonotic disease (n=223)	Brucellosis transmitted to human	1	0.4
	Brucellosis not transmitted to human	206	92.4
	Don't know	16	7.2
Where brucellosis cases seen (n=223)	Home	194	87.0
	Village	29	13.0
Animals affected with brucellosis (n=223)	Cow	24	10.8
	Goat and sheep	25	11.2
	Cow, goat and sheep	174	78.0
Mode of transmission for brucellosis (n=223)	Other zoonotic diseases	142	63.7
	Don't know	81	36.3
Treatment of brucellosis (n=223)	Treat clinical signs of brucellosis	192	86.1
	Do nothing	29	13.0
	Don't know the medicine	2	0.9
Perception on brucellosis prevention (n=260)	Brucellosis can be prevented	159	61.2
	Brucellosis cannot be prevented	0	0
	Does not know if brucellosis can be prevented	101	38.8

4.3.2 Signs predicting the presence of brucellosis

Pastoralists and agro-pastoralists recruited in this study confessed to have cases such as abortions, still births, retention of placenta, infertility and milk drop in their herds. Only 11 people among 221 (pastoralist and agro pastoralist) had no such cases. Fig. 2 indicates cases that reveal the presence of brucellosis in the study area.

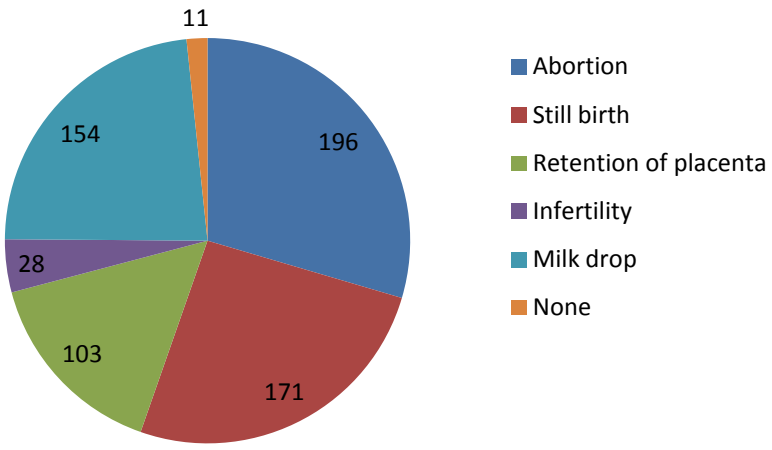

Figure 2: **Signs revealing the presence of brucellosis in Kilosa**

4.3.3 Risk factors for transmission of brucellosis in human

Risk factors for brucellosis transmission to human are grouped into two;

i. Consumption of infected materials

ii. Direct contact with infected materials

4.3.3.1 Risk factors for transmission of brucellosis by consumption

The study reveals that pastoralists' primary practices that accelerate the transmission of brucellosis disease include drinking of raw milk, consumption of raw animal blood and consumption of raw meat. Results summarized in Table 5 suggest that, risk factors in treatment group were significant different from control group (P-value $\leq$ 0.05). Risk

factors contributed to brucellosis infection were consumption of raw fresh milk (P=0.000237), use of butter (P=0.000008), use of milk powder (P=0.000828) and consumption of raw blood (P=0.000027). Appendix 9 shows a Maasai eating raw meat and others eating undercooked meat at slaughtering area.

Table 5: Risk factors for brucellosis transmission by consumption

Risk factor	Parameter	Category	Treatment group (n=119)	Control group (n=141)	P value
Milk consumption	Type of milk consumed	Fresh boiled milk	76 (63.9)	95 (67.4)	0.554077
		Fresh raw milk	93 (78.2)	80 (56.7)	0.000237
		Yoghurt	118 (99.2)	139 (98.6)	0.665131
		Butter	103 (86.6)	88 (62.4)	0.000008
		Milk powder*	9 (7.6)	0 (0)	0.000828
Raw blood consumption	Kind of blood used	Consume raw blood	84 (70.6)	79 (56.1)	0.004782
		Mix with hot soup	3 (2.5)	4 (2.8)	0.052868
		Mix with internal organs	1 (0.8)	0 (0)	0.118329
		Don't use blood	31(26.1)	58(41.1)	0.160458
Raw meat consumption	People using raw meat	Yes	28 (23.5)	12 (8.5)	0.054194
		No	91(76.5)	129(91.5)	0.068671

Milk powder* refers to 'Milk fermented and then sieved, the sieved contents are dried to get milk powder'

4.3.3.2 Risk factors for brucellosis transmission by direct contact

Results in Table 6 indicate risk factors for brucellosis transmission through direct contact. These factors include disposal of blood after slaughter where 85.9% leave the blood to drain itself or giving it to dogs. However, direct contact with aborted materials was found to be significantly different (P=0.001601) in treatment group and control group (P-value $\leq$ 0.05). Majority of respondents (80.5%) improperly dispose aborted fetus and other materials after delivery by giving them to dogs or just throw them in bushes.

Table 6: Risk factors for brucellosis transmission by direct contact

Risk factor	Category	Treatment group (n=101)	Control group (n=120)	P value
Contact with aborted materials	Wear gloves	0 (0)	8 (6.7)	0.001601
	Don't use	101 (100)	112 (93.3)	
Disposal of aborted materials	Incinerate	7 (6.9)	0 (0)	0.967247
	Bury	9 (8.9)	27 (22.5)	
	Give dogs while raw	85 (84.2)	93 (77.5)	
Disposal of blood after slaughter	Left to drain	95 (94.1)	95 (79.2)	0.338794
	Bury	6 (5.9)	25 (20.8)	
Animal contact	Domestic animals with other domestic animals from other herds	61 (60.4)	83 (69.2)	0.087752
	Domestic animals with wildlife animals	17 (16.8)	38 (31.7)	

4.3.3.3 Multivariate analysis of risk factors for transmission

Multivariate analysis was further done to all risk factors that were significantly different in Univariate analysis and the results are summarized in Table 7. Risk factors such as consumption of raw fresh milk, use of butter, use of milk powder, consumption of raw blood, direct contact with aborted materials were found to be statistically significant. After running a multivariate regression analysis, none of risk factor was found to be associated with each other regarding respondent's knowledge of brucellosis at 95% CI ($P \leq 0.005$).

Table 7: Multivariate analysis of risk factors for transmission of brucellosis

Variable	Odds Ratio	C.I.	Coefficient	S. E.	Df	Z-Statistic	P-Value
Consumption of raw fresh milk	0.5711	3.3772	0.5601	0.9067	1	0.6177	0.5367
Use of butter	2.6031	15.5076	0.9567	0.9105	1	1.0507	0.2934
Use of milk powder	0.2788	1.7847	1.2773	0.9473	1	1.3484	0.1775
Consumption of raw blood	1.3358	17.3554	0.2895	1.3084	1	0.2213	0.8249
Direct contact with aborted materials	0.0515	1.0612	11.3371	322.3550	1	0.0352	0.9719

4.3.4 Suggested measures by respondents to control abortions

Different measures were suggested by respondents to control abortions as signs of brucellosis in Kilosa District. According to respondents knowledge and believes towards the disease (brucellosis) there were different views that can help control abortions. Majority (64%) requested the government to provide trainings to them so that they understand the disease and know how they can control it. Veterinary medicine were requested by 58% as they think that abortion is a result of untreated diseases so treating these diseases can help reduce incidences of abortions. Other respondents (49%) requested vaccination and other measures such as improved veterinary services, more research, dip services, condemning affected meat, tracing affected animals and the use of artificial insemination were suggested. These measures were mentioned regarding interpersonal perception and understanding of the disease.

4.4 Human Diseases

Coming to human disease in relation to human brucellosis, respondents were asked to mention diseases that occur mostly in the household. Malaria being the most frequently mentioned disease by respondents as 99.2% mentioned it. Other diseases mentioned are chest, cough and flue. These diseases especially malaria affects both children and adults in the household, and many people 83.8% mentioned to get illness once or twice in six months (research duration). Health centers and dispensaries in the study area lack equipment for testing malaria hence people attend to hospital to get medicine or go outside the village for check-up and medication. Table 8 summaries human diseases occurring in the study area.

Table 8: Human disease in Kilosa District

Parameter	Category	Treatment group (n=119)	Control group (n=141)	P value
Common disease mentioned	Malaria	119(100)	139 (98.6)	0.193578
	Chest	11 (9.2)	14 (9.9)	0.852546
	Cough	10 (8.4)	21 (14.9)	0.108461
	Flue	15 (12.6)	22 (15.6)	0.492521
Who get sick most of the time	Children	29 (24.4)	39 (27.7)	0.549392
	Both children and adults	90 (75.6)	102 (72.3)	
Number of times a person got sick in six months (study period)*	Once or twice	103 (86.6)	115 (81.6)	0.075734
	More than two times	16 (13.4)	26 (18.4)	0.346992
Where they get medication	Within the village	51 (42.9)	69 (48.9)	0.160458
	Outside the village	63 (52.9)	40 (28.4)	
	In and outside the village	5 (4.2)	32 (22.7)	

*Time of sickness considered were only those required a person to go to the hospital for check-up or medication

4.5 Local Control Measures of Zoonotic Diseases

4.5.1 Use of gourds

Maasai people use gourds to store and ferment milk. Before putting milk into the gourd, they clean it and insert a burned piece of a tree, locally known as *Msisiri.* This tree is claimed to have a good smell which Maasai like most. Participants clarified the importance of gourds *"Gourds are very important; we milk into gourds, then filter the milk and put in another gourd where they are left to ferment for one day"* (Participant from Kidui). Another participant mentioned that "*milk fermented in gourds is very sweet, smells good as we do put Msisiri and it becomes very cold like refrigerated milk"* (Participant from Mbwade). On further investigation, it was learned that, gourds used are of different sizes. When a child is about three months they prepare a small gourd special for him/her, it's like a bottle feeding for children. For this case, milk in gourds is cooled hence lowering temperature that may favor microorganisms to grow. Plate 2 shows gourds and Msisiri tree.

		
A msisiri tree put in gourds	A gourd used for storing and/or fermenting milk	A young child using gourd to drink milk

Plate 2: Msisiri tree and gourds used in Maasai domain

4.5.2 Milk and milk products

Yoghurt (fermented milk) is an important food stuff in the study area, people use yoghurt accompanying their main dish (ugali or rice) and it was found that Maasai children cannot eat food without milk unless there is no any means of getting milk "*Children are used to milk, they cannot eat vegetables with ugali, If I don't have any means of getting milk, they can rather eat ugali with tea rather than ugali with vegetables*" (Participant from Twatwatwa). When milk is fermented the P^H is lowered hence inhibiting growth of some microorganisms. Other participants said that they do boil milk which was found to be a good practice as heating milk kills microorganisms. On the other hand, butter making and milk powder making is done after fermentation that is to say, p^H of milk is lowered hence inactivating microorganism and products made are heated during cooking hence microorganisms are killed. Respondent from Ulaya use milk powder, the milk made after fermentation process where they sieve fermented milk and dry the contents. Milk powder is used as ingredient in food especially vegetables. This form of milk is locally known as "*Mpoma*"

4.5.3 Treating infected animals

Many animals in Kilosa are not vaccinated, pastorist only treat animals with drugs they purchase public markets or veterinary shops. Several reasons were mentioned regarding this situation, A respondent from Mbwade said that "*I know signs of diseases, because I have spend my whole life taking care of animals, when I see an animal not okey I can easily know which drug I should use for it to recover*". Animal drugs are bought at public market and few people mentioned to buy drugs in veterinary shops. Dosage of drugs was found to be a problem because a women from twatwatwa confesed the use of higher doses when the animal is seriously sick "*We treat animals by ourselves, drugs are kept at home so, whenever the animal is sick we inject it with the drug responsible for the disease; we know the normal dose for a certain condition, but if the animal is seriously sick we inject higher dose or if it does not recover in expected days we change drugs*". Some people use salt or ashes for foot and mouth disease where they apply salt or ashes on the mouth and feet of an animal to treat wounds. Treating infected animals help reduce the rate of transmission to unaffected animals. Plate 3 shows common drugs used by respondents interviewed.

Plate 3: Common drugs used to treat animals

Treating animals with drug mentioned was a common solution for sick animals but not a control of diseased in the herd especially for zoonoses, a problem that affects human being too. With animal movements and keeping many animals in one place, vaccination could be the only solution to control diseases.

Vaccination of animals was mentioned to be unusual in the study area because the government does not provide drugs and vaccines. Information on drugs and vaccination was also not known to many women because men are the ones dealing with such issues, but when respondents were asked on cost sharing for vaccination a women from Magomeni said "*We have many animals where vaccination to all animals can not be possible due to high price of vaccines. we are willing to pay some cash if the government can provide vaccines at affordable prices*".

4.5.4 Personal cleanness

Participants recruited in this study did not know the consequence they may encounter when touching animals, aborted materials, still births and other materials following normal delivery without protective gears. Respondents were asked on how they handle aborted materials, still births and other materials following normal delivery and the following were the answeres; A respondent from Ulaya kibaoni said "*There is no any problem touching those things as long as I wash my hands with water and soap after assisting the animal*". Another respondent from Kidui said that "*When I finish assisting the animal I just wash my hands with water only, those are my animals and nothing can happen to me, when assisting human being its when we are advised to use gloves but not with animals*". Because respondents did not know the transmission modes for zoonotic diseases they are exposed to zoonoses through direct contact with aborted materials, still births and other materials following normal delivery.

4.5.5 Treatment of human brucellosis

Participants said that, for prolonged and undulant fevers, they use animal fat made from milk or meat. A respondent from Kidui said "*When I use medicine for malaria and not get relief I just use animal fat made from meat or milk where I diarrhoe or vomit and the disease goes away*". Some mentioned the use of fresh animal blood drawn from live animals to treat diseases like anaemia and malaria. A respondent from Mbwade said "*Its normal for we women to drink raw blood especially when the woman is pregnant, when she is anaemic, animal blood is drawn from a healthier cow or goat and she can mix it with water or milk and consume it*" Not only pregnant women, but other members of the family such as children or men also consume blood when they don't feel good. Forexample when a person feels dizyness, body weakness and untreaded fever they drink raw blood. Table 9 is a summary the local control measured pointed out earlier.

Table 9: Local control measure of zoonotic diseases in Kilosa District

Parameter assessed	Maasai	Other tribes	Total
Type of milk used by respondents			
(a) Raw fresh milk stored in gourds with msisiri	3	0	3
(b) Some use fresh boiled milk	0	1	1
(c) Fermented milk (yoghurt)	3	2	5
(d) Milk powder	0	1	1
Procedure followed when fermenting milk			
Use gourds with msisiri to ferment milk	3	0	3
Control of zoonotic diseases			
(a) Use of drugs (Ox tetracycline (OTC) and Tylosin)	3	2	5
(b) Apply salt or ashes to infected animals	3	0	3
Control of brucellosis			
(a) Wash animals with dip	3	2	5
(b) Treat infected animals	3	2	5
(c) Wash hands with water and soap after touching aborted materials	3	2	5
Treatment of human brucellosis (undulant fever)			
(a) Drink butter made from milk or animal fat	3	0	3
(b) Drink raw blood	0	2	2
Totals	**27**	**14**	**41**

4.6 Effectiveness of Local Control Measures

A local control measure identified in reducing the rate of brucellosis in Kilosa's population is boiling milk. Its effectiveness is calculated basing on those who boil milk either to kill pathogens and those mentioned that they sometimes boil milk when they feel like boiling it (Appendix 10). The effectiveness of those boiling milk to kill pathogens was 47.19% and those boiling milk when they decide (sometimes boil, sometimes not boil) was 18.32%. Therefore, the effectiveness for those boiling milk falls below 50%, that means some people are protected from the disease (those who boil milk) while others are completely not protected from the disease (those who don't boil milk).

CHAPTER FIVE

5.0 DISCUSSION

The purpose of this study was to assess knowledge, attitudes and practices of women on local control measures for brucellosis in Kilosa District. This study more information on women's understanding and discovering of health related knowledge, attitudes, and practices towards brucellosis as a main disease and its control were gathered. Knowledge, attitudes and practices (KAP) studies have been widely used around the world for different applications in public health based on principles that increasing knowledge may result in changing attitudes and practices to minimize disease burden (Sambo *et al.,* 2014). However, in order to have successful programmes, local people have to be involved in designing and planning measures that solve local problems (Catley *et al.,* 2011), therefore the current study indicates that, respondent's general knowledge on brucellosis and other zoonotic diseases was poor as most of them failed to point out the mode of transmission and did not know that zoonotic diseases they mentioned are also transmitted to human (zoonotic). This dictates them to treat their animals with antibiotics instead of applying proper control measures or even applying local control measures. Regarding respondents' knowledge on brucellosis, women as implementers of local control measures (KBBE, 2007) they were given an opportunity to suggest control measures based on their community and social context. Among the suggested measures to control abortions as a sign of brucellosis in Kilosa District are emphases on trainings for them to understand the disease and know how to control it, provision of vaccines, improving veterinary services, more research on brucellosis, tracing affected animals and the use of artificial insemination.

5.1 Women's Roles in Livestock Issues and Management

This study classified women as an important human category in the study area, apart from their obligation of taking care of their families, they also take care of livestock. The main obligation of women both pastoral (Maasai) and agro-pastoral (other tribes) is milking and processing milk and dairy products such as yoghurt, butter and animal fats. Also women especially the Maasai move around looking for markets of milk and their products through formal and informal markets. These findings correspond with the findings of the Borana women of southern Ethiopia as reported by Coopock (1994) who described different roles of women in livestock management. Apart from milking, they inspect and count animals before and after they leave home for grazing, they observe the health of animals and report disease cases to men and find the missing animals with the assistance of children. Some women graze animals and take care of calves left behind when older animals go for grazing. This reveals that, women also contribute in identifying animal diseases as they observe signs of sick animals, they are responsible for sick animals left at home, weak calves and animals which cannot go far for grazing. Among the signs reported by respondents are weaknesses of animals, not able to feed well and reduced quantity of milk.

Although men are the ones who normally treat animals, but women are the most identifiers of sick animals as they observe them early in the morning during milking and at evening after returning home; hence thisgives them an experience on diseases that normally occur in their herds. These findings concur with results by Grandin *et al.* (1991) who explained the roles of men and women in livestock production. For this case, women can play a major role in controlling brucellosis once they have proper knowledge of brucellosis, and because they are the primary carers of family member they prepare food, educate family members, identify illness in the family and seeking care for it. Their contribution to local control measures can bring about changes to the local communities.

Results of the present study found that, milk is very important among respondents of this study. In rain season when there is sufficient pasture and enough water for drinking they milk twice a day (morning and evening) but during dry season they only milk in the morning. After milking they filter the milk, and distributing some for home consumption and put the remaining in plastic gallons or bucket ready for sell. Milk consumers are people in village centers, people with hotels and sometimes they cross village boundaries for example, pastoralists living along Mikumi road (Ulaya and Mhenda) they collect their milk and transport them to Mikumi while those living along Morogoro road via Kimamba or Chanzuru, they take their milk to the collection center (DESA) at Kimamba. Milk was also important nutritional wise as it is the first food given to children, and for Maasai it is the main food they depend on for provision of nutritional requirements. This was found to be true because observations show that, main foods (ugali and rice) are accompanied by milk and small children were said to eat food with milk rather than vegetables.

Milk production contributes to income generation of many families studied in this study. For Maasai women who sell milk themselves the money obtained is for their own expenses, men do not ask for such money, unless they are bankrupt then they can ask the wife to give some cash. Money earned is used for food, buy kitchen equipment's, clothes and raw materials for making ornaments. These findings concur with findings in Arumeru District (Tanzania) reported by Kimaro *et al.* (2013). In their study they found that, proceeds from dairy products such as fresh milk, sour milk and butter brought more income than other activities among women groups involved in small-scale dairy production. This is different from agro-pastoral communities where men also assist in milking, and whether women sell milk or their husbands, the money earned is shared and it is mostly allocated to family expenses such as medical treatment, purchasing grains, and buying family assets like farms and furniture. A study by Tangka *et al.* (2000) also

reported similar findings on gender roles and issues in agro-pastoral systems. In the study area, livestock were found to be an important asset for livelihoods of many families especially pastoralists. They contribute a lot to food security and they measure the wealth of the family. This observation concurs with findings by Mung'ong'o and Mwamfupe (2003) who found livestock keeping being the central activity of pastoralist livelihood in Kilosa District. Some women in the study area especially Maasai own cattle which are given by husbands or parents as gifts when they are married, though they are not mandated to sell any of them without men's permission. When a Maasai women is in need of some cash and she intends to sell an animal, she discusses that matter with the husband, and on agreement, the husband sells the animal and gives the amount needed to the wife. This is contrary to Maasai women in Eastern Kajiado (Kenya) who own, sell and purchase small ruminants hence giving them prestige and security in their communities (Grandin *et al.,* 1991).

5.2 Knowledge on Zoonotic Disease

The current study shows that, majority of women in Kilosa district have poor knowledge on zoonotic diseases. Respondents failed to relate the clinical signs and respective zoonotic diseases they mentioned. Some were able to mention some zoonotic diseases prevalent in their herd but the signs mentioned were too general and others were confused with other diseases, for example, diarrhea was mentioned as a sign for almost all diseases including bovine Tuberculosis, Foot and Mouth Disease and other diseases beyond this study. Zoonotic diseases mentioned by respondents were bovine Tuberculosis, Foot and Mouth Disease, Brucellosis and Anthrax. Very few women who had fair knowledge on zoonotic diseases were the smallholder dairy keepers living in peri-urban areas (centers) and those of Kilosa center. This probably was due to their habits of consulting veterinary officers whenever they see problems in their herds and being exposed to educated people

and medias where they get information on several diseases. Swai *et al.* (2010) also reported similar findings, where they found high knowledge among smallholder dairy keepers than among traditional livestock keepers.

2.3 Knowledge on Brucellosis

The present study shows that, participants recruited in this study were not aware and had no proper information of brucellosis. In the study area, brucellosis is known through its Swahili name "*Ugonjwa wa kutupa mimba*" which means, a disease destructing pregnancies (abortions) and not other signs. Results suggest that among 223 respondents who have heard of brucellosis previously, 87% and 13% of them had observed abortion cases at their homes and their neighbors respectively. This means, abortions are common among several herds in the study area. The problem observed was respondent's failure to relate abortion cases with brucellosis. Participants of the current study did not know if abortions were among the signs of brucellosis, instead they mentioned that, abortions were just a bad luck as it also happens to human beings. Others mentioned that, abortions are caused by untreated diseases like trypanasomiasis, bovine tuberculosis and Foot and Mouth Disease when the animal is pregnant. This implies that participants don't know what really causes abortions and it could be due to pastoralists not acknowledging the importance of veterinary officers who could give them some hints on the disease. These findings are contrary to the findings of Díez and Coelho (2013) who observed higher knowledge of brucellosis among respondents in the Northeast Portugal. In their findings they said that higher knowledge was due to respondents experience on brucellosis infection and most of them believed that brucellosis was a zoonotic disease. Holt *et al.* (2011) also reported contrary findings, as they found high level of awareness on brucellosis among livestock keepers in Egypt. Results of the present study shows that smallholder food vendors have no information on brucellosis as only 2 women among 39

smallholder food vendors had heard of brucellosis. This indicates that food vendors are also at risk of acquiring brucellosis as no any preventive measure is taken by them as well as by their customers.

5.4 Risk Factors for Zoonotic Disease Transmission

The findings of this study revealed that consumption of fresh milk, use of yoghurt and butter made from raw milk, consumption of raw blood and consumption of raw meat were the primary practices that accelerate the transmission of brucellosis among respondents of this study. Uses of raw animal products are considered as normal behavior and it's a cultural habit for majority of respondents especially Maasai. A recent study by James (2013) found positive brucellosis cases being among those consuming raw milk, meat and blood, implying that, cultural dietary habit is the major route of brucellosis infection among people in the study area. Association of consumption of raw milk and its products with brucellosis transmission concurs with other studies elsewhere for example, a study is by Alsubaie *et al.* (2005); Sofian *et al.* (2008); and Julio *et al.* (2011). These results are contrary to the findings by Abo-Shehada *et al.* (1996) who reported that risk factor for brucellosis transmission is contact with infected animals and their products than ingestion of contaminated animal products.

From Morogoro Region socio-economic profile (1997), it is stated that the extensive number of livestock has been brought in by Maasai and Sukuma people in the region. This was also confessed by Kilosa district Livestock Extension Officer who said that large numbers of animals present in the district are of Maasai's and Sukuma's. On further investigation, it was found that animals are not tested for diseases when bought or trans-passing boundaries within villages or districts. Permits are given by Village Executive Officers and sometimes they are given illegally, this is due to corruption as they are given

some amount of money to let pastoralists enter an area and establish new settlement. A previous study conducted in Kilosa District by Benjaminsen *et al.* (2008) on Kilosa killings reported that corruption undermines people's trust in authorities and this has been a reason for many conflicts between pastoralist and farmers in the area. Not only conflict, but this is also a major route of disease transmission from one area to another. A recent study by Temba (2012) showed that, uncontrolled movement of indigenous animals in the rural settings of Tanzania including Kilosa is an important factor for herd-to-herd transmission of brucellosis. This concurs with other studies elsewhere, for example a study conducted in Spain by Julio *et al.* (2011) indicated that, pre-movement of animals was a route of brucellosis transmission in dairy cattle and another study in Portuguese by Coelho *et al.* (2007) reported that uncontrolled animal movements on and off farm was a risk factor for brucellosis transmission in small ruminants.

Other possible risk factors observed in the current study are direct contact with animals and their secretions as respondents said that, when assisting animals during normal delivery or abortions they touch the animal with bare hands and there after they wash their hands with water and soap. Lim *et al.* (2005) reported a similar case, where touching calves and/or placenta of infected animal was a risk factor for brucellosis transmission, and Mishal *et al.* (1999) found large number of infected people being those involved in calf delivery and those who come in contact with blood and placenta.

In the present study, some pastoralists were found slaughtering goats and sheep not inspected by veterinary or meat inspectors and even veterinary workers were found working without protective gears. This reveals that, both farmers, veterinary, slaughter, and butcher workers and meat inspectors are all at risk of getting brucellosis. Majority of participants of this study perform home slaughtering and in every week there is a public

market in one of the villages in Kilosa where meat is sold, hence putting even other people beyond Kilosa at risk of getting brucellosis. Swai and Schoonman (2012) reported the same thing that majority of people performing home slaughtering and meat inspection are at greater risk of acquiring zoonotic diseases.

5.5 Local Control Measures

The current study also aimed at assessing the adapted local control measures in the study area, but unfortunately local control measures observed were not done for the purpose of controlling brucellosis rather, they were done as normal routines of some people in Kilosa. Results in this study showed that people boiling milk are those living in peri-urban (center) and in Kilosa town, at least they mentioned that they boil milk to kill pathogens. Majority of people (pastoralists and agro-pastoralists) living in remote areas were not aware of health hazards that may occur to a person as a result of raw milk consumption. Similar findings were reported by Karimuribo *et al.* (2005) and Mosalagae *et al.* (2011) who found smaller number of people being aware of health hazards due to raw milk consumption. Findings by Bukuku (2013) opposed these observations as in his study at Arusha and Meru Distict he found higher number of people being aware of health hazards that may occur to a person as a result of raw milk consumption. Because few people in this study boil milk, its effectiveness towards brucellosis control was found to be below 50%, implying that only those boiling milk are protected from brucellosis while majority are not protected.

5.6 Brucellosis Control and Prevention

Many countries have succeeded in controlling brucellosis through vaccination, slaughter of infected and exposed animals based on serological testing and control of animal movement and quarantine on infected farms. Observations from this study shows that, in Kilosa District it is currently very difficult to control animal movements and practice zero grazing because farmers keep large herds and due to shortage of land for grazing and

water sources they cannot control animal movements. The only solutions suggested by author of this study are vaccination of all animals susceptible for brucellosis in line with change of social and cultural dietary habits. It has to be noted that, vaccination programmes in some developing countries have not been adopted by farmers due to social and cultural aspects (Heffernan *et al.,* 2008; Heffernan *et al.,* 2011). Therefore education programmes on brucellosis have to be initiated first so that farmers are aware of the importance of the disease and the control measures. In line to that, farmers should learn to acknowledge the importance of veterinary workers, use arm gloves when attending to animals, proper and hygienically disposal of materials (afterbirths), treating all abortions as potential brucellosis cases and report them to veterinarians. Brucellosis can be controlled like other zoonoses, for example a study by McCarthy and Moore (2000) in Australia reported that achievement of controlling emerging helminthes zoonosis was due to changes in dietary practice, changes in notification following increase awareness of infection and changes in human behavior.

Investigation on the current study shows that, brucellosis in human is not diagnosed in the study area. Respondents of this study mentioned that, many health facilities around do not provide diagnostic services, this dictates them to move a long distance to seek diagnostic services. Also lack of medicine in many health centers make them delay attending to health centers. They normally purchase some pain killers and some especially Maasai consume butter made from milk or animal fat to cure acute signs of malaria without knowing the exact diseases they have. Maasai believe that, using butter they diarrhea and vomit hence remove all disease agents especially malaria agents, the belief that is not true. These findings concur with a study in Tanzania by Kunda *et al.* (2008) where they reported poor diagnostic capacity of health centers being a challenge in treating many diseases including zoonoses. They then stated that laboratories particularly in the rural

areas are poorly equipped and cannot diagnose most of the emerging and re-emerging diseases. Also lack of knowledge among health workers contribute to poor diagnoses of zoonotic diseases. Such findings were also similar to that of McDermott and Arimi (2002) as they observed difficulties in diagnosis and treating zoonotic diseases being contributed by long distances to health centers, difficulty in obtaining reagents and materials used for testing, low numbers of qualified technicians, and little awareness on the importance of brucellosis even in areas where its risk is high.

CHAPTER SIX

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

Women's responsibilities in livestock keeping and family welfare expose them to brucellosis infections. Majority had poor knowledge on brucellosis hence unaware on risk factors, mode of transmission and control measures. Their attitudes and practices towards risk factors for brucellosis are driven by traditions and customs especial for Maasai. Women being important in the society due to their roles in taking care of families and food preparation they can act as instrumental persons in controlling brucellosis. Local control measures such as proper boiling of milk, thorough cooking of meat and proper handling of animals, their products and by-products should be adopted to reduce transmission of brucellosis from animals to humans.

6.2 Recommendations

Base on the findings of the current study, it is therefore recommended that:

i. People should be educated on zoonoses to help them prevent and protect themselves against them.

ii. Proper and clear information of brucellosis should be provided in Kilosa District especially on local control measures so that they are adopted to reduce the incidence the disease.

iii. Heath information concerning brucellosis can be disseminated through different media such television, radio, newspapers, posters, public enlightenment campaigns for example cinemas, primary healthcare attendants and school-based educators.

Like how other emerging and re-emerging zoonoses (dengue, ebola and malaria) are announced by mass media in Tanzania, brucellosis information should also be announced in different media to make it understandable to people.

iv. Occupational groups (workers) at risk of getting brucellosis in their working places should use personal protective devices to protect themselves from acquiring infection.

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APPENDICES

Appendix 1: Questionnaire to investigate women's knowledge, attitude and practices contributing to Zoonotic disease in reference to brucellosis control in Kilosa District, Morogoro, Tanzania

SECTION A - Socio-demographic characteristic of the respondent.

1) District name……Date…….Questionnaire No……..
2) Ward name ……
3) Village name ……
4) Participant's name ……..…
5) Age of participant (i) 15-25 years (ii) 25-40 years (iii) Above 40 years
6) Setting (i) Pastoral (ii) Agro pastoral (iii) Peri-Urban (smallholder)
7) Ethnicity (i) Maasai (ii) Kaguru (iii) Sukuma (iv) Sagara (v) Other (specify)……
8) Education level (i) None (ii) Primary school (iii) Secondary school (iv) High school or above

SECTION B – Human diseases

1) What disease commonly affects you and/or your family members?
   …….
2) Who is/are affected by such diseases? (i) Children (ii) Adults (iii) Both
3) How many times did you or your family member diseased that lead you go to the hospital for diagnosis and/or treatment? (In past six months)
4) Where do you get medication? (i) Within the village (ii) Outside the village (iii) Both

SECTION C – Farm characterization.

1) How many animals do you have? ……..
2) Were these animals bought or born in this boma?.....
3) Who takes care of the animals? (i) Men (ii) Women (iii) Both
4) What are your tasks in relation to livestock production? ……
5) (a) Do you receive veterinary services whenever needed? (i) Yes (ii) No
   (b) If not? Why?
6) What procedures do you take when the animal is sick?

Procedure	Seek for veterinary services	Purchase medicine myself	Other(s)specify
Yes/No			

7) (a) Are you animals vaccinated? (i) Yes (ii) No (iii) Don't know

(b) If yes, which vaccination did you vaccinate? And for which disease? …….

SECTION D – Knowledge on zoonoses

1) What are the common five diseases affecting your animals? Mention according to their importance (Common -to-Rare cases)

Disease	Species affected	Clinical signs	Mode of transmission	Control measure
1.				
2.				
3.				
4.				
5.				

2) (a) Have you ever heard of zoonotic diseases? (i) Yes (ii) No
(b) If Yes, mention them;
……

3) Are your animals mixed/ moving with other animals from other boma? (i) Yes (ii) No (iii) I don't know

4) Have you ever practice artificial insemination? (i) Yes (ii) No (iii) I don't know

SECTION E: Knowledge on brucellosis

1) (a) Have you ever heard of a disease known as brucellosis? (i) Yes (ii) No
(b) If Yes, where did you hear it? (i) Neighbor (ii) Friend (iii) Veterinary officer
(iv) Another person (Specify)…….

(If the answer is NO , go to number 8)

2) (a) Can animals transmit brucellosis to human being? (i) Yes (ii)No (iii) I don't know
(b) If Yes, mention modes of transmission for brucellosis……
……..
(c) Are your ever been affected by this diseases? (i)Yes (ii) No (iii) I don't know
(d) If Yes, how did you know it is brucellosis?
.....
(e) Which animals were affected?
……..

3) Which signs indicate you to know brucellosis in:
(a) Animals? ……..
(b) Human? .....

4) Which measure do you take when the animal is infected by brucellosis?
.....

5) Have measure do you take when the a person in the family is infected by brucellosis?

6) Have you ever observed any of the following cases in your animals?

Case/sign	Yes/ No
Abortion	
Still birth	
Retention of placenta	
Infertility	
Milk drops	
Changes in meat quality	
Changes in meat quantity	

7) Do you think that brucellosis can be controlled? (i) Yes (ii) No (iii) I don't know

8) What precautions do you undertake to control/prevent brucellosis in your family?

Method	Yes/No
Proper boiling of milk	
Handling of aborted foetus by wearing plastic bags	
Handling of aborted foetus by wearing gloves	
Washing of hands with soap immediately after assisting calving	
Disposing aborted materials in pit/hole and cover them	
Washing of hands with water immediately after assisting calving	
Prohibite anyone with cut/scratches from assisting calving or handle aborted materials	
Cleaning the environment	
Cook meat	
Other(s) specify	

9) What kind of milk and/or milk product do you use at this household?

Milk and/or milk product	Fresh boiled	Fresh raw	Yoghurt	Butter	Milk powder
Yes/No					

10) Why do you boil milk?

Reasons	Yes/No
To kill pathogenic microorganisms	
Were told by a medical personnel	
People are advanced, they do not accept un boiled milk	
Other(s)Specify	

11) How do you know that milk is well boiled?

Means of knowing	Yes/No
Once foams are appeared, then its boiled	
When foams appears it is left for some few minutes	
After boiling, I put a spoon/plate and left for few minutes	
Boil until cream appears	
Other(s) Specify	

12) If not boiling milk, why?

Reasons	Yes/No
No enough time to boil milk	
Boiling reduces nutrients	
Taste and flavor become bad after boiling	
Butter fat decreases after boiling	
Lack of fire wood	
Boiled milk does not ferment properly	
Other(s) Specify	

13) Where do you get meat for your family?

Source	Home slaughter	Shop	Neighbor	Public market	Wildlife	Other(s) Specify
Yes/No						

14) (a) Is the meat consumed at your household inspected prior to cooking? (i)Yes (ii) No
(b) If No, why?.....

15) (a) Do you/your family member consume blood? (i) Yes (ii) No
(b) If yes, why do you/ your family member consume blood?.....
(c) If not, why?.....

16) Who consume blood in your family?

Consumer	Father	Mother	Daughter	Sons'	Attendant	Relative	Other(s) Specify
Yes/No							

17) Where do you get blood for your family?

Source	Yes/No
Bled from live animal	
From home slaughter	
From butcher	
From public market slaughter	
From neighbor	
From relative (specify area)	
Other(s) Specify	

18) How is blood prepared before consumption?

Method	Yes/No
No prior preparation (consumed as it is)	
Fried/cooked	
Raw blood mixed with hot soup	
Raw blood mixed with milk	
Raw blood mixed with duodenal content, bile and offal chops like liver	
Raw blood mixed with ruminal fluid (used as medication)	
Other(s) Specify	

19) How do you dispose blood after slaughter?

Method	Yes/No
Left to drain after slaughter	
Given raw to dogs	
Given cooked to dogs	
Cooked and prepared for livestock meal	
Other(s) Specify	

20) How do you protect yourself when assisting animals during delivery or abortion?

Method	Yes/No
Wear plastic bags on hands	
Wear gloves	
Touch with bare hands, then wash with water only	
Touch with bare hands, then wash with water and soap	
Other(s) Specify	

21) How do you dispose materials following abortion, normal delivery and/or still births?

Method	Yes/No
Throw in the bush	
Give dogs	
Burry	
Incinerate	
Other(s) Specify	

22) Do your animals come into contact with other animals?

Herds	Dry season		Wet season	
	Grazing area	Watering point	Grazing area	Watering point
Cattle from other herds				
Goat/sheep from other herds				
Wild animals, name them				

23) Where do you keep your animals at night? (i) In their boma (ii) In the house with family members (iii) Outside the house (iv) to my neighbor (v) Other(s) specify……..

24) Do you believe that Brucellosis can be controlled/ prevented? (i) Yes (ii) No (iii) Don't Know

25) If yes, what do you do to control brucellosis problem in your family?
.....

26) What do you think the government should do to eradicate the problem?
……

Thank you for your time and participation in this study

Appendix 2: Translated version (Kiswahili version) of a questionnaire used for face to face interview

DODOSO KWA WANAWAKE JUU YA UELEWA WA UGONJWA WA KUTUPA MIMBA KWA MIFUGO, MADHARA NA NAMNA WANAVYOJIKINGA NA UGONJWA HUO WILAYA YA KILOSA- MOROGORO

SEHEMU A: Taarifa za awali za mshiriki (weka alama √ kwenye jibu sahihi)

Wilaya……Terehe……Dodoso namba…….

Kata……...

Kijiji..…….

Jina la mshiriki……

Umri wa mshiriki (i) Miaka 15-25 (ii) Miaka 25-40 (iii) Miaka zaidi ya 40

Kazi (i) ufugaji tu (ii) kilimo na ufugaji (iii) Maeneo ya mjini

Kiwango cha Elimu (i) Sijasoma (ii) Elimu ya Msingi (iii) Elimu ya Sekondari (iv) Elimu ya juu

SEHEMU YA B: Magonjwa ya binadamu

1. Ni magonjwa gani yanayokusumbua wewe au mwanafamilia yeyote katika kaya yako?.....
2. Ni kundi gani huathirika zaidi na magonjwa? (i) Watoto (ii) Watu wazima (iii) Wote
3. Ni mara ngapi wewe/ mwanafamilia wako ameugua: Ugonjwa uliopelekea wewe/ mwanafamilia kuhitaji vipimo/ matibabu ya hospitalini? (ndani ya miezi sita iliyopita)……..
4. Huwa unapata/mnapata wapi matibabu? (i) Hapa kijijini (ii) Nje ya kijiji hiki (iii) Ndani na nje ya kijiji hiki

SEHEMU C: Maelezo kuhusu zizi.

1) Una jumla ya wanyama wangapi? …….
2) Wanyama hao uliwanunua au walizaliwa hapa hapa? ……...
3) Ni nani haswa hushughulikia mifugo (i) Mwanaume (ii) Mwanamke (iii) Wote
4) Ni nini kazi yako kuhusiana na mifugo ……

5) (a) Je, unapata huduma za kitaalamu kutoka kwa afisa mifugo wa eneo hili? (i) Ndiyo (ii) Hapana

(b) Kama jibu ni hapana, kwanini?

6) Ni hatua zipi unachukua pale mnyama anapokuwa mgonjwa?

(i) Kumtafuta mtaalam (ii) Nanunua dawa na kutibu mwenyewe (iii) Nyingine (taja)…….

7) (a) Je wanyama wako wamechanjwa? (i) Ndiyo (ii) Hapana (iii) Sifahamu

(b) Kama ndiyo, (ni chanjo gani, kwa ajili ya nini)……

SEHEMU YA D: Uelewa juu ya magonjwa yanayoambukizwa kutoka kwa wanyama kwenda kwa binadamu

1) Ni magonjwa au matatizo gani huathiri wanyama wako mara nyingi (taja kulingana na uzito wa tatizo lake kwa kwako)

Ugonjwa	Wanyama wanaoathirika	Dalili za ugonjwa	Namna unavyosambazwa	Namna unavyozuia ugonjwa
1.				
2.				
3.				
4.				
5.				

2) (a) Umewahi kusikia magonjwa yanayosambazwa na wanyama kwenda kwa binadamun au binadamu kwa wanyama? (i) Ndiyo (ii) Hapana

(b) Kama ndiyo, taja yale unayoyajua /kuyakumbuka?.....…….

3) Je, wanyama wako huchangamana na wanyama wa mazizi mengine mfano, machungani? (i) Ndiyo (ii) Hapana (iii) Sijui

4) Je, umewahi kuwafanyia wanyama wako uhimirishaji kupandikiza mimba? (i)Ndiyo (ii) Hapana (iii) Sifahamu

SEHEMU YA E: Uelewa kuhusu ugonjwa wa kutupa mimba

1) (a) Umewahi kusikia kuhusu ugonjwa wa kutupa mimba? (i) Ndiyo (ii) Hapana

   (b) Kama ndiyo, Uliusikia wapi? (i) Jirani (ii) Rafiki (iii) Mtaalam

   (iv) Mwingine (taja)……

   (c) Kama jibu ni hapana, nenda swali la 8

2) (a) Je ugonjwa huo unaweza kusambazwa na wanyama kwenda kwa binadamu?

   (i) Ndiyo (ii) Hapana (iii) Sifahamu

   (b) Kama ndiyo, orodhesha njia zinazoweza kuleta maambukizi

   ……

   ……

   (c) Je ugonjwa huo ulishawahi kuathiri zizi lako? (i) Ndiyo (ii) Hapana (iii) Sifahamu

   (d) Kama ndiyo, Ulijuaje kuwa ni ugonjwa wa kutupa mimba kwa wanyama?

   ……

   (e) Ni wanyama gani walidhurika?

   ……..……

3) (a) Je, ni dalili zipi huonekana kwa mnyama kuhusiana na ugonjwa wa kutupa mimba? .....

   (b) Je, ni dalili zipi huonekana kwa binadamu anapopata homa za mara kwa mara?

   ……..……

4) Ni hatua gani huwa unachukua pale mnyama au binadamu anapopata ugonjwa wa kutupa mimba? ……..……..

5) Ni hatua gani huwa unachukua pale binadamu kwenye familia yako anapopata ugonjwa wa homa za mara kwa mara?… ……..……..

6) Je, umewahi kuona dalili zifuatazo kwenye kundi lako la wanyama?

Dalili	Ndiyo/hapana
Kutoka kwa mimba	
Kuzaa motto mfu	
Kukwama kwa kondo la nyuma	
Kutokushika mimba	
Kupungua kiasi cha maziwa	
Nyama kutokuwa na ubora unaokusudiwa	
Nyama kutokuwa na wingi (kiasi) kinachokusudiwa	

7) Je, unafikiri kuwa ugonjwa wa kutupa mimba unaweza kudhibitiwa au kuzuiwa?

(i) Ndiyo (ii) Hapana (iii) Sifahamu

8) Je, ni juhudi gani unafanya kujikinga na/ kuzuia ugonjwa wa homa za mara kwa mara (brucellosis)?

Njia	Ndiyo/hapana
Kuchemsha maziwa vizuri	
Kuvaa mifuko ya plastiki tunaposhika masalia ya wanyama	
Kuvaa glovus tunaposhika masalia ya wanyama	
Kunawa mikono kwa maji na sabuni mara baada ya kuhudumia wanyama	
Kufukia kwenye shimo masalia ya wanyama	
Kunawa na maji tu, baada ya kuhudumia wanyama	
Nazuia mtu mwenye kidonda au mchubuko kuhudumia wanyama au kushika masalia ya wanyama	
Nasafisha mazingira yangu vizuri	
Napika nyama	
Nyingine (taja)	

9) Je, unatumia maziwa yakiwa katika hali gani?

Maandalizi	Maziwa freshi yaliyochemshwa	Maziwa freshi yasiyochemshwa	Maziwa ya mgando yaliyochemshwa	Mgando yasiyochemshwa	Maziwa ya unga
Ndiyo/ hapana					

10) Kwanini unachemsha maziwa?

Sababu	Ndiyo/hapana
Kuua wadudu wanaosababisha magonjwa	
Tuliambiwa na mtaalam wa afya	
Watu wameendelea, hawakubali maziwa ambayo hayajachemshwa	
Nyingine (taja)	

11) Je, unajuaje kuwa maziwa yamechemka?

Sababu	Ndiyo/hapana
Yakichemka yanatoa povu	
Baada ya kutoa povu nayaacha jikoni kwa dakika kadhaa	
Yakishchemka naweka kijiko/sahani/kisosi na kuacha dakika kadhaa	
Yanachemka mpaka yanatengeneza utando wa mafuta juu	
Nyingine (taja)	

12) Kama hachemshi maziwa, ni kwanini?

Sababu	Ndiyo/hapana
Sina muda wa kutosha kuchemsha maziwa	
Ukichemsha maziwa unapunguza virutubisho	
Ukichemsha maziwa unaharibu radha	
Ukichemsha unapunguza mafuta (crimu)	
Ukosefu wa chanzo cha moto (kuni, mkaa n.k)	
Ukichemsha maziwa hayagamdi vizuri	
Ukichemsha maziwa ndama anakufa	
Nyingine (taja)	

13) Je, unapata wapi nyama kwa ajili ya chakula cha familia?

Chanzo	Chinjio la familia	Chinjio la mtaani	Jirani	Buchani	Soko la jumla	Wanyama pori	Nyingine (taja)
Ndiyo/ hapana							

14) (a) Je, nyama hiyo hukaguliwa na wataalamu kabla ya kupikwa? (i) Ndiyo (ii) Hapana

(b) Kama jibu ni hapana, kwanini?.....

15) (a) Je, wewe au kuna mwana familia yeyote katika kaya yako ambaye anakunywa damu ya wanyama? (i) Ndiyo (ii) Hapana
(b) Kama ndiyo, kwanini?.....
(c) Kama hapana, kwanini?.....

16) Je, ni nani haswa anayekunywa damu ya wanyama?

Mnywaji	Baba	Mama	Watoto	Mfanyakazi	Ndugu (taja)	Mwingine (taja)
Ndiyo/ hapana						

17) Je, unapata/ anapata wapi damu ya wanyama?

Chanzo	Ndiyo/hapana
Navuta/ anaivuta kwa mnyama aliye hai	
Kwenye chinjio la familia	
Kwenye bucha	
Kwenye chinjio la jumuia (sokoni)	
Kwa jiraniFrom relative	
Kwa ndugu (taja)	
Nyingine (taja)	

18) Je, Unaandaaje/ anaandaaje damu hiyo kabla ya kuinywa?

Njia	Ndiyo/Hapana
Hakuna maandalizi yoyote	
Damu mbichi inachanganywa na mchuzi wa moto	
Damu mbichi inachanganywa na maji	
Damu mbichi inachanganywa na maziwa	
Damu mbichi inachanganywa na utumbo, nyongo, ini lililosagwa n.k	
Damu mbichi inachangwa ruminal fluid (inatumika kama dawa)	
Nyingine (taja)	

19) Je, mnahifadhi vipi damu baada ya kuchinja mnyama?

Njia	Ndiyo/hapana
Baada ya kuchinja tunaacha inakauka yenyewe	
Ikiwa bado mbichi wanapewa mbwa	
Inachemshwa na kupewa mbwa	
Inapikwa na kuandaliwa kwa ajili ya chakula cha mifugo	
Nyingine (taja)	

20) Je, ni kwa namna gani unamhudumia/ kumsaidia ng'ombe/mbuzi anapozaa/ mimba ikitoka?

Namna	Ndiyo/ Hapana
Nashika hivo hivyo, bila kitu cha kujikinga	
Navaa mfuko wa plastiki	
Navaa glovus	
Nanawa na maji	
Nanawa na maji na sabuni	
Nyingine (taja)	

21) Je, mnahifadhi vipi/wapi masalia baada ya mnyama kuzaa/ mimba ikitoka/ mtoto mfu?

Namna	Ndiyo/ Hapana
Tunatupa porini	
Tunafukia	
Nyingine (taja)	

22) Je, wanyama wako huchangamana na wanyama wengine?

Aina ya wanyama	Wakati wa kiangazi		Wakati wa masika	
	Sehemu ya marisho	Sehemu ya maji	Sehemu ya marisho	Sehemu ya maji
Ng'ombe kutoka zizi jingine				
Mbuzi/kondoo kutoka zizi jingine				
Wanyama pori (taja)				

23) Mnawalaza wapi wanyama wenu wakati wa usiku? (i) Zizini (ii) Ndani tunachanganyika nao (iii) Wanalala nje (iv) Kwa jirani (v) Nyingine (taja)……

24) Je, unaamini kuwa ugonjwa wa kutupa mimba kwa mifugo unaweza kuepukika/ unazuilika? (i) Ndiyo (ii) Hapana (iii) Sifahamu

25) Kama ndiyo, Unafanya nini kuepuka ugonjwa huu katika familia yako?.....

26) Je, Unafikiri, serikali ifanye nini kutokomeza ugonjwa huu katika jamii zetu?.....

AKSANTE KWA USHIRIKIANO WAKO

Appendix 3: Interview guide to discuss and explore information on Knowledge, attitude and practices inrelation to locally appropriate control measure of brucellosis and their effectiveness in Kilosa District

1. What diseases or problems do you face in your herds regarding livestock production?

Disease	Species affected	Clinical signs	Mode of transmission	Control measure
1.				
2.				
3.				
4.				
5.				

2. Consumption of raw animal products

i) Who consume raw milk, blood and meat in your area?
   a) Raw milk…….……
   b) Raw meat……..…….…….
   c) Blood……

ii) Why are they consuming raw animal products?
   a) Raw milk…….……..…..…..…….
   b) Raw meat…..……...…..……...…….
   c) Blood…….……...……

iii) What are the effects of consuming raw animal products?
iv) What is the benefit of consuming cooked or properly boiled animal products?
v) What do you do to prevent people from not taking raw animal products?
vi) What should be done to overcome these beliefs (consumption of raw animal products)

3. Direct contact with aborted materials, placenta and other materials during and after abortion or delivery
   i) What preparations do you perform before assisting an animal at abortion or before delivery?
   ii) What is the importance of using protective gears?
   iii) Why are you not using protective gears when assisting animals on abortion or delivery or when touching aborted materials?
   iv) How do you dispose aborted materials, placenta or other materials after abortion or delivery?
   v) What should be done to make sure that people are not touching such materials with their own hands?

4. Vaccination against brucellosis
   i) Do you vaccinate your animals against brucellosis?……..
   ii) Are vaccinations available at any time once needed by a pastorist?.....
   iii) What does it cost to vaccinate one animal?
      a) Cattle…….

b) Goat……..
c) Sheep……
d) Other(s) specify……

iv) If No in (i) above, why are you not vaccinating your animals?
v) What should be done to make all animals vaccinated?

5. Overcrowding of animals
   i) Why do you keep your animals in crowded area?
   ii) What are the effects of keeping animals in crowded areas?
   iii) What should be done to make sure that animals are kept in a ventilated area?

6. Sharing same house with animals
   i) Why do you keep your animals inside the premise where you are living?
   ii) What is the effect of sharing same house with animals?
   iv) What do you do to avoid this problem?
   v) What should be done to make sure that people not to share same house with animals?

7. Animal movement and interaction
   i) Are your animals mixed with other animals from other herds or villages? Why?
   ii) Are your animals interact with wild life animals? Why?
   iii) What do you do to control these movements or interaction?
   iv) What are your suggestions to the authorities?

8. Medical services
   a) In animals
      i) What measures do you take when your animal is sick?
      ii) Do you get veterinary services timely?
      iii) Are the services affordable? How much do you pay or contribute?
      iv) What should be done to improve veterinary services?
   b) In human
      i) Are the diagnostic and treatment of brucellosis accessible and affordable?
      ii) Do you know symptoms and signs of the disease that will lead you seek for treatment?
      iii) For how long does it take for a person to present him or herself to the hospital after symptom arises?
      iv) What challenges do you face when attending to the hospital (to refer brucellosis cases only)
      v) What should be done to improve the situation in your hospitals or health centers?
9. Comments and additional questions from participants

Thank you for your time and participation in this study

Appendix 4: Translated version (Kiswahili version) of interview guide used for focus group discussion

MAJADILIANO KWA WANAWAKE JUU YA UFAHAMU, MTAZAMO NA VITENDO WANAVYOVIFANYA KAMA NJIA ASILIA ZINANOWASAIDIA KUZUIA AU KUJIKINGA NA MAAMBUKIZI YA UGONJWA WA KUTUPA MIMBA KWA WANYAMA WILAYA YA KILOSA MKOA WA MOROGORO.

1. (a) Ni magonjwa au matatizo gani yanayowasumbua nyie kama wafugaji?

Maogonjwa/matatizo	Wanyama wanaothirika	Dalili	Namna unavyosambazwa	Njia za kujikinga
1.				
2.				
3.				
4.				
5.				

(b) Je, mnaufahamu ugonjwa wa kutupa mimba kwa wanyama? Je unaambukizwa na kwa binadamu?

2. Ulaji wa mazao ya wanyama yakiwa mabichi

a) Ni nani hasa anayekunywa mazao hayo kwenye jamii yenu?

i. Maziwa mabichi…….……

ii. Nyama mbichi…….…….

iii. Damu ya wanyama……

b) Ni kwanini wanatumia mazao hayo ya wanyama yakiwa mabichi?

i. Maziwa mabichi…….……..…..…….

ii. Nyama mbichi…….……..…..……...……..…..…….

iii. Damu ya wanyama …….……...……

c) Ni kwanini hamchemshi maziwa? Mnakunywa damu? Mnakula nyama mbichi?

d) Ni madhara gani mtu anayapata anapotumia mazao ya wanyama yaliyo mabichi?

e) Ni faida gani mtu anazipata anapotumia mazao ya wanyama yaliyopikwa vizuri?

f) Kama wanawake, mnafanya nini kuzuia wanafamilia wenu wasitumie mazao ya wanyama yaliyo mabichi?

g) Mnafikiri nini kifanyike kuondoa dhana hizi katika jamii (Ulaji wa mazao ya wanyama yakiwa mabichi)

3. Mnashika au kugusa masalia ya mnyama anapotoa mimba, kondo la nyuma baada ya kazaa na masalia mengine kama mototo mfu n.k

a) Ni maandalizi gani mnafanya kabla ya kumsaidia mnyama anapozaa au mimba ikitoka?

b) Ni nini umuhimu wa kuvaa vifaa vya kujikinga kama mifuko ya plastiki au glovus?

c) Ni kwanini hamvai vifaa vya kujikinga kama vile mifuko ya plastiki au glovus wakati mnawasaidia wanyama?

d) Mnahifadhi vipi masalia ya wanyama mnyama anapotoa mimba, kondo la nyuma baada ya kazaa na masalia mengine kama mototo mfu n.k

e) Mnafikiri tufanye nini ili kuhakikisha kuwa watu hawashiki masalia ya wanyama kwa mikono mitupu?

4. Kinga dhidi ya ugonjwa wa kutupa mimba kwa wanyama

a) Wanyama wenu wamechanjwa dhidi ya ugonjwa wa kutupa mimba?

b) Je chanjo zinapatikana muda wowote mnapokuwa mnazihitaji?

c) Je, gharama za kuchanja wanyama wenu ni zipi?

i. Ng'ombe…….ii. mbuzi……iii. Kondoo……

iv. Wengine (taja)……

d) Kama hawachanji, ni kwanini hamchanji wanyama wenu?

e) Mnafikiri tufanye nini kuhakikisha mifugo yote inapata chanjo katika eneo hili?

5. Mkusanyiko wa wanyama katika eneo moja
    a) Ni kwanini mnahifadhi mifugo yenu kwenye mikusanyiko mikubwa?
    b) Ni nini madhara ya kuhifadhi mifugo kwenye mikusanyiko mikubwa?
    c) Mnafikiri tufanye nini kuhakikisha kuwa mifugo inahifadhiwa katika maeneo yenye nafasi ya kutosha na mzunguko mzuri wa hewa?
6. Kuchangia nyumba moja na mifugo
    a) Ni kwanini mnahifadhi mifugo yenu katika nyumba mnazoishi nyie? (Mnachangia nyumba moja)
    b) Ni nini madhara ya kuchangia nyumba moja na mifugo?
    c) Je, mnafanya nini kuepukana na tatizo hili?
    d) Mnafikiri tufanye nini kuhakikisha kuwa watu hawachangii nyumba moja na wanyama?
7. Mwingiliano wa wanyama
    a) Je, mifugo yenu wanachanganyika na mifugo kutoka kwenye mazizi mengine au vijiji vingine? Kwanini?
    b) Je, mifugo yenu inachanganyika na wanyama pori? kwanini?
    c) Je, mnafanya nini kuzuia au kuepuka mwingiliano huo?
    d) Mnashauri nini kwa taasisi husika ili kupambana na tatizo hili?

8. Huduma za matibabu
    a) Matibabu kwa mifugo
        i. Ni hatua gani huwa mnachukua pale mifugo yenu inaposhambuliwa na magonjwa?
        ii. Huwa mnapata huduma za kitaalam kutoka kwa maafisa mifugo kwa wakati?
        iii. Je, mnamudu gharama za matibabu? Mnalipia shilingi ngapi?
        iv. Je nini kifanyike kuboresha huduma za kitaalam kwa mifugo?

b) Matibabu kwa binadamu

i. Je, uchunguzi na matibabu ya homa za mara kwa mara (brucellosis in human) unapatikana, na mnamudu gharama zake?

ii. Je, mnajua dalili za ugonjwa huo zitakazo kupelekea utafute huduma ya matibabu hospitalini?

iii. Je, inamchukua mtu muda gani kwenda hospitalini mara baada ya dalili ya ugonjwa kuonekana?

iv. Ni changamoto zipi mnakumbana nazo mnapokwenda hospitalini (Hasa kwa homa za mara kwa mara (to refer brucellosis cases only)

v. Mnafikiri ni nini kifanyike kuboresha mazingira ya hospitalini au vituo vya afya katika kutibu homa za mara kwa mara?

vi. Je, mnachochote cha kuchangia au maswali ya nyongeza?

9. Maoni au ushauri kutoka kwa washiriki?

Asanteni kwa ushirikiano wenu

Appendix 5: Checklist for observing animals present and herd condition

1. Where animals are kept: In the boma or outside
2. How far is the boma built from the house of respondent: Near (less than 50 meters) or far (more than 50 meters)
3. Estimation number of animals depending on the boma available: Small (1-50), medium (51-100) or big (more than 100)
4. Interaction with companion animals (especially a dog): Yes, No or were not seen
5. Movement of young animals in and out of the house used by people in the household: Yes, No, not seen

Appendix 6: Translated version (Kiswahili version) of a check list used for direct observation

1. Wanyama wanalala wapi: Zizini au nje
2. Kuna umbali gani kutoka wanyama wanapolala mpaka kwenye nyumba wanayolala watu: Karibu (Mita chini ya 50) au mbali (Mita zaidi ya 50)
3. Makadilio ya wanyama waliopo: Wachache (1-50), wastani (51-100), wengi (zaidi ya 100)
4. Uhusiano na wanyama rafiki (Mbwa): Ndiyo, hapana, hawakuonekana
5. Kuingia na kutoka kwa wanyama madogo ndani nan je ya nyumba waishio binadamu: Ndiyo, hapana, hawakuonekana

Appendix 6: Vice chancellor permission

KIBALI CHA KUFANYA UTAFITI NCHINI TANZANIA

CHUO KIKUU CHA SOKOINE CHA KILIMO
OFISI YA MAKAMU WA MKUU WA CHA CHUO
S.L.P 3000, MOROGORO, TANZANIA
Simu: 023-2604523/2603511-4; Fax: 023-2604651, MOROGORO

Kumb. Zetu: SUA/CB/26 **Tarehe**: 22/10/2013

Mkurugenzi Mtendaji,
Halmashauri ya Wilaya, Kilosa,
KILOSA - MOROGORO..

UTAFITI WA WALIMU NA WANAFUNZI WA CHUO KIKUU

Madhumuni ya barua hii ni kumtambulisha kwako **Bi. Witness Jasson Bashaka** ambaye ni mwanafunzi wa mwaka wa pili wa shahada ya uzamili (**MSc. Public Health and Food Safety**) katika Chuo kikuu cha Sokoine cha Kilimo. Huyo hivi sasa yuko katika shughuli za utafiti.

Chuo kikuu cha Sokoine cha Kilimo (SUA) kilianzishwa chini ya sheria ("Universities Act No.7 of 2005") na Hati ya Idhini (SUA Charter,2007") ambayo ilianza kutumika Januari 1,2007. Hati Idhini ilichukua nafasi ya sheria Na.6 ya mwaka 1984. Moja ya sababu hiyo, waalimu,wanafunzi na watafiti wa Chuo hufanya tafiti mbalimbali katika nyakati zinazostahili.

Ili kufanikisha utekelezaji wa tafiti hizo Makamu wa Mkuu wa Chuo SUA amepewa mamlaka ya kutoa vibali kufanya utafiti nchini kwa waalimu, wanafunzi na watafiti wake kwa niaba ya serikali na Tume ya Sayansi na Tekinolojia.

Hivyo basi tunaomba umpatie Mtaalamu aliyetajwa hapo juu msaada atakaouhitaji ili kufanikisha uchunguzi wake. Gharama za malazi na chakula chake pamoja na usafiri wake atalipia mwenyewe. Msaada anaouhitaji zaidi ni **kuruhusiwa kufanya utafiti katika Wilaya yako.**

Kiini cha Utafiti wa Mtaalamu aliyetajwa hapo juu ni: **"A Study on the Potential Role of Women in Controlling Bruceullos."**

Sehemu anazofanyia utafiti huo ni **Wilaya ya Kilosa.** Ikiwa kuna baadhi ya sehemu ambazo zinazuiliwa, ni wajibu wako kuzuia zisitembelewe.

Muda wa utafiti huo ni kuanzia **Oktoba, 2013** hadi **Februari, 2014.**

Ikiwa utahitaji maelezo zaidi tafadhali wasiliana nami.

Wasaalam,

Prof.Gerald C. Monela
MAKAMU WA MKUU WA CHUO

Nakala: **Mwanafunzi Bi. Witness J. Bashaka**

MAKAMU WA MKUU WA CHUO
CHUO KIKUU CHA SOKOINE CHA KILIMO
S. L. P. 3000
MOROGORO. TANZANIA

Appendix 7: Kilosa District executive director permission

JAMHURI YA MUNGANO WA TANZANIA
OFISI YA WAZIRI MKUU
TAWALA ZA MIKOA NA SERIKALI ZA MITAA

HALMASHURI YA WILAYA YA KILOSA

Telegrams: "DISCO"
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DED DIR. 023 - 2623093
Fax No: 023 - 2623333
Email: kdcded@yahoo.co.uk

Ofisi ya Mkurugenzi Mtendaji (W)
S.L.P 65
KILOSA

31 Januari 2014

Kumb. Na: KDC/E.10/96

Makamu wa Mkuu wa Chuo
Chuo Kikuu cha Sokoine cha Kilimo
S.L.P 3000
MOROGORO.

YAH:UTAFITI WA WALIMU NA WANAFUNZI WA CHUO KIKUU

Tafadhali husika na somo tajwa hapo juu, ukirejea barua yako yenye Kumb Na. SUA/CB/26 ya tarehe 22/10/2010

Napenda kukujulisha kwamba Ofisi ya Mkurugenzi Mtendaji Wilaya imempatia ruhusa ya kufanya utafiti **Bi. Witness Jasson Bashaka unaohusu " A Study on the Potential Role of Women in Contoolling Bruceullos"** katika kata za Kilangali,Ulaya,Mikumi,Dumila,Kimamba A,Kimamba B,Rudewa,Madoto na Mamlaka ya Mji Kilosa.

Aidha Halmashauri haina bajeti kwa ajili ya mwanafunzi anayefanya utafiti huo, lakini atapata ushirikiano wa kutosha katika kufanikisha utafiti wake

Amandus L. Mtani
Kny: MKURUGENZI MTENDAJI (W)
KILOSA.

Kny. MKURUGENZI MTENDAJI (W)
KILOSA

Nakala: Afisa Mtendaji Mamlaka ya Mji Kilosa

Afisa Mtendaji Kata kata ya Kilangali

Afisa Mtendaji Kata kata ya Ulaya

Afisa Mendaji Kata Kata yaMikumi

Afisa Mtendaji Kata Kata ya Dumila

Afisa Mtendaji Kata Kata ya Kimamba A

Afisa Mtendaji Kata Kata ya Kimamba B

Afisa Mtendaji Kata Kata ya Rudewa

Afisa Mtendaji Kata Kata ya Madoto

Appendix 8: Field photos

	
Maasai smoking meat after slaughtering	Maasai eating undercooked smoked meat at slaughtering area
	
A Maasai holding a goats' kidney	A maasai eating goats' kidney
	
Maasai slaughtering goats at Mbwade public market place while giving some offal's to a dog.	A dog eating offal's given at Mbwade public market place

	
Unhygienic slaughtering house and dogs resting under the table	A two days retained placenta
	
People waiting meat at the butcher	A two month old child drinking cow's milk

Appendix 9: Calculation for Effectiveness of Local Control Measures

A local control measure that would help reduce the rate of brucellosis in Kilosa's population is boiling milk. Its effectiveness is calculated basing on those who boil milk either to kill pathogens and those mentioned that they sometimes boil milk when they feel like boiling it.

1. Effectiveness of boiling milk to kill pathogens

Effectiveness = (1-Odds ratio) x 100

(From Table 8: Multivariate analysis of risk factors for transmission), Odds ratio of those boiling milk to kill pathogens is 0.5281.

Therefore,

Effectiveness = (1-0.5281) x 100

Effectiveness = 0.4719 x 100

Effectiveness = 47.19%

2. Effectiveness of boiling milk when they decide (sometimes boil, sometimes not boil)

(From Table 8: Multivariate analysis of risk factors for transmission), Odds ratio of those boiling milk when decide to is 0.8168.

Therefore,

Effectiveness = (1-0.8168) x 100

Effectiveness = 0.1832 x 100

Effectiveness = 18.32%