

Prevalence of Caprine and Human Brucellosis Estimated at Slaughterhouses Processing Grilled Meat and Female Goat Meat Traders Consumed in Lubumbashi Neighborhoods, Democratic Republic of Congo

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ABSTRACT

The aim of this study is to determine the rate of brucellosis infection in goats slaughtered in small private slaughterhouses; in people involved in the handling of these animals for the preparation of grilled goat meat locally called "mitshopo" and women selling meat at the Lubumbashi market. Specific aims are to identify factors influencing goat and human brucellosis infection, to determine the risk of spread of brucellosis in the population at large from small slaughterhouses and to address areas of collaboration between animal and human health services to control brucellosis infections.

A thorough description of slaughterhouse facilities is conducted to determine the presence of running water, sewer, overall cleanliness, garbage disposal, slaughtering processes, the use of byproducts such as blood and skin. Human and goat blood samples are collected from veins and stored in insulated box. The diagnosis is based on the use of Rose Bengal antigen to determine the presence or absence of Brucella. A logit model is developed to identify risk factors among slaughterhouse personnel.

Descriptive study has demonstrated a prevalence of 1.9% in goats and 9.8% in humans respectively. Relational study through non-parametric test showed no significant difference between the various factors, namely species, site and sex. Areas of collaboration between human and animal health services are identified. This study is an alarm for the presence of brucellosis and therefore requires collaboration between human and animal health services to take sanitary provisions for the well-being of communities and ecosystem, for higher livestock profitability and a bigger socio-economic impact in the community. Future studies are recommended to determine the prevalence of brucellosis in communities and pets exposed to byproducts from slaughterhouses.

Key words: One Health competencies, Serological diagnosis, Zoonosis

INTRODUCTION

In Lubumbashi, rearing of goat is a traditional family activity as a source of income. Paradoxically, animals sold for slaughter also result in potential loss, because every goat in two that is sold is pregnant¹⁶. This result in a long term reduced profitability as nearly 10 fetuses are lost daily during the slaughter of pregnant animals in various slaughter houses in the city¹⁵. There are no efforts to improve productivity at a time when the most daunting challenges, including poverty and disease are reported in Africa¹⁹. Application of domains of One Health competencies would be an asset to meet these and other complex production challenges through multidisciplinary and multisectoral collaboration⁷.

In ruminant, brucellosis results in spontaneous abortion and infertility^{1,2}. This is the main complication of the disease⁶. In humans, the disease is manifested as undulant fever with debilitating complications².

Failure to diagnose brucellosis would cause considerable losses in livestock productivity. Indeed, the infected animal is subject to pregnancy losses, but more serious, the female continues to excrete *Brucella* and thus maintains the contagious cycle of brucellosis.

In spite of this fact unfortunately, brucellosis seems not to be an emergency in Africa. Communities prefer to live with brucellosis rather than starve. Indeed, the detection and slaughter method of control of brucellosis would pose a problem in a community whose socio-economic situation is already precarious¹⁷.

Brucellosis is also a major public health problem¹³ as there is a danger of contamination pathways. In Lubumbashi where slaughter of animals causes discharge of secretions into sewers and drains that are poorly maintained is a good example of public

health concern. *Brucella* spp can survive for a longtime in mud and water. To this end, runoff is a public health risk^{6,9} and is a source of infection to stray pets and humans living in unclean environment like slums.

Any factor that reducing reproductive performance adversely affects productivity. This is a factor of herd profitability. Slaughterhouse of Lubumbashi environments do not have sewer pipes, and this contributes to the sustaining of *Brucella* in the environment, which in turn exposes both humans and pets to *Brucella* infection. Over 500,000 cases in humans are reported annually for this zoonosis which appears to be most prevalent in the world^{4,17}, but the full extent of which is still virtually unknown in the sub-Saharan Africa¹⁷, particularly in Democratic Republic of Congo.

The aim of this study is to determine the rate of brucellosis infection in goats slaughtered in small private slaughterhouses; in people involved in the handling of these animals for the preparation of grilled goat meat locally called "mitshopo" and women selling meat at the Lubumbashi market. Specific aims are to identify factors influencing goat and human brucellosis infection, to determine the risk of spread of brucellosis in the population at large from small slaughterhouses and to address areas of collaboration between animal and human health services to control brucellosis infections.

MATERIAL AND METHODS

Two sets of data were collected from December 2013 to January 2014. The first set was collected at four different *mitshopo* selling points and at the Mzee Kabila Market. The second data set was obtained from goat meat traders at the Lubumbashi market.

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Human and goat blood samples were collected from veins and stored in insulated box. The diagnosis was based on the use of Rose Bengal antigen to determine the presence or absence of *Brucella*. Laboratory tests were carried out at the Faculty of Veterinary Medicine of University of Lubumbashi.

Comparison of means was performed using the non-parametric tests.

RESULTS

Descriptive and relational study

Depending on the species, the collection of data concerned small ruminant (98 goats /104 and 6 sheep). Of human participants, 46 were

male and 15 female. Small ruminants had presented for ovine 5 males and 1 female and for caprine 14 males and 74 females.

Samples came from the area of Kamalondo (35.6%), Lubumbashi (37.5%) Kampemba (0.0%) and Ruashi (26.9%). Serological tests (n= 8) showed a prevalence of 1.9% (2/104) in goats (Table 1) and 9.8% (6/61) in humans (Table 2). Relational study through non-parametric tests showed no significant difference between the various factors, namely species, site and sex ($p > 0.05$). The main One Health competencies are shown in table 3.

Table 1: Data collected in small ruminant

| Site | Species | Sex | Brucellosis | | Total |
|------------|---------|--------|-------------|-----|-------|
| | | | No | Yes | |
| Kamalondo | Caprine | Female | 24 | 2 | 26 |
| Kamalondo | Caprine | Male | 9 | 0 | 9 |
| Kamalondo | Ovine | Female | 1 | 0 | 1 |
| Kamalondo | Ovine | Male | 1 | 0 | 1 |
| Kampemba | Caprine | Female | 0 | 0 | 0 |
| Kampemba | Caprine | Male | 0 | 0 | 0 |
| Kampemba | Ovine | Female | 0 | 0 | 0 |
| Kampemba | Ovine | Male | 0 | 0 | 0 |
| Lubumbashi | Caprine | Female | 31 | 0 | 31 |
| Lubumbashi | Caprine | Male | 5 | 0 | 5 |
| Lubumbashi | Ovine | Female | 0 | 0 | 0 |
| Lubumbashi | Ovine | Male | 3 | 0 | 3 |
| Ruashi | Caprine | Female | 17 | 0 | 17 |
| Ruashi | Caprine | Male | 10 | 0 | 10 |
| Ruashi | Ovine | Female | 0 | 0 | 0 |
| Ruashi | Ovine | Male | 1 | 0 | 1 |
| Total | | | 102 | 2 | 104 |

Table 2: Data collected in Human

| Site | Sex | Brucellosis | | Total |
|------------|--------|-------------|-----|-------|
| | | No | Yes | |
| Kamalondo | Female | 0 | 0 | 0 |
| | Male | 22 | 0 | 22 |
| Lubumbashi | Male | 16 | 5 | 21 |
| | Female | 14 | 1 | 15 |
| Kampemba | Female | 0 | 0 | 0 |
| | Male | 2 | 0 | 2 |
| Ruashi | Female | 0 | 0 | 0 |
| | Male | 1 | 0 | 1 |
| Total | | 55 | 6 | 61 |

Domains of One Health competencies:**Table 3: Domains of One Health competencies**

| Domains of competency |
|------------------------------|
| Management |
| Communication |
| Values and Ethics |
| Systems thinking |
| Culture, Belief and Gender |
| Policy and advocacy |

DISCUSSION**Descriptive and relational study**

Results show a One Health approach that focuses on human and animal. In this study, results showed a prevalence of 9.8% in goats (Table 2) and 1.9% in humans (Table 1). The incidence is low in humans; 6 cases out of a population of over 100,000. Studies by Li *et al*¹³., reported 11 cases in 100,000 in China while Bonfoh *et al*³., in Kyrgyzstan, recorded one of the highest incidences in humans (77.5 out of 100,000).

This study helps to consolidate the cases reported globally each year, more than 500,000 cases of human brucellosis^{4,5,17} and to address the lack of data¹⁷ including the Democratic Republic of Congo.

Factors related to the species, sex and the site were not significantly correlated in the influence of brucellosis. The main contamination factor in the transmission of brucellosis is the consumption of raw milk^{1,2,3} and our study has not explored this factor in the area of study.

Contact with pregnant females likely to be seropositive is a risk factor in the spread of *Brucella* from the personal attendant at slaughterhouses and in the preparation of grilled meat. In Lubumbashi, 1 goat in 2 that is slaughtered is pregnant¹⁶. Contact with afterbirths is frequent and increases the risk of human infection^{3,13}. Regard to the work of Pappas *et al*¹⁷., this risk is too high in an environment where fever cases are empirically oriented to malaria. And only a few sero-epidemiological studies can have similar results to those we recorded in Lubumbashi.

Domains of One Health competencies

Table 3 is a One Health approach⁷ to raise the complex challenges in animal health, human

and environmental settings through multidisciplinary and multisectoral collaboration and are applicable in Lubumbashi environment.

Management

Brucellosis is the most widespread zoonosis in the world⁵. It requires, through management, a program capable of having a planned approach and provide sustainable for optimal effectiveness of a health actions. This is intended to develop the capacity to monitor and evaluate disease management programs to identify and prioritize problems linked to One Health approach and adapt training to the realities of public health. It should be noted that zoonosis start as animal diseases. For this purpose, man must reconsider how he is connected to animals¹⁴. Also, it is good to know that brucellosis is a threat to public health and no vaccine is available to protect humans^{8,9}.

Communication

Results of this study contribute to improve and promote a common understanding of the One Health action through the making of a shared data base and a multidisciplinary research team with a spirit of complementarity for effective collaboration. Moreover, the development of communication strategies is necessary to obtain the consent of communities during the data collection. Rubin *et al*¹⁸., found that multidisciplinary and multisectoral cooperation is needed to respond effectively to One Health challenges. Moreover, it takes awareness to overcome the infection of those who are not breeding. Indeed, contact with infected products presents a potential acquisition of brucellosis¹².

Values and Ethics

Taking into account existing communicable diseases including AIDS, data collection requires compliance with ethical principles, namely the person and charity in the blood. On this occasion, skills highlighted concern the protection of the public and practice based on the low risk in relation to HIV / AIDS.

Systems Thinking

It is important to have knowledge on the health of the ecosystem to identify and explain the basic principles of One Health model and implement effective systems approach. This allows to address One Health relevant issues and to develop a strategic vision based on opportunities and threats. Indeed, it is beneficial to use the added value of One Health approach to prevent public health problems¹⁸. It should be noted that among the human disease, brucellosis seems to be neglected both in terms of morbidity and in terms of socio-economic consequences^{5,10,11}, even if the disease is of a minimum mortality¹⁷.

Culture, Belief, and Gender

The ability to reshape cultures, beliefs and practices for good disease management is a useful skill for the prosperity of communities. It is the same for the promotion of the will and culture for self-training.

Policy and Advocacy

To support the One Health approach, it is necessary to design a strategy to fill a gap that is ignorance of pathogenic aspects. Advocacy will be effective through implementation of the strategy to fill the gaps identified in the evaluation exercises. For this purpose, we need a development of databases of One Health. And for this, the One Health approach essentially needs Leadership¹⁸.

CONCLUSION

Results show the prevalence of brucellosis 9.8% (2/104) in goats and 1.9% (6/78) in humans at slaughterhouses of Lubumbashi. Risk factors in caprine and human brucellosis in Lubumbashi do not show a significant evidence set. Further, areas of collaboration between human and animal health services are identified. This study is an alarm for the diagnosis and for subsequently taking sanitary provisions for the well-being of communities and ecosystem productivity. This study is an asset to avoid factors which affects the profitability of livestock production and the socio-economic impact in the community. Future studies might be designed to determine

the prevalence of brucellosis in communities and pets exposed to byproducts from slaughterhouses.

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