BRUCELLA INFECTION AMONG ABATTOIR WORKERS IN KAMPALA AND MBARARA DISTRICTS, UGANDA

BY

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DECLARATION

I Immaculate Nabukenya, do hereby declare that this research is my original work and has not been published or submitted for the award of a Diploma or Degree to any institution.

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DEDICATION

I dedicate this thesis to my best friend Dr. Christine Namwanje who was there with me through it all, and my daughter Ingrid Julian for being patient with me.

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LIST OF ABBREVIATIONS AND ACRONYMS

MAAIF	Ministry of Agriculture, Animal industry and Fisheries
MoH	Ministry of Health
SPSS	Statistical Package for Social Sciences
UMI	Uganda Meat Industries abattoir
MAT	Microplate Agglutination Test
STAT	Standard Tube Agglutination Test
ELISA	Enzyme-Linked Immunosorbent Assay
cELISA	competitive Enzyme-Linked Immunosorbent Assay
MCA	Municipal Council abattoir
KCC	Kampala City Council
HC	Head of Cattle
SDA	Seventh Day Adventist
KII	Key Informant Interview
POU	Pyrexia of Unknown Origin
RBT	Rose Bengal Test

OPERATIONAL DEFINITIONS

Brucella infection was defined in this study as exposure to Brucella organisms leading to subsequent production of antibodies detected agglutination with Microplate Agglutination test and confirmed by titres of 1:80 or greater using Standard Tube Agglutination Test (STAT).

Malaria parasitaemia was defined in this study as presence of trophozoites in Giemsa stained blood slides. Classification was done as per high power field (HPF) where +1 = 1-10 parasites per 100 fields examined, +2 = 10-100 parasites per 100 fields examined, +3 = 1-10 parasites per 10 fields examined.

Abattoir workers were people operating/doing work routinely in these abattoirs (slaughter places for cattle, goats and sheep) as a source of their livelihoods. They included those who inspect, slaughter, prepare food within, dress the carcass, the cleaners, meat and offal traders/sellers, offal cleaners, those who prepare skins/hides, head and hooves.

Protective gear was defined as a full set comprising of a white coat or overall, gloves, apron and gumboots. The set would protect someone from direct contact with blood and possibly the exposure reduced. This would thus leave only inhalation as the possible mode of infection.

ABSTRACT

Introduction: Brucellosis is among the most widespread zoonotic infections. The disease is transmitted from infected animals by direct contact with blood, fetuses and fetal membranes, uterine secretions, and aborted material or through consumption of infected, raw animal products. In Uganda, a study done among hospital patients estimated prevalence of the disease to be 18-24%. There is no information available to the public domain on prevalence of this important disease among abattoir workers in Uganda. The objective of the study was to estimate the seroprevalence of brucellosis and associated risk factors among abattoir workers in Kampala and Mbarara districts.

Methodology: A survey with nested cross-sectional study was done in Kampala City Council and Mbarara Municipal Council abattoirs. Current abattoir workers aged 18 years and above who had worked for at least three months and who consented to participate in the study were included. A sample size of 232 participants was studied. Socio-demographic, occupational and health-related data was captured using a pre-tested and pre-coded questionnaire. Blood was obtained from the cephalic vein of each participant using a vaccutainer system. This was assessed for malaria parasitaemia a common misdiagnosis for brucellosis using a Giemsa stained thick blood smear while brucellosis was tested using Microplate Agglutination Test and Standard Tube Agglutination Test. Twelve key informant interviews were also conducted including a manager, a meat inspector, a health worker from each district and six participants with a history of brucellosis. Data was double entered in Epidata and analyzed in SPSS version 12.0. Risk factor analysis was done by binary logistic regression.

Results: The proportion of people with antibodies to brucella was 10% (95%CI 6 – 16; n=232), that of malaria was 3% (95%CI 0 – 6; n=232). One case of dual infection of brucellosis and malaria was found and malaria was due to *Plasmodium falciparum.* Although bivariable analysis identified duration of exposure, district with abattoir and keeping animals at home as important factors, the final regression model showed only use of protective gear OR 0.3 (95%CI 0.02 – 0.8) as a significant risk factor.

Conclusions: This study has clearly shown that brucella infection is a real risk among abattoir workers. The use of full protective gear when working reduces risk significantly. Dual infection of brucella and malaria is low. This calls for sensitization and increased public health care programs by the authorities in the control of this emerging problem.

CHAPTER ONE

INTRODUCTION

1.1 Background of the study

Health of both human and animal population is pivotal for development, prosperity and stability. The burden of infectious diseases affects health and reproductivity of livestock, thereby greatly reducing its value and opportunities for trade (Wahaab, 2003). Brucellosis is among the most widespread zoonotic infections. It is one of the most important zoonoses in terms of human suffering and economic losses in livestock (Ayyildiz, 2004; Henk and Sally, 2004). However, it is often a neglected cause of morbidity in many regions of the world. The disease is most common in rural areas and among those involved in animal husbandry. It also occurs in urban settings when animals are kept in compounds around houses and among meat-packers, dairy workers, and veterinarians (Henk and Sally, 2004).

Brucellosis is transmitted from animals (cattle, goats, pigs, sheep camels and buffaloes) to humans by bacteria belonging to the genus *Brucella* (Wahaab, 2003). *Brucella abortus*, *Brucella suis*, and *Brucella melitensis* are the causative agents, which have, respectively, cattle, swine, goats and sheep as their main hosts. *Brucella melitensis* (sheep and goats) is of highest pathogenicity; *B. abortus* (cattle) is of moderate pathogenicity, *B. suis* (pigs) of high pathogenicity and *B. canis* (dogs) of moderate pathogenicity to humans (McDermott and Arimi, 2002). The disease is transmitted from infected animals by direct contact with blood, fetuses and fetal membranes, uterine secretions, and aborted material or through consumption of infected, raw animal products, of which milk and milk products are the most

important (Ayyildiz, 2004; McDermott and Arimi, 2002). In addition to this, inhalation has been cited as a potential mode of transmission among abattoir and laboratory workers (Kaufmann *et al.*, 1980).

The global burden of human brucellosis remains enormous; it causes more than 500,000 infections per year worldwide (El Ansary *et al.*, 2001, Refai, 2002). Brucellosis has been reported from almost all countries in Africa (Bigler *et al.*, 2002). In Africa, the prevalence varies from 5-55% in humans and 8-46% in animals (El Ansary *et al.*, 2001). The animals thus pose a big threat in transmission of the disease to humans. In Uganda, a study done among hospital patients estimated prevalence of brucellosis to be 18-24% (Ndyabahinduka and Chu, 1984). A study by Ssekawojjwa (2006) estimated the seroprevalence to be 6 – 7% among herdsmen and consumers of raw milk and products. There is no published data on prevalence of this important disease among abattoir workers which is a high risk group.

Zoonotic diseases like brucellosis are not only of veterinary importance but also severely affect human health, contributing to morbidity and reduction of working capacity with concomitant loss of income. Human brucellosis causes physical and psychological suffering due to infection, hospitalization, the cost of drugs, and the loss of work or income due to illness. It is estimated that cases of the disease in humans are under diagnosed and misreported and that the disease continues to be a major human health hazard (McDermott and Arimi, 2002).

In Uganda, livestock production contributes about 50% of the Gross Domestic Product and populations are estimated at 7.5 million cattle and 5.2 million goats and sheep (MAAIF, 2001). Many rural dwellers rely on livestock production as a source of their livelihood and yet disease is most common in rural areas. Occupational contact with infected animals by Veterinarians, packing house employees, government meat inspectors, farmers and livestock truckers are likely to be exposed and at high risk due to the nature of their work. The aim of this study therefore is to find the seroprevalence of brucellosis among abattoir workers in Kampala and Mbarara districts.

1.2 Problem statement

Uganda has an agriculture-based economy of which livestock forms an important part. Brucellosis is a highly prevalent disease in Uganda among livestock with 7-42.2% (Nabaasa, 2002; Ocoma, 2002; Nakavuma *et al.*, 1999; Bernard *et al.*, 2005; Ssekawojjwa, 2006) among cattle and thus poses a big threat to abattoir workers and consumers. Among humans, a study about brucellosis published in 1984 was about the prevalence of brucellosis among hospital patients while that in 2006 was among herdsmen and consumers of raw milk or products. There is no published study on prevalence of brucellosis in Uganda among abattoir workers who are a high risk group.

Brucellosis is a febrile condition especially in acute form and thus resembles malaria in presentation. Malaria is endemic in 95% of Uganda and accounts for up to 40% of outpatient visits (MoH, 2000). With increasing prevalence of malaria in Uganda,

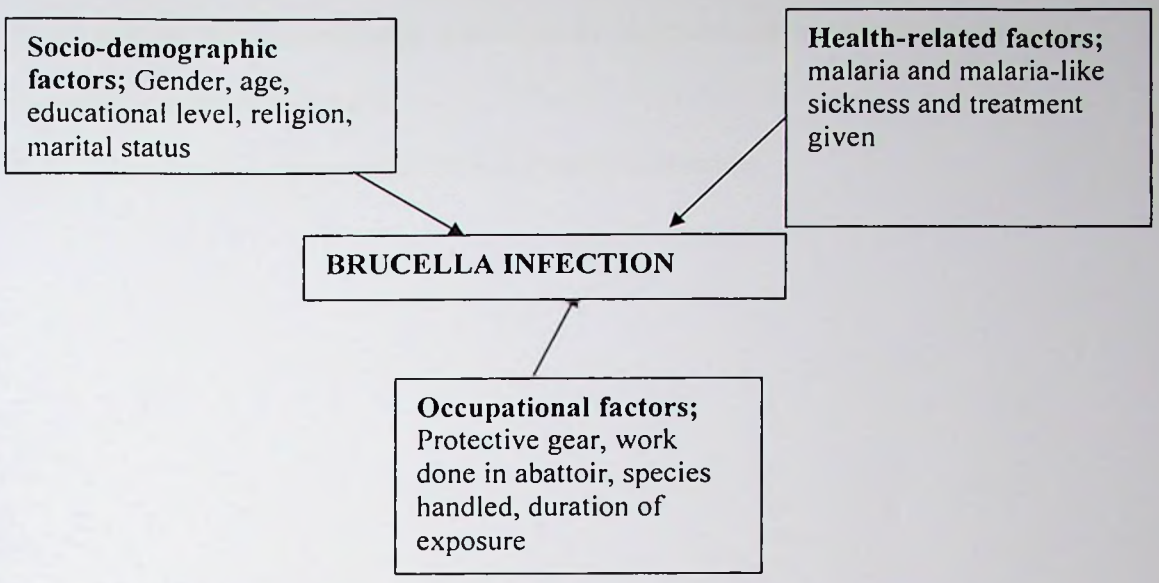
clinicians are more likely to diagnose and treat brucellosis as malaria. However, there is also no information on dual occurrence of malaria and brucellosis. Brucellosis may therefore be considered a differential diagnosis in febrile patients whose occupation brings them into contact with reservoirs of the disease.

1.3 Significance of the study

There is no policy addressing control of brucellosis in the general population and specifically among abattoir workers. In the Ministry of Health policy on treatment of malaria-like diseases or conditions, brucellosis is not addressed. There is however no information regarding prevalence of brucellosis among abattoir workers to inform and influence policy formulation. In addition studies have not been done on dual occurrence of malaria and brucellosis, the former being a common misdiagnosis. Findings from this study therefore may be used to formulate policy on control of brucellosis among abattoir workers and the management of dual infection of brucellosis and malaria.

1.4 Conceptual framework

Several factors to be studied are mapped out that may independently predict occurrence of brucellosis:



1.5 Research questions

1. What is the prevalence of brucella infection among abattoir workers in Kampala and Mbarara districts?
2. What are the factors associated with brucella infection among abattoir workers in Kampala and Mbarara districts?
3. What is the prevalence of brucella and malaria infection?

1.6 Study objectives

1.6.1 General objective

To establish the prevalence and factors associated with brucella infection among abattoir workers in Kampala and Mbarara districts.

1.6.2 Specific objectives

1. To establish the prevalence of brucella infection among abattoir workers in Kampala and Mbarara districts.

2. To identify factors associated with brucella infection among abattoir workers in Kampala and Mbarara districts.

3. To determine prevalence of brucella and malaria infection.

CHAPTER TWO

LITERATURE REVIEW

2.1 Prevalence of brucellosis among humans

Prevalence of human brucellosis in any area of the world parallels animal prevalence although the likelihood of disease is further greatly influenced by degree of contact with animals or their excreta and especially by ingestion of unpastuerised milk or inadequately cooked meat (Ayyildiz, 2004; Maloney and Fraser, 2004). Internationally prevalence of brucellosis varies across nations but is obviously higher in more agrarian societies and in places where handling of animal and dairy products is less stringent. Highest incidence is in the Middle East, Mediterranean region, Peru, India, China, Mexico and Africa (Maloney and Fraser, 2004).

A study among 256 abattoir workers San Luis, Argentina found 11.7% reactive to brucellosis antibodies. The highest rate was 44.2% among those who had contact with blood and viscera, and 26.1% among workers at slaughter section (Martinez *et al.*, 1986). Studies carried out in India to detect the antibodies against zoonotic intracellular bacterial infections viz., brucellosis, listeriosis and tuberculosis in abattoir associated personnel employing dot-ELISA found that out of 165 serum samples tested 25.5, 40.0 and 10.9 per cent were detected as positive for brucellosis, listeriosis and tuberculosis, respectively (Barbuddhe *et al., 2000*). In another study among abattoir workers in three Victorian abattoirs found that out of nearly 1000 specimens of serum tested for *Brucella* antibodies, 25% gave positive results with a wide variation in frequency in different abattoirs (Gilbert *et al.*, 1980).

In a study done in Argentina where screening of 280 serum specimens of risk groups and 100 of control group (general population) by STAT was done gave positive result in 50 (17.9%) and four (4.0%), respectively. The differences between risk and control group was found to be significant ($P < 0.001$). The seropositivity rates were 24.1% in the veterinarians (n=58), 19.6% (n=112) in the butchers, 16.7% (n=60) in the abattoir workers and 8.0% (n=50) in the farm workers (Martinez *et al.*, 1986). The differences in the seropositivity rates obtained from the occupational groups were not significant. However, seropositivity was not associated with the demographic characteristics of the individuals.

Brucellosis remains endemic in Saudi Arabia where the national seroprevalence of the disease is 15%, with recent national statistics indicating that the disease incidence in humans is close to 40 cases per 100,000 (Memish, 2001). A total of 860 human and 1637 animal sera were tested for antibodies against *Brucella* species and 28 (3.8%) people were found seropositive for brucellosis (Schelling *et al.*, 2003). A study in Jordan found *Brucella* antibody titres for the 900 human serum samples obtained using the microtitre agglutination test. The cumulative percentage of the serum samples showing a titre reading greater than 1:80 was higher in the at-risk group than among the normal population (7% compared to 4.1%). Although these results were not statistically significant, the higher percentage of positive reactors among the high-risk group may indicate an increased risk factor among professional agricultural and veterinary personnel in Jordan (Mrunalini and Ramasastry, 1999).

A study among hospital patients in Markudi Nigeria showed overall brucellosis prevalence of 7.6% and of this, 43.8% were abattoir workers and butchers (Ofukwu *et al.*, 2005). In a study on acute febrile illnesses in Egypt by Afifi *et al.*, 2005, of 10,130 patients evaluated between 1999 and 2003, 5% were culture positive for *Salmonella typhi*, 3% for *Brucella*, and 2% for other pathogens. Patients with pyrexia of unknown origin (PUO) who were predisposed to brucellosis through rearing of animals and consumption of different animal products were tested for presence of *Brucella abortus* antibodies using Rose Bengal and serum agglutination antigens. Of the 500 patients, 26 (5.2%) had *B. abortus* antibody (Baba *et al.*, 2001).

Over 55% of 7161 people examined in different parts of Western Nigeria have positive *Brucella abortus* antibodies in their sera. Higher incidences of titres were found among dairy farmers and slaughter men than in the general population. The rates of infection among human and cattle populations in two farms studied were very similar (Alausa and Awoseyi, 1976).

From previous studies done in Uganda about animal brucellosis, prevalence was between 7 and 42.2% (Nakavuma *et al.*, 1999; Nabaasa, 2002; Ocoma, 2002). A study in Mbarara district in 2005, a total of 315 herds (of 10,562 animals) was tested for brucellosis using the serum Rose Bengal Test. The herd prevalence for brucellosis was 55.6% individual-animal prevalence 15.8% and within-herd range 1-90%(Bernard *et al.*, 2005). The prevalence of brucellosis would therefore parallel this prevalence in animals. In Uganda, a study done among hospital patients estimated prevalence of brucellosis to be 18-24% (Ndyabahinduka and Chu, 1984). A study by

Ssekawojjwa (2006) estimated the seroprevalence to be 6 – 7% among herdsmen and consumers of raw milk and products.

Pathogenesis

Once infection is established the organisms are carried from the point of entry to the regional lymph nodes, leading to acute lymphadenitis. Bacteria multiply inside phagocytes and disseminate via systemic circulation to other organs or tissues such as the spleen, lymph nodes, uterus and the mammary gland. In males, B. abortus can be found mostly in the testicles where the organisms cause orchitis, and accessory sex glands as well as lymphoid tissue. The bacteremia can last for months, and in cases of chronic disease it can be intermittent, recurring mostly around parturition.

The bacteria localize in the uterus during gestation and cause ulceration of the endometrium. The initial lesions are seen in the wall of the uterus, but the organism quickly spreads to the placental cotyledons and destroys the villi. Depending on the severity of the lesions potential sequelae include: abortion, especially in the last trimester, stillbirths, and premature or weak offspring. Following abortion or parturition the organism is shed by the uterus for weeks, and the animal remains infected for life thus may infect other people and animals that get in contact.

2.2 Diagnosis of brucellosis

Diagnosis of brucellosis based on clinical picture is often difficult to establish, largely due to similarity with clinical presentations of other infections prevalent in sub-Saharan Africa such as malaria. Therefore, laboratory testing is an absolute prerequisite for a proper diagnosis of human and animal brucellosis. Laboratory

diagnosis of brucellosis in animals or man may be achieved either through blood culture or serological testing (Henk *et al.*, 1999).

Typical severe acute brucellosis in its early stages cannot be diagnosed on clinical grounds alone (Maloney and Fraser, 2004, Bettelheim *et al.*, 1984, Muriuki *et al.*, 1997). Symptoms and signs are non-specific, and several other febrile illnesses may be simulated, for example glandular fever, influenza, malaria and enteric infections. Also, when an unusual complication is present, it may be overlooked (Afifi *et al.*, 2005; Muriuki *et al.*, 1997).

Laboratory tests such as culture and serological tests including the serum agglutination test (SAT or STAT), anti-human globulin test (Coombs test), complement fixation test and enzyme-linked immunosorbent assay (ELISA), therefore, are indispensable for an accurate diagnosis (Bettelheim *et al.*, 1984, Henk *et al.*, 1999). Only relatively skilled personnel in well-equipped laboratories can perform SAT and ELISA, and these tests are too elaborate for widespread application under field conditions. A rapid dipstick assay as an easy-to-perform method for diagnosis of acute human brucellosis was developed and evaluated. It gave a sensitivity of 89.0% and specificity of 98.6% when tested on 150 confirmed cases and 342 control patients. Robustness and simplicity make the assay highly suitable for application under field conditions (Henk *et al.*, 1999).

2.3 Factors associated with prevalence

2.3.1 Animal handling

A study of 244 patients in Minnesota from 1937 to 1954 revealed that 81% became infected by contact with animals. In Iowa, out of 2405 cases between 1940 and 1946, 75% were classified as having had contact with animals (Stanley and Meyer, 1975). Among animal rearers, the highest prevalence (20%) was observed among cattle handlers followed in decreasing order of prevalence by goat rearers (10%), mixed sheep and cattle rearers (9%), mixed sheep and goat rearers (8%), and 4% between each of sheep rearers and non-rearers of animals. A dynamic model of livestock-to-human brucellosis transmission was developed in Mongolia considering transmission within sheep and cattle populations and the transmission to humans as additive components. The simultaneously fitted sheep-human and cattle-human contact rates show that 90% of human brucellosis was small ruminant derived (Zinstang *et al.*, 2005).

A study of brucellosis prevalence between 1963-1975 in Florida by Bigler *et al.*, 1977 showed that of the occupations identified, 44% were related to the livestock-producing industry, 16% to the meat processing industry and 28% to hunters, housewives, students and children. Some of the cases did not fall in any of these categories (12%).

2.3.2 Consumption of animal products

Where occurrence of brucellosis in animals is high, transmission to humans not directly handling them get the infection from consumption of raw milk, milk products

and meat not cooked well (Maloney and Fraser, 2004). Risk factor analysis in several studies identified animal contact and consumption of raw dairy products was significantly associated with brucellosis. In addition, one study showed that consumers of yogurt and fresh goat milk had higher prevalence (20%) than consumers of other milk products (Afifi *et al.*, 2005). A study of seroprevalence of brucellosis among consumers of raw milk and products in Kampala by Ssekawojjwa, 2006 found it at 7% and thus identified to be a risk factor ($P<0.05$).

2.3.3 Gender and age

Age is generally not incriminated but the disease is rare in very young and elderly. In developing countries, literature has shown that it is more common in children because of lack of pasteurization of milk and working in agrarian societies (Schelling *et al.*, 2004).

Regarding sex, since exposures are occupational, males are sometimes more exposed and affected with ratios of 5:2 to 5:3.9 (Baba *et al.*, 2001). A study by Bigler *et al.*, 1977 about brucellosis in Florida, White males in the 25-34 and 35-44 deciles were most affected. In a study in nomadic tribes in Chad, the total number of human and animal sera tested were 911 and 1637, respectively, for antibodies against *Brucella* species and 16 brucellosis positive human sera resulted in a seroprevalence rate of 2%. Male participants were significantly more often brucellosis seropositive than females (Schelling *et al.*, 2004).

2.4 Brucellosis and malaria

Malaria is a potentially life-threatening disease, causing highest morbidities (at least 300 million acute cases) and one to three million deaths annually worldwide. More than 80% of the deaths are estimated to occur in sub-Saharan Africa, mostly among children under five years of age. Recent estimates of the global burden of malaria are even higher, with one study estimating that 515 million cases of clinical malaria occurred in 2002. Overall, malaria accounts for 10% of Africa's disease burden, and it is estimated that malaria costs the continent more than $12 billion annually. Malaria is endemic in 95% of Uganda responsible for up to 40% of the outpatient visits (MoH, 2000). Patients may present with fever and a wide range of symptoms. Humans are infected with *Plasmodium* protozoa when bitten by an infective female *Anopheles* mosquito vector. Four species can cause disease: *Plasmodium falciparum*, *Plasmodium vivax*, *Plasmodium ovale*, and *Plasmodium malariae*. Timely diagnosis of the correct species is required because the particular species of *P. falciparum* can be fatal and is often resistant to standard chloroquine treatment. Occasionally, patients may be infected with more than a single species. *P. falciparum* and *P. vivax* are responsible for the majority of new infections. Each species has a defined area of endemicity, although geographic overlap is common. Species can usually be distinguished by morphology on a thin blood smear.

Severe disease is typically seen with *P. falciparum* infection. This species is more virulent because it may create high levels of parasitaemia and sequestration that contribute to end-organ damage. Sequestration is a specific property of this species. As it develops through the 48-hour life cycle, it demonstrates adherence properties,

which result in the sequestration of the parasite in small post capillary vessels. For this reason, only early forms are observed in the peripheral blood, before the sequestration property develops. This is an important diagnostic clue that the patient is infected with *P. falciparum* (Mutanda, 1998).

Some studies have related brucellosis and malaria since they present with similar signs and symptoms. This masks diagnosis of brucellosis as malaria especially in areas where malaria is endemic and with a high prevalence (MoH, 2000).

A microbiologically confirmed case of *Brucella melitensis* and *Plasmodium falciparum* malaria co-infection in a febrile traveler returning from Chad, Africa has been reported. The patient had been doing veterinary research in rural Chad; during that time she took no anti-malarial chemoprophylaxis (Badiaga *et al.*, 2005).

Monthly disease summary sheets from 1986-1992 of 60 dispensaries, clinics and hospitals in Narok district, Kenya were reviewed for the occurrence of brucellosis and other diseases with "flu-like symptoms". Diseases with these symptoms accounted for about 52% of the 1,037,875 cases reported for the time period. These were classified as malaria (79.3%), rheumatism (7.1%), POU (2.4%), and brucellosis (0.8%). Brucellosis was diagnosed by a positive Rose Bengal test (RBT) routinely conducted in seven out of the 60 health units. In these units, 55% of flu-like cases were classified as malaria and 21.2% as brucellosis (Muriuki *et al.*, 1997).

Out of 355 patients attending a private clinic in Kampala, whose blood was examined for both malaria and typhoid, 97% were positive for malaria parasites compared to

0.84% with significant O and H *Salmonella typhi* antibody titres of > 1:80. Where multiple tests were requested on one patient having general malaise or body joint pains and/or constant headaches, malaria was found to play a major role (73%) compared to syphilis (4.3%) and brucellosis (13.3%). Malaria parasites were seen in normal sizes and in somehow young or stunted forms. The latter were found more often in patients who had experienced one or a combination of the following: intermittent fevers, backache, headache, tiredness, joint and/or neck pains, and who had already received treatment for malaria (Mutanda, 1998).

CHAPTER THREE

METHODS

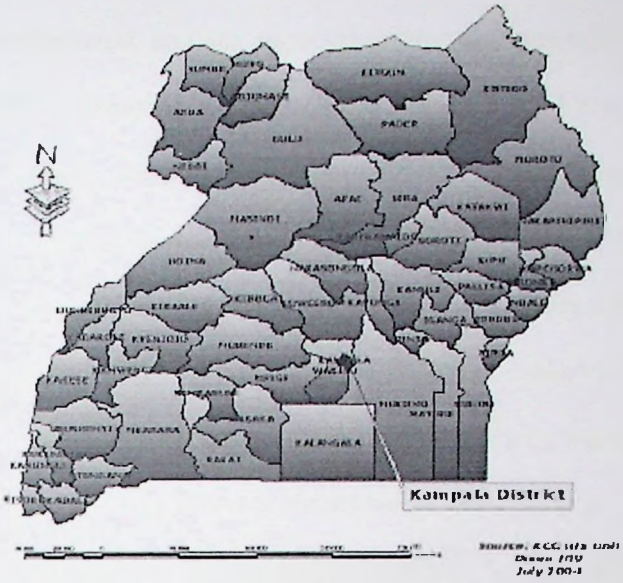
3.1 Study design

This study was a survey (descriptive) with a nested cross-sectional study (analytic component). Both qualitative and quantitative data collection methods were used.

3.2 Study setting

The study was carried out in Kampala City Council abattoir in Kampala district and Mbarara Municipal Council abattoir in Mbarara district. Kampala was chosen because it has the highest population in Uganda, handles a big slaughter load and also gets animals for slaughter from many parts of the country thus representing significant risk to the abattoir workers. On the other hand, Mbarara was chosen conveniently to represent rural districts in Uganda on the assumption that abattoir workers are also most likely keeping animals at home and thus at higher risk of brucellosis exposure. In addition, Mbarara has many animals and many studies had been conducted about animal brucellosis in the district. This study therefore sought to find out brucellosis infection among humans in these districts (Refer to map of Uganda below).

Map 1 Showing different districts of Uganda highlighting Mbarara and Kampala districts



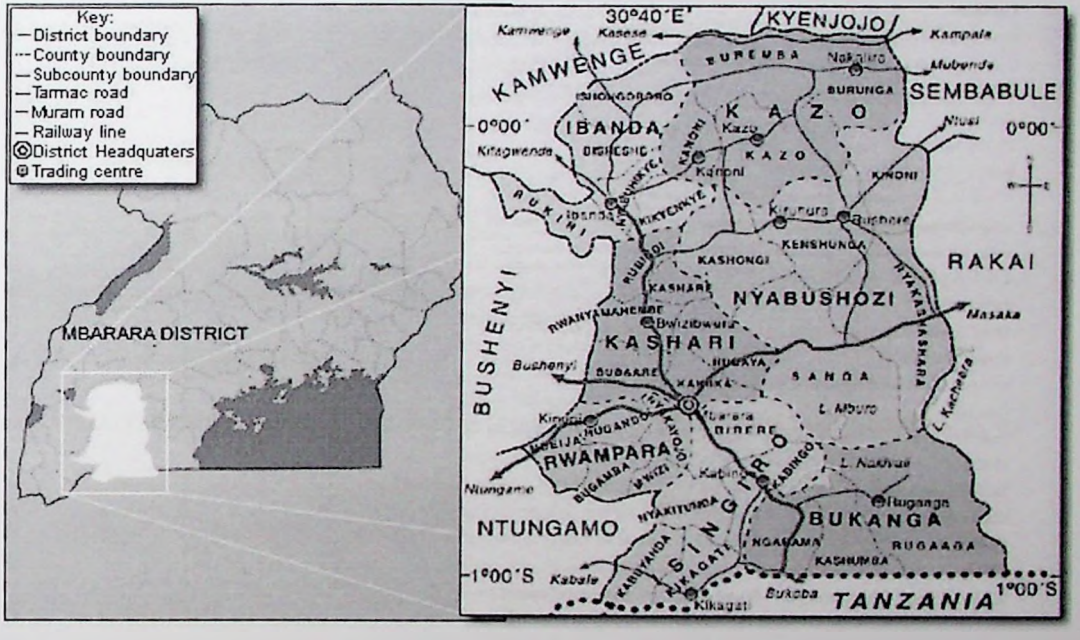
Map 2 Showing boundaries of Kampala district

Kampala is the capital city of Uganda with five divisions. With a population of 1,208,544 (UBOS, 2003), it is the largest city in Uganda. It is located at 0°19'N, 32°35'E, at 1,190 (3,900 ft) above sea level. It has five recognized slaughter houses with three of these in the central division i.e. Uganda Meat Industries (UMI), Kampala City Council (KCC) and Kalerwe abattoirs. This study was proposed to be carried out in Uganda Meat Industries and Kampala City Council abattoirs but was

eventually done only in the latter. Management in the UMI abattoir was not cooperative and has about 40 routine workers which is a small number.

KCC abattoir is located on old Port Bell road in Central division of Kampala district. Animals slaughtered in Kampala district are brought in from all parts of the country mostly Mbarara, Ntungamo, Bushenyi, Masaka, Kibaale, Kiboga, Mpigi, Mubende, Rakai and Jinja districts. KCC abattoir handles a bigger number of these animals and has about 220 routine workers. Different categories of workers and participated in this study including slaughterers, meat inspectors, transporters, traders and cleaners.

Map 3 Showing Mbarara district boundaries



Mbarara Municipal Council abattoir is located in Mbarara town in Ruti ward, Kamukuzi division along Mbarara-Kabale road. Mbarara district is one of the 80 districts in Uganda which is located in South-western region. It on longitude 30° 20′ E and 31° 20′ W, latitude 1° 30′ S and 0° 30′ N. The district is located about 266km from Kampala on the road to Kabale. Mbarara district is bordered by the districts of

Ntungamo, Sembabule, Rakai, Bushenyi and the neighbouring United Republic of Tanzania to the south. It has a population of 360.008 (UBOS, 2003), updated in 2005 from 2002 census. The district has one main recognized abattoir but has other small slaughter places especially on market days. The main abattoir has about 80 workers. Animals i.e. cattle, goats and sheep slaughtered there are from Mbarara and nearby districts including Kiruhura, Isingiro, Ibanda, Ntungamo.

3.3 Study participants

3.3.1 Target population:

Abattoir workers and all people having routine contact with animals as part of their occupation.

3.3.2 Accessible population:

All people working in KCC and Mbarara Municipal Council abattoirs during the study period.

3.3.3 Study population:

All workers in these abattoirs fulfilling the eligibility criteria and who consented to participate in the study by signing the consent form.

3.4 Eligibility criteria

3.4.1 Inclusion criteria:

Men and women, 18 years and above who had worked for at least three months in the selected abattoirs, and who had consented to participate in the study by signing the consent form (Appendix III, IV).

3.4.2 Exclusion criteria:

None.

3.5 Sample size estimation

In order to determine the prevalence and factors associated with brucellosis among abattoir workers, we estimated two different sample sizes for the survey and cross sectional studies. A study by Ndyabahinduka and Chu, (1984) which reported a seroprevalence of brucellosis of 18% among hospital patients was used as the best estimate of brucellosis in Uganda and to be 95% confident that the error in he estimate is 5%, the sample size for the survey was calculated using standard formula (Kish and Leslie, 1965; Martin *et al.*, 1987) below.

$$n = \frac{Z_\alpha^2[PQ]}{d^2}$$

Where n is number in the sample

Z_α is the allowable error in the normal distribution = 1.96

P is proportion of population with disease = 0.18

Q is the complement of P = 0.82

d is the allowable error in the estimate

Inserting into the formula above for prevalence,

$$n = \frac{1.96*1.96(0.18*0.82)}{0.05^2}$$

n = 227

To account for missing data, a 10% allowance in sample size was made bringing the sample size estimate to 250 people.

In order to identify factors associated with brucellosis the cross sectional study design was employed. Use of full protective gear was assumed to be a key factor associated

with brucellosis among abattoir workers. I further assumed the seroprevalence of brucellosis to be 15% prevalence among those who use full protective gear (gloves, white coat/overall, gumboots and or no head gear) while those without full protective gear I assumed 50% prevalence of brucellosis. I therefore calculated the sample size using the formula below by Martin *et al.*, 1987.

$$n = \frac{[Z_\alpha (2PQ)^{1/2} - Z_\beta (P_e Q_e + P_c Q_c)^{1/2}]^2}{(P_e - P_c)^2}$$

Where n is the number in the sample

Z_α is the allowable error in the normal distribution = 1.96

$Z_\beta = -0.84$

$P = (P_e + P_c)/2$

Q is 1-P

P_e prevalence of brucellosis in exposed group (without protective gear) = 0.50

Q_e is $1-P_e = 0.5$

P_c prevalence of brucellosis in unexposed group (with protective gear) = 0.15

Q_c is the complement of $P_c = 0.85$

The total number of participants we got from the above calculation was 54 with 27 for each group. However, because this was smaller than the sample calculated above for the survey and therefore we used the bigger sample.

The sample size of 250 (after 10% adjustment of 227) was calculated proportionately. Mbarara MCA has a population of 80 routine workers and KCC abattoir has 220 workers giving a total of 300 workers to sample from. However, only a proportion of this was to be included in the study. In order to get the sample size of 250 abattoir workers, the proportions were calculated as shown below.

Population A/Total population (A+B) * sample size = Proportion from A

80/300 * 250 = 67 abattoir workers from Mbarara MCA.

Population B/Total population (A+B) * sample size = Proportion from B

220/300 * 250 = 184 abattoir workers from Kampala abattoir.

3.6 Sampling

The abattoirs were selected purposively because they are large abattoirs in Uganda handling a relatively big slaughter load. The study participants were selected consecutively where every individual fulfilling the eligibility criteria was included until the sample size was exhausted. For qualitative data Key Informant Interviews were conducted with twelve participants who were selected purposively.

3.7 Variables and measurements

3.7.1 Independent variables:

Socio-demographic factors (sex, age, marital status, religion, education level), occupational factors (protective gear, species handled, work done in abattoir, duration of exposure), health-related factors (malaria, malaria like symptoms, previous use of antibiotics) were studied.

3.7.2 Outcome variable:

Brucellosis serostatus.

3.8 Data collection

3.8.1 Quantitative methods:

We pre-tested and pre-coded the questionnaire a week before data collection started. The principal investigator trained two research assistants who were undergraduate medical students of Makerere University, Faculty of Medicine. These were to collect data in both districts and were conversant with written and spoken Luganda language which we used in the study in both districts. The participants from Mbarara district also understood Luganda (assessed during pre-testing of the questionnaire) and therefore this is the language that was used in both districts. On the day of data collection in the respective abattoirs, written informed consent using a consent form translated to Luganda and back translated to English by an expert from the Institute of languages, Makerere University (Appendix III, IV) was obtained first from participants. After this, the research assistants administered the questionnaire by personal interview. This was done in the office of meat inspectors at the respective abattoir with enough space and light.

Blood collection: A qualified laboratory technician then collected a blood sample using a plain vaccutainer (BD Plymouth UK source BDH laboratories Ltd) and needle (gauge 21) from the cephalic vein of each participant for brucellosis serology. A drop of this blood was used at the same time to make a thick blood smear (air dried) to assess for malaria parasitaemia. Blood samples and smears were identified using codes similar to those on the participant's questionnaire indicating the district and participant number for example K001 meaning the first blood sample and questionnaire interview from Kampala district. Blood was allowed to clot, then

centrifuged to separate serum and stored at -20°C in plastic cryovials (Oonderstoport, South Africa), until it was tested for presence of *Brucella* antibodies.

Serum specimens were analyzed in two phases, using *B. abortus* antigens. This is because in both abattoirs, the majority of the animals slaughtered are cattle (up to 300 Head of cattle in Kampala and 70 HC in Mbarara) and few goats (up to 60 goats in Kampala and 20 in Mbarara). This in essence means that there is a higher likelihood of *B. abortus* infection compared to *B. melitensis* infection. In addition, *B. melitensis* antigen was not available where we got *B. abortus* antigen and also there is cross-reaction between the two species. We therefore estimated brucellosis prevalence using only *B. abortus* antigen and not both. In the first phase, all specimens were screened by the Microplate Agglutination test and confirmed by the Standard Tube Agglutination Test (Lucero and Bolpe, 1998) described below. This was done in Microbiology laboratory of Mulago Hospital, Kampala. Data from laboratory results was also entered against the participant's identity number on the data form.

Microplate Agglutination Test (MAT)

The test was done as described by Lucero and Bolpe (1998). The test antigen, sera and control (iced distilled water from the laboratory) were thawed to room temperature for about 30 minutes. After gentle mixing, equal volumes (50 microlitres) of test sera and control were put on separate wells on the microplate. Equal amount (50 microlitres) of *B. abortus* antigen (Veterinary Laboratory Agency UK, source Human Diagnostics, Uganda) was added to the wells and gently mixed using an applicator stick then left for about 1 minute. Under bright white light results were read for any visible agglutination which was considered positive. This is a rapid agglutination test and agglutination of any amount was considered to show the

presence of specific agglutination *Brucella* antibodies (seropositive). All positive samples were further processed by STAT to quantify the amount of agglutination.

Standard Tube Agglutination Test (STAT)

This was done as described by Lucero and Bolpe (1998) and tests for presence of IgG antibodies. Samples (20 microliters each) of serum and control thawed to room temperature were diluted with 1.98 microlitres of saline solution to make six dilutions starting with 1:20 to 1:640. One drop using a microtitre pipette (20 microliters) of antigen (Veterinary Laboratory Agency UK, source Human Diagnostics, Uganda) was added to each tube, closed, mixed thoroughly and incubated at 37°C for 24 hours after which it was read. A thick agglutination with a settled supernatant was taken as positive and the highest dilution showing agglutination was recorded. This is a slow agglutination test and a titer of 1:80 or greater was taken as an index of seropositivity. This was the confirmatory test and all samples that had titres less than 1:80 were not included. Therefore a person had to be positive on both tests to be considered seropositive.

Malaria diagnosis

Only thick blood smears were initially prepared at the same time, air-dried, stored in a dry place and taken to Uganda Malaria Surveillance Project laboratory, Mulago Hospital Kampala. This was because the interest was to detect malaria parasitaemia and not the morphology or species of the parasites. Thin smears to identify the species were later done for those people with parasitaemia. Giemsa staining was done as described by Lillie (1977) to assess for malaria parasitaemia. The stained slides were then examined under the microscope using 100x objective lens (with oil emulsion). Presence of trophozoites indicating active malaria infection was assessed. Level of

infection was quantified using high power field (HPF) density where +1 = 1-10 parasites per 100 fields examined, +2 = 10-100 parasites per 100 fields examined, +3 = 1-10 parasites per 10 fields examined (Lillie 1977).

3.8.2 Qualitative methods:

With the purpose of explaining findings from quantitative methods further and to explore issues on perceived factors associated with brucellosis, 12 key informant interviews were also carried out. This was done with two managers, two meat inspectors, six people who had reportedly suffered from brucellosis and two medical officers (one each for Kampala City Council and Mbarara Municipal Council). The interviews were carried out in the offices of the respective person and for people with past history of brucellosis interviews were conducted in office of the meat inspector. Standard topic guides were used (Appendix II).

3.9 Data analysis

Data was double entered daily for quality control by the principal investigator in Epidata version 3.1 (Lauritsen, 2000), cleaned and then exported to SPSS version 12.0 (Apache software, 2003) for analysis.

3.9.1 Descriptive statistics

To summarize continuous variables such as age, means, medians, range and standard deviations are used. Categorical variables such as education level were summarized into simple proportions, percentages, frequencies and medians. Prevalence of brucellosis and malaria were estimated using percentages and frequencies.

3.9.2 Bivariable analysis

As part of the cross-sectional study, to establish factors associated with brucellosis, association between brucellosis and each categorical independent variable was

assessed. Odds ratios and the 95% confidence intervals were computed and reported. Level of significance was initially set at $p<0.2$, two-sided test. For dual occurrence of brucellosis and malaria, we used percentages, frequencies and cross-tabulations.

3.9.3 Multivariable analysis

To assess for multi-collinearity, confounding and interaction among the predictor variables, statistically significant factors ($p<0.2$) after bivariable analysis were entered into binary logistic regression models with brucellosis as the dependent variable.

3.9.4 Qualitative data analysis

Data from key informant interviews was double entered into EZ text 3.06 then later summarized and separated into major themes. These are communicated in the results and discussion for explanation.

3.10 Quality control

1. Training of the research assistants in conducting the interview and collecting/handling blood samples was done by the principal investigator.
2. The questionnaire was pre-tested and standardized. A standard topic guide was used for Key Informant Interviews (Appendix II).
3. Controls were used when processing samples in the laboratory. Laboratory results were double-checked by two different technicians.
4. Data from interviews was double entered to minimize errors.

3.11 Ethical considerations

Ethical approval was sought from;

Makerere University Clinical Epidemiology Unit (Appendix V), Faculty of Medicine Research and Ethics Committee, the administrators of KCC and Mbarara Municipal Council abattoirs. Written consent was obtained from the participants (Appendix III, IV). Participants with brucella infection and malaria were referred for treatment.

3.12 Dissemination of findings

A manuscript has been prepared for publication. Study results will be disseminated to Makerere University Clinical Epidemiology Unit, School of Graduate Studies Makerere University, Sir Albert Cook library, Uganda Meat Industries, City and Mbarara main abattoirs, Ministry of Health, conferences ad symposiums.

CHAPTER FOUR

RESULTS

Description of the study population

A total of 232 people who work in Kampala City Council (161) and Mbarara Municipal Council (71) abattoirs were interviewed and tested for brucella infection and malaria between January and February 2007. A questionnaire was administered to the participants and twelve key informant interviews were carried out with two administrators, two medical officers, two meat inspectors and six people who had reportedly suffered from brucellosis.

Socio-demographic characteristics of participants

The participants from Kampala City Council and Mbarara Municipal Council abattoirs were 161 and 71 respectively. The majority of the participants were males (78%, n=232). The overall mean age of the participants was 32.7 +/-9 years; the range was 19 - 70 while the median age was 30 years (Figure 1). The mean age of the participants was 32.25 +/-9 and 32.27 +/-9 in Kampala and Mbarara districts respectively. The majority the participants (91%, n=232) had some formal education and 48% had at least attained secondary school education. The religion where majority of the participants were affiliated was Islam (50%, n=232) while 27% were Catholics. Participants who were married formed the majority 69% (n=232) but 23% were single (Figure 2). Results of the socio-demographic characteristics of the abattoir workers are shown in Table 1 below.

Table 1 **Socio-demographic characteristics of abattoir workers in Kampala and Mbarara districts (n=232)**

Variable		Kampala (n=161, %)	Mbarara (n=71, %)	Overall (n=232, %)
Sex	Male	118 (73)	62 (87)	180 (78)
	Female	43 (27)	9 (13)	52 (22)
Age	20&below	7 (4)	0 (0)	7 (3)
	21 – 30	79 (49)	32 (45)	111 (48)
	31 – 40	49 (31)	24 (34)	73 (31)
	41 – 50	21 (13)	12 (17)	33 (14)
	51+	5 (3)	3 (4)	8 (4)
Education	None	15 (9)	7 (10)	22 (10)
	Primary	53 (33)	35 (49)	88 (38)
	Secondary	87 (54)	25 (35)	112 (48)
	Tertiary	6 (4)	4 (6)	10 (4)
Religion	Catholic	34 (21)	28 (39)	62 (27)
	Protestant	30 (19)	17 (24)	47 (20)
	Muslim	92 (57)	25 (35)	117 (50)
	Born again	3 (2)	1 (2)	4 (2)
	SDA	2 (1)	0 (0)	2(1)
Marital status	Single	38 (24)	17 (24)	55 (24)
	Married	112 (70)	47 (66)	159 (69)
	Separated	11 (6)	5 (7)	16 (7)
	Divorced	0 (0)	2 (3)	2 (1)

From the table above on socio-demographic characteristics, the populations of abattoir workers in Mbarara and Kampala districts are similar. The data was therefore analysed, reported and discussed together.

Figure 1 Age distribution of abattoir workers in Kampala and Mbarara districts (n=232)

The age distribution of the abattoir workers was skewed to the right with a few people older than 50 years. This was also reflected in the duration taken in the abattoir since most of the people older than 50 years had also spent longer than 20 years.

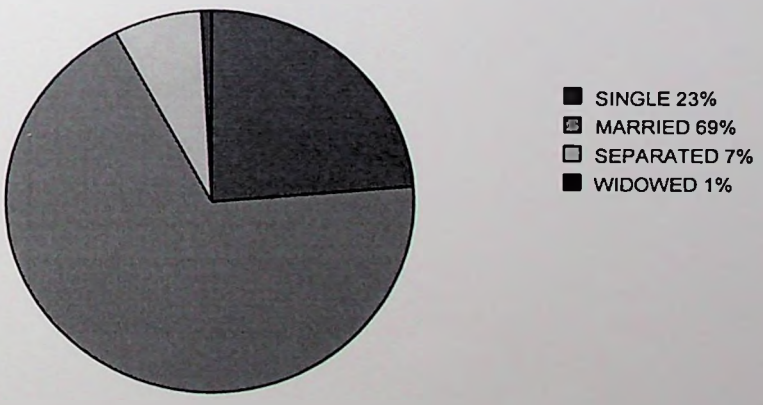


Figure 2 Marital status of abattoir workers in Kampala and Mbarara districts (n=232)

4. 2 Seroprevalence of brucella infection

The overall proportion of brucella infection was 10% (95% CI 6 – 16; n=232). On gender disaggregation, the prevalence of brucella infection in females was 12% (n=52) and in males 10% (n=180). In addition, the seroprevalence of brucella infection was 27%, n=33 in participants with ages between 41 and 50. The proportion of participants with brucella infection among participants with at least secondary education and Muslims was each 13%. Kampala district had more brucella seropositive abattoir workers (12% n=161) compared to those in Mbarara district (7%, n=71). Brucella infection was more among participants who had reportedly been diagnosed and treated for brucellosis in the past two years than those who had not (27%, n=24 and 10%, n=208 respectively). Participants who consume raw milk or products and those who did not had similar brucella infection (10% and 11% respectively). A summary of the results is in Table 2 below.

Table 2 **Seroprevalence of Brucella infection among abattoir workers in Kampala and Mbarara districts in different strata (n=232)**

Variable		(n=232, %)	+ve Kampala (161, %)	+ve Mbarara (71, %)
Overall		24 (10)	19 (12)	5 (7)
Sex	Male	18 (8)	13 (8)	5(7)
	Female	6 (3)	6 (4)	0 (0)
Age	20 and below	1 (1)	1 (1)	0 (0)
	21 – 30	6 (4)	6 (4)	3 (3)
	31 – 40	8 (5)	8 (5)	0 (0)
	41 – 50	3 (2)	3 (2)	2 (3)
	Above 50	1 (1)	1 (1)	0 (0)
Education	None	3 (1)	2 (1)	1 (1)
	Primary	7 (3)	5 (3)	2 (3)
	Secondary	13 (6)	12 (8)	1 (1)
	Tertiary	1 (1)	0 (0)	1 (1)
Religion	Catholic	7 (3)	5 (3)	2 (3)
	Protestant	4 (2)	3 (2)	1 (1)
	Muslim	13 (6)	11 (7)	2 (3)
	Born again	0 (0)	0 (0)	0 (0)
	SDA	0 (0)	0 (0)	0 (0)
Marital status	Single	6 (3)	4 (3)	2 (3)
	Married	17 (7)	14 (9)	3 (4)
	Separated	1 (1)	1 (1)	0 (0)
	Divorced		0 (0)	0 (0)
Keep animals	No	8 (3)	2 (1)	4 (6)
	Yes	16 (7)	17 (11)	1 (1)
Malaria in past 3 months	No	23 (10)	2 (1)	0 (0)
	Yes	1(1)	17 (7)	5 (7)
Raw milk /products	No	8 (3)	6 (4)	2 (3)
	Yes	16 (7)	13 (8)	3 (4)
Protective gear	Yes	3 (2)	1 (1)	0 (0)
	No	21 (9)	18 (11)	5 (7)
Brucellosis (past 2 years)	No	6 (3)	3 (2)	3 (4)
	Yes	18 (8)	16 (10)	2 (3)

4.2.2 Knowledge and past experience with brucellosis

The majority of the participants, 61% (n=232) reportedly had heard of brucellosis and of these only 30% (n=142) said they knew how the disease was transmitted. The most cited modes of transmission of brucellosis were ingestion of meat that is not well prepared and drinking raw milk (55%, n=42 and 38% respectively).

Table 3 Knowledge and past experience with brucellosis among abattoir workers in Kampala and Mbarara districts (n=232)

Variable		Frequency	Percentage
Knowledge of brucellosis			
Heard of it	Yes	142	61
	No	91	39
Transmission	Yes	42	30
	No	100	70
Mode of transmission of brucellosis			
Ingestion of meat not well cooked		23	55
Drinking raw milk and products		16	38
Touching infected meat/blood		8	19
Staying with animals for long		5	12
Inhalation		2	5
Suffered from brucellosis before			
Yes		24	10
No		208	90
Know someone who has suffered from brucellosis			
Yes		52	22
No		180	78

Past experience with brucellosis was reported by 11% (n=232) while 23% (n=232) reported that they knew someone who had suffered from brucellosis. There is however a degree of overlap as some had suffered from brucellosis and also knew someone who had (Table 3).

Table 4 below illustrates the different symptoms and signs manifested by those who suffered from brucellosis.

Table 4 Symptoms of brucellosis experienced as reported by abattoir workers in Kampala and Mbarara districts (n=67)

Symptom	Frequency	Percentage
Undulant fever	45	67
Joint pains	40	60
Back pain	31	46
Headaches	23	34
Weakness	23	34
Fatigue	14	21
Abdominal pain	11	16
Chills	11	16
Excessive sweating	9	13
Loss of appetite	8	12
Night sweats	7	10

Undulant fever and joint pains were the most common symptoms reported (67%, n=67 and 60% respectively). Loss of appetite and excessive sweating were reported least by the participants.

4.3 Occupation of workers in the abattoir

The type of work done in the abattoir by the participants is summarized in Table 5. Slaughterers of cattle, goats and sheep formed the majority 35% (n=232) of the different workers who participated in the study, followed by those who prepare food 19%, traders who also sell meat 15% and transporters 11%.

Table 6 Type of protective gear used and duration of exposure for abattoir workers and brucella sero-positivity (n=232)

Type of protective gear/duration	Brucellosis Positive	Total	Percent positive
Gumboots, headgear, overall	2	52	5
White coats, gumboots	8	47	35
Gumboots, overall	4	37	17
Headgear, white coat	0	30	0
White coat	4	26	17
Gumboots, gloves, white coat*	1	11	2
Gumboots	5	9	22
1 year or less	1	30	4
2 – 5	3	19	13
6 – 10	8	43	33
11 – 15	5	53	21
16 – 20	2	29	8
21 – 25	2	15	8
26 and more	3	19	13

*** Full protective gear**

Seroprevalence of brucella infection was up to 11% (n=214) among abattoir workers who did not have full protective gear while it was only one percent (n=11) who had full protective gear (Table 6). When asked how often they used the protective gear, 95%, n=214 reportedly used them all the time, 4% twice or more times a week and 0.9% once a week.

4.3.4 Duration of exposure

The majority of the participants (47%, 109/232) had spent between six and fifteen years working in the abattoir (table 6 above). Participants who had spent five years or less were 23% (53) followed by 48 (21%) participants who had spent sixteen to twenty five years, were 21 (48). Participants who had worked for more than twenty six years represented 9% (22).

4.4 Health-related factors

4.4.1 Malaria and malaria-like illness

Data about the health related factors of the participants was captured and 37% (n=232) had a bout of clinical malaria in the past three months and 80% of these had sought treatment in either a clinic or dispensary or hospital. Only 3% (n=n=232) of the participants had smear positive results for malaria parasites (Table 7).

Table 7 **Response of abattoir workers on malaria and malaria-like symptoms (n=232)**

Variable	Frequency	Percentage
Malaria in past 3 months		
Yes	86	37
No	146	63
Treatment facility visited		
Clinic/dispensary	43	50
Hospital	26	30
Drug shop/pharmacy	14	16
Herbs	3	4
Tests done for diagnosis		
Yes	55	64
No	31	36
Which tests		
Blood smear	53	96
TB, Brucellosis	2	6
Repeated fever/flu like symptoms		
Yes	107	46
No	125	54
How often		
Every evening	22	20
Every week	28	26
Monthly	45	42
3 or more months	12	12
Where they were treated		
Clinic/dispensary	29	27
Hospital	16	15
Drug shop/pharmacy	53	50
Herbs	9	8
Drug given		
Anti-malarial	27	27
Antibiotics	17	17
Pain killers	16	16
I don't know	31	31
Anti-malarial/pain killers	7	7
Antibiotics/pain killers	6	6
Prevalence of malaria		
Positive	7	3
Negative	225	97

4.4.3 Consumption of milk and milk products

The majority of the participants (65%, n=232) did not consume raw milk or its products. Of the 81 participants who drank raw milk and/or unprocessed products, 41% drank raw milk while 17% ate uncooked cow ghee (Table 8).

Table 8 Consumption of milk and products by abattoir workers in Kampala and Mbarara districts (n=81)

Product consumed	Frequency	Percentage
Unboiled/raw milk	33	41
Uncooked cow ghee (eshabwe)*	14	17
Local yoghurt (bongo)*	8	10
Raw milk and local yoghurt	8	10
Raw milk and uncooked cow ghee	6	7
Local yoghurt and uncooked cow ghee	4	5
Uncooked cheese	3	4
Raw milk, uncooked ghee and local yoghurt	3	4
Uncooked ghee and uncooked cheese	2	3

* Local common names of the products

4.4.4 Contact with animals

Results showed that only 27% (n=232) kept animals at home. Common species kept were goats 28% (n=61) while a combination of cattle and goats was kept by 25% respectively. Cattle were kept by 22% participants, 15% kept dogs and cats and cattle, goats and dogs were kept by 10% participants. The majority of the participants interacted with these animals during grazing or feeding them 52% (n=61). Some participants never interacted with them 26% and 22% of the participants interacted with them always.

4.5 Association between brucella infection and independent predictors

In the cross sectional study, participants with full protective gear were 11 instead of 27 required in the sample size. We still went ahead and analyzed the data for use of protective gear and other factors. At bivariable analysis, association between brucella infection and other independent variables was assessed using chi square tests or Fisher's exact test with set p-value at 0.2 or below. Odds ratios with their confidence intervals were got (Table 9).

Table 9 Associations between Socio-demographic characteristics with brucella infection among abattoir workers in Kampala and Mbarara districts (n=232)

Variable		Frequency (/n)	Unadjusted OR (95% CI)	p value
Sex	Female	6/52	1.1 (0.6 – 2.5)	0.39
	Male	18/180	1	
Age	30 yrs or less	10/118	**1**	**0.097**
	Above 30 yrs	14/114	**1.2 (0.9 – 1.6)**	
Education level	Primary or less	10/110	1	0.40
	Above primary	14/122	1.0 (0.5 – 2.1)	
Religion	Others*	11/109	1	0.51
	Muslim	13/123	1.1 (0.6 – 1.9)	
Marital status	Single	7/55	1	0.322
	Married	17/177	1.1 (0.4 – 3.7)	
District	Mbarara	5/71	**1**	**0.13**
	Kampala	19/161	**1.2 (1.0 – 1.4)**	

*Others includes Catholics, Protestants, born again, SDA

Among socio-demographic factors, district and age came out as the significant factor at bivariable analysis (p = 0.13 and 0.097 respectively) and were therefore included in the multivariable analysis (Table 11).

Table 10 **Associations between independent predictors with brucella infection among abattoir workers in Kampala and Mbarara districts (n=232)**

Variable		Frequency (/n)	Unadjusted OR (95% CI)	p value
				0.85
Occupation	Slaughterers**	20/90	1.0 (0.7 – 1.5)	
	Others***	29/140	1	
Species handled	Cattle	41/182	1.5 (0.7 – 3.5)	0.31
	Goats, sheep	8/50	1	
Protective gear	Full gear	1/11	**1**	**0.15**
	Not full gear	23/221	**2.5(1.1 – 22.0)**	
Duration	4 yrs & less	4/53	**1**	**0.12**
	Above 5 yrs	20/179	**1.2 (1.1 – 1.4)**	
Keep animals	No	7/169	**1**	**0.14**
	Yes	17/63	**1.3 (0.9 – 1.9)**	
Malaria history	No	1/146	1	0.26
	Yes	23/86	1.3 (0.7 – 2.9)	
Drugs given	Antibiotics	3/23	1	0.25
	Other drugs	21/82	1.0 (0.7 – 1.6)	
Raw milk	No	16/151	1	0.51
	Yes	8/81	1.0 (0.8 – 1.3)	

**Slaughterers include those who dress carcasses

***Others represents occupations in abattoir **(Table 5)**

The factors taken for multivariable analysis from this table were use of protective gear, keeping animals at home and duration of exposure (Table 11).

4.6 Multivariable analysis

All variables with p-value of 0.2 or less (district, use of protective gear, keeping animals at home and having been diagnosed and treated for brucellosis) were entered

in binary logistic regression procedure using backward elimination method. These factors were first assessed for multicollinearity to see if any, factors that were collinear and could affect the data. There was none and district where abattoir is, having suffered from brucellosis before, keeping animals at home and use of protective gear were thus entered in the multivariate model to assess for interaction using the Enter method and Chunk test.

There was no interaction and therefore we went ahead and assessed for confounding using Backward LR. The above four factors were entered in the binary logistic model. There was no confounding among these variables. The final model is shown in Table 11.

Table 11 Associations between independent predictors with brucellosis among abattoir workers in Kampala and Mbarara districts (n=232)

Variable	Coefficient	OR (95% CI)	p-value
Keep animals	2.4	1.1 (0.3 – 4.2)	0.190
Protective gear	1.26	0.3 (0.02 – 0.8)	0.02**
District	0.22	2.1 (0.8 – 5.4)	0.135
Duration of exposure	1.54	2.4 (0.6 – 5.6)	0.057
Age	2.60	1.1 (0.03 – 10.4)	0.13
Constant	8.3		0.105

* Product term between keeping animals and having been diagnosed and treated for brucellosis

** Significant predictors of brucellosis seropositivity

Use of full protective gear was associated with reduced risk in seroprevalence of brucellosis infection; odds ratio 0.3 (95% CI 0.02 – 0.8). Those without full gear were

about three times more at risk of being brucellosis seropositive compared to those with full protective gear.

4.7 Results from key informant interviews

Key informant interviews were conducted with health workers, those with past experience with brucellosis, administrators, meat inspectors for their views on the prevalence and possible risk factors of brucella infection, what they have done to limit these. Below are summaries of some of the responses got which were aimed at explaining quantitative findings and exploring other perceived risk factors for Brucellosis among abattoir workers.

4.7.1 Experience with brucellosis

Most of the participants had heard about brucellosis but some administrators had not seen or heard about anyone suffering from it. One of the meat inspectors and the administrators had past experience with brucellosis and the workers in the abattoir kept on referring to him. Several experiences were narrated by the key informants.

> *"I got fevers and sweats but thought it was malaria, got some antimalarials...when it finally put me down, the back pain was too much I could hardly move."* (Male KII respondent, Mbarara).
>
> *"I got a bad attack after continuously taking antimalarials, ended up in the Mbarara Hospital,"* said another key interviewee.
>
> *"It is a bad disease, people think you have HIV."* (Male KII respondent, Mbarara).

Most of them complained of fever, back and joint pains causing inability to work and possible delay in diagnosis aggravating the symptoms.

4.7.2 Transmission, diagnosis and treatment of brucellosis

Drinking raw milk or products, eating roasted or cooked meat that is not ready, and inhalation of the organisms at slaughter or in the laboratory were identified as ways of possible transmission.

> *"...I may have got brucellosis from raw milk and uncooked cow-ghee, I take them a lot."* (Respondent, Mbarara MCA).
>
> *"I always eat uncooked cow-ghee and raw milk, and I may get brucellosis...may be I should stop."* (Participant in KCC abattoir).

All those with past experience complained of delay in proper diagnosis which indirectly led to delayed treatment of brucellosis. This was later corroborated by one of the health service providers.

> *"...tested and got treatment for malaria...later requested for brucellosis test since I knew about the disease, was positive and got the right treatment."* (Participant in KCC abattoir).
>
> *"...when you do not think of testing for brucellosis but it is quite common especially in Mbarara with many animals..."* (Participant in Mbarara abattoir).
>
> *"The tests are not very accurate and readily available in many clinics except in main hospitals...affects our diagnostic abilities."* (Health worker, Mbarara).

Others still complained of symptoms even after treatment possibly due to under dosing and failure to complete the treatment course.

> *"I still get the same attacks after treatment especially chills, night sweats, fevers, joint pains every now and then."* (Participant in KCC abattoir, Kampala).

Diagnosis taking long meant that in most cases treatment becomes complex and thus long courses are given which may affect adherence and quick cure as highlighted by one of the health providers.

> *"May treat someone for three months yet they got initial treatment before but did not heal"*
>
> *"Takes a long time to treat...I was injected for four months before the signs completely disappeared."* (Respondent from Mbarara MCA).

4.7.3 Control measures

The administrators, meat inspectors and health personnel all concurred about possible control measures including protective gear like gloves, gumboots, overalls and white coats. However, financial constraints limited this except for meat inspectors. Other possible control measures identified included use of a centrally placed disinfecting solution for workers to use after work to kill *Brucella* among other microorganisms.

> *"Sensitization is important for these people to invest in and continue using protective gear in order to protect themselves."* (Respondent from KCC abattoir).
>
> *"...sensitization done jointly with help of government would have a bigger impact."* (KII respondent, KCC abattoir).

About enforcing the use of protective gear, it was emphasized that sometimes it is up to the individuals.

> *"Those who understand the importance of protective gear use them but others do not."* (KII respondent, Mbarara MCA).
>
> *"...the emphasis is from us that they use protective gear when working."* (Administrator, KCC abattoir).

Some of the proposed control mechanisms that administrators and health representatives of both districts were drinking boiled or pasteurized milk and products, eating properly cooked meat, using protective gear when working and washing their hands with disinfectant after work.

CHAPTER FIVE

DISCUSSION

This study being a cross sectional one was not able to establish the causal relationship between brucellosis and possible factors associated. This is because such a study is not able to establish a temporal background. Owing to the fact that assessment of the factors was through self report by the participants responses to a questionnaire, there is a potential bias of underreporting. This could therefore lead to underestimation of the factors associated with brucella infection.

The study was strong on several counts like obtaining an adequate sample size it and having no missing values. This increased the confidence in the results. In addition to this, the tests used in this study are less specific when carried out singly but to counter this they were combined in series. This leads to higher specificity making the results more reliable. Also being the first study among abattoir workers who are a high risk group in Uganda is a big strength of this study.

In this vein therefore, we believe the findings from this study are valid.

5.1 Prevalence of brucella infection

The overall seroprevalence of brucella infection in this study was high with about one in every ten abattoir workers being brucellosis seropositive.

This prevalence is high and parallels that in animals (8 – 46%) which are the primary source for the abattoir workers (Ocoma 2002, Nabaasa 2002, Nakavuma *et al.*, 1999). Similar studies among abattoir workers elsewhere have found similar results (Barbuddhe *et al.*, 2000; Gilbert *et al.*, 1980). The prevalence appeared to vary according to districts with a higher prevalence being in Kampala (11%) compared to

that in Mbarara (7%) which was not significant in the final model. However, there was no statistically significant difference between the two districts ($p>0.05$). The prevalence in Mbarara was similar to findings from a recent study done among herdsmen of brucellosis seropositive herds by Ssekawojjwa (2006) where it was found to be 6% (95%CI, 3.3-8.3) There are similar levels of exposure among abattoir workers and herdsmen who deal with animals from different areas of brucellosis endemicity. One reason for sale of animals by farmers is culling off due to such diseases like brucellosis which cause infertility and abortion. A significant proportion of the animals slaughtered, therefore, could be such culls. In addition to this, 10% (24) of the participants attested to having been diagnosed and treated for brucellosis before. Since the study was a serosurvey, the tests used did not discriminate between current active and past infections. This proportion is therefore still part of the overall prevalence obtained.

Results from Microplate Agglutination Test and Standard Tube Agglutination Test may also suffer from a problem of low specificity due to cross-reacting antibodies between smooth *Brucella* species and other gram negative bacteria like *Yersinia* species, *Enterobacteria, Pseudomonas maltophilia, Salmonella urbana* and others (Corbel *et al.*, 1983). This in part may explain similar result of brucellosis infection to the findings of Sekawojjwa (2006) who used the same tests and a more specific cELISA test. What is strange is that despite the high prevalence of brucella infection in humans, it is not considered for routine laboratory referrals in cases of acute febrile illness.

The prevalence of brucella infection in Kampala was 11% which results are different from findings of a study by Ndyabahinduka and Chu (1984) who estimated seroprevalence of brucella infection to be 18-24% among hospital patients around Kampala. Both studies however were in a selected population representing increased risk (hospital patients versus abattoir workers) and thus the high prevalence of brucellosis.

The proportion of abattoir workers with Brucella antibodies in Mbarara was lower than this (7%). This could be explained by the fact that animals coming to KCC abattoir are from different parts of the country with probably different brucellosis endemicity levels. In addition, Kampala handles a larger number of animals for slaughter (up to 30,000 Head of cattle (HC) vs. 8,500 Head of cattle (HC) per month respectively) and thus possibly a higher degree of exposure for the workers. Measurement bias was reduced by the two tests which improve on the specificity and thus have less false positives. No factor was found to cause interaction.

5.2 Factors associated with brucella infection

Abattoir workers who had been diagnosed and treated for brucellosis before were about fourteen times as likely to be seropositive in this study compared to those who had not (14 (95%CI 3.3 – 47.4). This is so because the tests used were establishing brucellosis serostatus and yet the STAT test measures IgG antibodies which stay for long (up to three years) in the body post infection (Lucero and Bolpe, 1998; Corbel, 1983). Since the study was establishing post exposure to brucella infection, these exposed people tested positive and are thus contributing to the prevalence.

The risk factor associated with brucella infection was use of full protective gear (OR 0.2, 95%CI 0.002 – 0.206). This was associated with reduced risk for brucella infection. This has not been documented before much as it is recommended to use protective gear in abattoirs. However, since assessment on risk factors for brucellosis seropositivity was done through interview and self report there could be underreporting leading to some factors not being significant predictors in this study. On top of this, the numbers in some cells were less than five yet some also had zero which may have led to some factors not being significant.

The proportion of individuals who had full protective gear (gloves, white coat/overall, gumboots and or no head gear) and were brucella seropositive was small (9%) compared to that without (23%). Also those without full protective gear were about three times as likely to be brucella seropositive as those with full protective gear. However, the nine percent seroprevalence of brucella infection among those with full gear may be explained by inhalation as the mode of transmission of brucellosis among abattoir workers (Rodriguez *et al.*, 2001; Luna *et al.*, 1998; Kaufmann *et al.*, 1980). Socio-demographic factors (age, sex, education level, religion) were all not significantly associated with brucella infection. A study by Ofukwu *et al.*, 2006 found no association between brucellosis and sex or age although females were more affected than males and those with age in the second and fourth deciles were more affected. In that study however, there were more females participating and this could explain the higher prevalence associated. This finding does not concur with other studies which found age and gender associated significantly (Schelling *et al.*, 2004; Baba *et al.*, 2001; Bigler *et al.*, 1977). Males were more affected than women, 76%

and 24% respectively but this was not statistically significant and could be explained by the fact that more males work in the abattoir. Qualitative results further attempt to explain this age and sex differences where some of the respondents attributed their routine contact as on of the reasons for high prevalence of brucellosis among men compared to women.

However, for religion 27% of the brucellosis seropositive participants were Muslims followed by the Catholics 12%. This may however due to the fact that majority if the abattoir workers are also Muslims and therefore more predisposed to *Brucella* infection.

Education level and marital status were not statistically significant but worth noting is that 55% of the brucellosis seropositive participants at least had secondary school education at ordinary level followed by 33% with primary education. The likelihood of a married person being brucellosis seropositive was about two times the likelihood for single, separated or divorced abattoir worker. These factors have not been cited in any study to be risk factors for brucellosis among abattoir workers or any other population studied.

Other factors like duration of exposure and age of individual were also not statistically significant but those who had worked in the abattoir for six to 15 years were 57% (28) and those aged 26 to 35 up to 61% (30) were mostly affected. This is similar to work by Afifi *et al.*, 2005 where it was stated that people in their third to fifth decade were mostly affected. It is most likely due the fact that this is the most active and productive age and thus many of the abattoir workers are in this range.

Some of the strata had small numbers and therefore we could not ascertain some of the associations leading to lack of statistical significance.

Consumption of raw milk and products was not statistically significant (P>0.05). This differs from previous studies by Sekawojjwa, 2006, Afifi *et al*, 2005, Maloney and Fraser, 2004 where there was a strong association. However, since this was a self reported factor, there may be underestimation resulting in less affirmative answers.

Work done in abattoir (P= 0.280), species handled (0.265), district with abattoir (P=0.056), keeping animals at home (0.116) were all not statistically significant in predicting brucella infection. This differs from the results in studies by Baba *et al.*, 2001 and Zingstang *et al.*, 2005 which found species of animals handled and keeping or interacting with animals at home to be predictors of brucella infection.

5.3 Brucella and malaria infections

Malaria parasitaemia among abattoir workers was low (3%). This is lower than findings in the general population given the highly endemic setting in Kampala and Mbarara districts. The overlap between the two infections is also low with only one case of dual occurrence of the two infections. Malaria infection was caused by *Plasmodium falciparum.* A similar result was reported as a clinical case in a traveler returning from Africa to the USA by Badiaga *et al.*, 2005.

This could be attributed to the fact that venous blood from the arm was used to make the thick film rather than capillary blood obtained by finger prick. This was done to

reduce on the trauma subjected to the participants by collecting blood using both methods. The low prevalence could also be attributed to the fact that there is a lot of self-treatment as shown in this study (19.3%) which therefore reduced the smear positive results. This finding however contradicts results of a high prevalence of 97% of malaria which was reported by Mutanda in 1998 but this was among patients attending a clinic.

CHAPTER SIX

RECOMMENDATIONS AND CONCLUSIONS

6.1 CONCLUSIONS

The results of this study show that:

- ❖ The seroprevalence of brucellosis among abattoir workers is rather high (10%) suggesting that one in ten abattoir workers is infected with brucellosis.
- ❖ Nonuse of full protective gear when working was associated with increased risk of brucellosis seropositivity. Abattoir workers without full protective gear were at about three times more likely to be infected with brucellosis.
- ❖ The dual occurrence of malaria and brucella infections was low but is likely to be due to self treatment for malaria.

6.2 RECOMMENDATIONS

1. In order to reduce brucella infection, abattoir workers need to use full protective gear.
2. In order to improve on case detection and treatment, regular screening for brucellosis among abattoir workers needs to be undertaken in Uganda.
3. Brucellosis needs to be considered as a differential diagnosis among symptomatic abattoir workers and other occupationally exposed people.
4. Sensitization of abattoir workers, management and the general population about brucellosis for effective control and prevention.
5. Studies among the general population, contacts of abattoir workers (such as relatives who eat meat brought in routinely) and animals slaughtered in these abattoirs need to be done to protect the public against brucellosis.

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APPENDIX 1 QUESTIONNAIRE

Dr. Nabukenya Immaculate is a Masters student in Makerere University and is conducting a study on prevalence and factors associated with brucellosis among abattoir workers in Kampala and Mbarara districts of Uganda. You are one of the participants and you are requested to answer these questions. The information collected will be kept confidential and your name will not be directly included. Tick or circle appropriately.

Initials of participant..... Date of interview.....

Code no..... Name of abattoir..... Name of interviewer.....

SOCIO-DEMOGRAPHIC FACTORS

1. Age (Emyaka gyo).....
2. Year of birth (Wazalibwa mwaka ki?) .....
3. Sex (Obutonde).....
4. Religion (Eddiini gyosoma) 1. Catholic.....2. Protestant.....

3. Muslim..... 4. Born-again.....5. Other (specify).....

5. Education level (Obuyigirize bwo) 1. None.....2. Primary (P.1 – P.7).....

3. O'level..... 4. A'level.....

5. Tertiary institution/university.....

6. Marital status (Oli mufumbo?) 1. Single.....2. Married.....

3. Separated..... 4. Widowed.....

OCCUPATIONAL FACTORS

7. Occupation/work done in the abattoir (Omulimu gwokola wano).....
8. Species of animals handled (Ebisolo byokolako)

1. Cattle..... 2. Goats.....3. Sheep.....

9. Do you use any protective gear here when working? (Olina bwoyambala ng'okola omulimu gwo?) 1. Yes 2. No (skip to 12)

10. If yes, what protective gear do you use? (Observe and tick all applicable)

1. Gum boots.....2. Overall.....

3. Head gear.....4. Gloves.....

5. White coat.....

11. How often do you use this protective gear? (Obyambala buli ddi?)

1. All the time.....2. Twice/more a week.....

3. Once a week.....

12. Why do you use this protective gear? (Lwaki oyambala bwotyo ng'okola?)

1. Protects against dirty materials 2. A requirement here

3. Protects against some diseases 4. I don't know

13. How long have you worked in the abattoir doing this kind of work? (Omaze bbanga ki ng'okola omulimu ogwo wano?).....

14. Do you keep animals at home? (Olina ensolo z'okuuma ewaka?)

1. Yes 2. No (skip to 16)

15. If yes, which species? (Tick all applicable) (Okuuma nsolo ki?)

1. Cattle 2. Goats 3. Sheep 4. Dogs/cats 5. Pigs

16. How often do you interact with them? (Obeera ddi nazo?)

1. All the time 2. Grazing/feeding 3. Never

HEALTH-RELATED FACTORS

17. Have you been diagnosed with malaria in the past three months? (Walwalako omusujja gw'ensiri mu myezi esatu egiyise?)

1. Yes 2. No (skip to 20)

18. If yes, where did you seek treatment? (Wafuna wa obujjanjabi?)

1. Clinic/dispensary 2. Hospital

3. Drug shop/pharmacy 4. Took herbs 5. Other (specify)

19. Were any tests done at diagnosis? (Baakukebera okumanya obulwadde?)

1. Yes 2. No (skip to 20)

20. If yes, please describe to interviewer what was done (Nnyonnyola bwebaakukebera).....
.....
.....
.....

21. Have you had repeated fever attacks or flu-like symptoms? (Otera okufuna omusujja ogwomuddinganwa oba obubonero ng'obwasennyiga?)

1. Yes 2. No (skip to 24)

22. If yes, how often? (Kibaawo ddi?)

1. Every evening 2. Every week 3. Monthly

23. How do you treat these fevers/flu-like symptoms? (Wejjanjabisa otya bwobufuna?) I go to 1. Clinic/dispensary 2. Hospital 3. Drug shop/pharmacy 4. Took herbs 5. Other (specify)

24. Which drugs did you take/were you given? (Baakuwa ddagala ki?)

1. Anti-malarial 2. Antibiotics 3. Pain killers 4. I don't know

25. Have you heard of a disease called brucellosis? (Wawulirako ku bulwadde obuyitibwa omusujja gw'ente?)

1. Yes 2. No (skip to 27)

26. If yes, have you heard about how it is transmitted? (Wawulirako engeri gye butambuzibwamu?)

1. Yes 2. No (skip to 27)

27. May you please tell the interviewer some of these? (Tubulireko ezimu ku ngeri zino.)

.....
.....
.....

28. Have you been diagnosed and treated for brucellosis in the past two years? (Walwalako n'ojjanjabibwa ku musujja gw'ente mu myaka ebiri egiyise?)

1. Yes 2. No (skip to 32)

29. Do know someone who has been diagnosed and treated for brucellosis in the past two years? (Olina gwomanyi eyalwalako najjanjabibwa ku musujja gw'ente mu myaka ebiri egiyise?)

1. Yes 2. No (skip to 32)

30. If yes, what symptoms manifested? (Obulwadde buno bwalaga bubonero ki?)

1. Undulant fevers (on and off) 2. Joint pains 3. Headaches

4. Night sweats 5. Chills 6. Fatigue 7. Excessive sweating

8. Weakness 9.Headache 10. Abdominal pain 11. Back pain

12. Loss of appetite

31. How and where was the disease diagnosed from? (Wafuna wa obujjanjabi?)

1. Clinic/dispensary 2. Hospital 3. Laboratory 4. I don't know

32. What treatment was given? (Baakuwa ddagala ki?)

1. Antibiotics 2. Pain killers 3. I don't know

33. Do you drink raw milk or products? (Not boiled) (Onywa amata oba ebivaamu nga sibifumbe) 1. Yes 2. No (End of questions)

34. If yes, which of these?

(Tubulireko).....

1. Unboiled milk 2. Uncooked ghee 3. Uncooked cheese

4. Home-made yoghurt

APPENDIX 2 KEY INFORMANT INTERVIEW GUIDE

I am Dr. Nabukenya Immaculate a student from Makerere University, Kampala. I am interested in studying the prevalence and factors associated with brucellosis among abattoir workers in Kampala and Mbarara districts of Uganda. The purpose of this interview is to find out some information regarding this disease from you and I request you to answer the following questions.

Topic guide for administrators

1. Do you know about brucellosis as a disease? (Omanyi obulwadde obuyitibwa omusujja gw'ente?)

.....

...

2. How is it transmitted? (Butambuzibwa butya?)

.....

...

3. Have you or any of your colleagues had it before? (Gwe oba banno bokola nabo mwali mubulwaddeko?)

.....

...

4. How did it present? (Give signs) (Obulwadde buno bwalaga bubonero ki?)

.....

....

5. How was it diagnosed and treated? (Mwamanya mutya nti bwebwo era bwajjanjabibwa

butya?).....

.....

6. How is brucellosis controlled? (Omusujja gw'ente gukendeezebwa gutya?)

.....

....

7. Do you use any of these methods to control the disease among your workers here? (Wano mukozesa ngeri ki okukendeeza obulwadde buno?)

.....

....

Topic guide for health workers

1. Have you encountered cases of brucellosis before?

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2. How did you diagnose and treat them?

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3. Is there a reporting or active surveillance for brucellosis with this department?

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4. Which methods have you instituted to control this disease among abattoir workers?

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Topic guide for meat inspectors (veterinarians)

1. Have you or any of your colleagues had brucellosis before?

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2. How did it present? (Give signs)

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3. How was it diagnosed and treated?

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4. What factors do you think are associated with this disease?

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5. How is brucellosis controlled here?

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6. Do you advise others here on its control?

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Topic guide for people with past history of brucellosis

1. Tell us about your experience with brucellosis. (Tubuliremu ku bulwadde bw'omusujja gw'ente bwebwakuyisa.)

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2. How did it present? (Give signs) (Wafuna bubonero ki?)

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3. How was it diagnosed and treated? (Wajjanjabibwa otya?)

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4. What factors do you think are associated with this disease? (Olowooza bintu ki ebiyamba ku kusasanyizibwa kw'obulwadde buno?)

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APPENDIX 3 PARTICIPANT CONSENT FORM

Study title: Prevalence and factors associated with brucellosis among abattoir workers in Kampala and Mbarara districts, Uganda.

Site of Research: Kampala City Council and Mbarara Municipal Council abattoirs.

Principal Investigator: Dr. Nabukenya Immaculate, Makerere University, Kampala.

Purpose of the study

Dr. Nabukenya Immaculate, a student of Makerere University Medical School is carrying out a study to determine the prevalence and factors associated with brucellosis among abattoir workers. This study is important because abattoir workers are at risk of getting this disease due to daily contact with animals. However no study in Uganda has been done and therefore there is need to study these factors and help future policy makers about the prevalence of the disease for proper control strategies.

How the study will be done

After fully understanding this research, you may provide consent to participate in this study. If you do, you will be interviewed by a research assistant and after this, a blood sample will be taken off from the left or right arm. A blood smear will be done immediately for malaria parasitaemia assessment and the rest of the blood kept for brucellosis tests later. After results are got from the laboratory, all those who participated will get their results. Those who test positive will be referred for treatment.

Risks and discomforts

The risks of drawing blood from the upper arm include temporary discomfort. The amount of blood removed will be too small to affect your health.

Confidentiality

Participation in research may involve a loss of privacy, but information about you will be kept as confidential as possible. Information about you will be seen by only the people working on the study. You will be identified only by a code and your name will not appear on any study record.

Benefits

There is no direct benefit to you for participating in this study. If found positive, you will be referred for proper treatment against brucellosis.

Cost/payment

There is no cost to you for participating in this study, and you will not be paid for participation.

Alternatives to participation

Your participation in this study is completely voluntary.

Use of the results

The findings from this study may be published in a medical journal. You will not be identified by name. You may request an explanation of the study results.

Questions

If you have any other questions, ask or call Dr Nabukenya Immaculate no. 0772-606518.

Statement of consent

I .....have understood what is going to be done, the risks, the benefits involved and my rights regarding this study. In the use of this information, my identity will be concealed. I understand that by signing this form, I indicate that I have been informed about the research study in which I am voluntarily agreeing to participate.

Signature or Fingerprint of Participant Date/Time

Signature of Research assistant Date/Time

APPENDIX 4 PARTICIPANT CONSENT FORM (LUGANDA)

Study title: Prevalence and factors associated with brucellosis among abattoir workers in Kampala and Mbarara districts, Uganda.

Site of Research: Kampala City Council and Mbarara Municipal Council abattoirs.

Principal Investigator: Dr. Nabukenya Immaculate, Makerere University, Kampala.

Ekigendererwa ky'okunoonyereza kuno

Dr. Nabukenya Immaculate muyizi mu ttendekero ekkulu erya Makerere University era ali mu kunoonyereza ku musujja gw'ente mu bakozi b'omulufula. Kino kirungi kubanga abakola mu bisolo buli lunaku bangu bakukwatibwa bulwadde buno okuva ku nsolo oba ennyama.

Ebikwata ku kunoonyereza

Bwoba oyagala okwetaba mu kunoonyerereza kuno ajja kubuuzibwa ebibuuzo ebitonotono ebumukwatako. Omusawo agenda kukujjako omusaayi mutono ku mukono tusobole okunoonyereza ku musujja gw,ent n'ogwensiri. Amangu ddala nga ebivudde mu kunoonyereza nga bifunise, tujja kubireeta buli omu tumubulire ebivuddemu nga ali yekka. Abasangiddwa nga balwadde bajja kulagirirwa ew'okugenda okujjanjabibwa.

Obulumi oba obuzibu obulimu

Akayiso ng'oggyibwako omusaayi kalumamu katono naye omusaayi gwetuggyako mutono nnyo era tewali bulabe ku bulamu bwo.

Ebivuddemu

Ebivudde mu kunoonyereza kuno bijja kutwalibwa nga byakyama, bimanyibwe gwe kikwatako naabo abali mu kunoonyereza kuno bokka. Amannya go tegajja kulabikako ku bivuddemu okujjako ennamba enekuweebwa.

Okusasula n'okusasulibwa

Tetukusuubiza kukuwa kintu kyonna oba gwe okusasula oketaba mu kunoonyereza kuno. Ebinaavaamu ojja kubimanya era omulwadde abulirwe ew'okujjanjabibwa.

Ebibuuzo

Bwoba olina kyotategedde oba kyewetaaga okutangazibwamu, buuza Dr. Nabukenya Immaculate ku ssimu 0772606518 eri ku foomu eno gyowereddwa.

Okukkiriza

Nze.....ntegedde bulungi ebinyonnyoleddwa ku kunoonyereza kuno. Ntegedde nti erinnya lyange n'ebinkwatako bya kyama era nti bwenzisa omukono ku foomu eno nzikirizza abanoonyereza okukozesa ebinkwatako.Siwaliriziddwa kwenyigira mu kunoonyereza kuno.

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Omukono/ekinkumu Olunaku