



Research Article

Prevalence and Socio-Economic Incidence of Bovine Tuberculosis in a Slaughter Area in the Northern Sudan Region of Burkina Faso

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Abstract | The present study was conducted in the slaughter area of the urban commune of Koudougou to determine the prevalence and socio-economic incidence of bovine tuberculosis. For this purpose, daily monitoring of cattle from various farms and slaughtered at the slaughter area was carried out from February to June 2019 during ante and post-mortem inspections. The results of the analysis of the data collected during these inspections revealed that 1,716 cattle of local breeds, consisting of 875 females and 841 males, were slaughtered and checked by the veterinary inspection officers. At post-mortem inspection, 30 cattle were found to have tuberculosis, giving an overall prevalence of 1.75%. This prevalence showed no significant difference ($P > 0.05$) between breeds, sex, age and body score of the animals while it was significantly influenced ($P = 0.0283$) by the breeding origins of the inspected cattle. The seizures made were mainly partial seizures of lung organs (70.28%) followed by liver (17.57%), kidneys (8.10%) and heads (4.05%). Following the inspection of all the animals during the study period, the urban commune of Koudougou received a total of 1,029,600 CFA francs in slaughter fees. In addition to the considerable losses in animal protein, the financial losses linked to the seizure of organs affected by tuberculosis were evaluated at 206,949.968 CFA francs for butchers without any compensation during the same period. The study shows that tuberculosis exists in the cattle population of the urban commune of Koudougou, and that these animals must therefore be properly inspected to protect human health.

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Introduction

Like all the Sahelian countries in Africa, Burkina Faso is an agro-pastoral country where livestock

farming accounts for 18% of GDP, with a large national herd, particularly cattle, estimated in 2014 at 9,091,718 animals (MRA, 2014). The method of raising these animals is essentially traditional and

is currently faced with several difficulties, including animal diseases of parasitic, viral and bacterial origin (MRA, 2010). Among the bacterial diseases, bovine tuberculosis is a major pathology in dairy production and a zoonosis that attracts the attention of all stakeholders in animal production. Bovine tuberculosis (TBB) is an infectious and contagious disease of chronic evolution, transmissible to humans and many animal species. This enzootic disease is present in all parts of the world with a variable frequency from one country to another with potential socio-economic significance in public health as it can negatively impact on international trade in animals and animal products. In rural areas, bovine tuberculosis leads to an increased morbidity rate and can induce mortalities that decrease the financial capital of the farm and increase production costs. The disease also indirectly leads to losses in agricultural productivity, due to the reduction in draught animals' labour and organic manure (Boukary *et al.*, 2011). In addition, there are the economic losses suffered by the butchery industry as a result of the many seizures in slaughterhouses due to tuberculosis. In this context, it is necessary to know the prevalence of tuberculosis and its risk factors if we want to fight effectively against the disease. Hence the interest of our study which is a contribution to public health in our country in the fight against animal tuberculosis in the urban commune of Koudougou. The general objective of the study is to determine the prevalence of bovine tuberculosis and the associated risk factors, as well as its socio-economic consequences.

Materials and Methods

Study area

A cross-sectional study was conducted from February to June 2019 in the urban commune of Koudougou (2°21'51" West Longitude and 12°15'3" North Latitude) located in the northern Sudanian region of Burkina Faso. This site has a slaughter area where a large number of domestic animals are slaughtered each day to supply meat to the resident population estimated at 188 308 inhabitants in 2018 (Commune de Koudougou, 2018).

Animal material

Animals used in our study were cattle slaughtered and inspected in the slaughter area of the urban commune of Koudougou.

Methodology applied

To carry out the study, two forms of data were used to collect ante and post-mortem information (FAO, 2004). The first form was used to collect ante-mortem information on slaughtered cattle. The second form was used to collect post-mortem data at the slaughter site.

Ante-mortem inspection: For the ante-mortem inspection, butchers were sensitized beforehand for the purposes of the study. This inspection made it possible to estimate the body condition of the animals according to the method described by (Vall and Bayala, 2004) and to collect information on the origins/provenances of the animals and the reasons that led to their sale by the farmers from direct interviews with the butchers. In addition, it enabled the breed and sex to be determined by direct observation of the animals and the age of the animals to be estimated by reading the dental table. Ages were categorized as very young for animals under 2 years of age, young for those between 2 and 6 years of age and adult for those over 6 years of age.

Post-mortem inspection: Post-mortem inspection was carried out every day at the slaughter area in the urban commune of Koudougou from 7am in accordance with the rules established in Burkina Faso. To this end, the procedure indicates the need to apply palpation and incision during the inspection of the lungs, liver, stomach, intestine, spleen and kidneys. This is followed by the examination of several lymph node clusters, namely the retro-mammary, inguinal, pre-crural, pre-scapular, retro-pharyngeal and sub-maxillary nodes. As a result of this inspection, seizures due to tuberculosis were made and their selling prices were estimated from the butchers. All the seizures made were recorded on a card.

Statistical analysis

All data collected was used to perform a descriptive statistical analysis by performing frequencies and percentages and to determine the prevalence rate of tuberculosis. The prevalence rates (PR) were calculated using the following formula:

$$PR (\%) = (\text{number of positive cases} / \text{total number of cattle inspected}) * 100$$

The chi-square test was used to compare data for selected parameters collected at 5% level. All statistical analyses were done using Stat View for Windows, version 4.57.

Results and Discussion

The prevalence of tuberculosis and the risk factors among the cattle inspected in the study are presented in [Table 1](#). Of 1716 cattle slaughtered and inspected in the slaughter area of the urban commune of Koudougou by veterinary officers, 30 animals were infected with TB, giving an overall prevalence rate of 1.75%. These animals belonged to four breeds of cattle, of which Fulani zebu (1.63%) were the most affected cattle breed, followed by taurine (0.06%) and crossbred (0.06%) breeds ([Table 1](#)). However, the breed effect did not significantly influence ($P = 0.836$) the prevalence of TB. Similarly, females were more affected (0.99%) than males (0.76%) but this gender difference had no significant effect ($P = 0.530$) on the prevalence of TB. By age, younger cattle (0.06%) were less affected than juveniles (0.52%) and adults (1.17%) although no significant effect ($P = 0.2645$) was notified on TB prevalence. Regarding the body condition score of the inspected cattle, the prevalence was low in cattle with very good body condition (0.29%) compared to the other groups. However, this parameter did not have a significant effect ($P = 0.7398$) on the prevalence of TB. As for the origins of the cattle inspected, they came from the Centre West (71.85%), Boucle du Mouhoun (23.31%), North (4.2%), Centre North (0.47%) and Sahel (0.17%) regions. [Table 1](#) shows that the origins of the cattle inspected significantly ($P = 0.0283$) influenced the prevalence of TB. The Boulkiemdé province in the Centre West region had the highest prevalence rate with 0.58%, including 0.41%, 0.12% and 0.05% in the communes of Koudougou, Nandiala and Ramongo, respectively.

All the cattle detected with tuberculosis in the Koudougou slaughter area were sold by the herders for the main reason of need of money (76.66%), disease (20%) and fractures (3.33%). Zebu Peul cattle were sold most often for need of money (76.66%) and disease (16.66%), in contrast to the other breeds affected by tuberculosis ([Figure 1](#)).

Of the cattle with TB, no carcasses were seized by the inspection officers. However, partial seizures were made of various organs consisting of lungs (70.28%), liver (17.57%), kidneys (8.10%) and head (4.05%) with TB lesions ([Table 2](#)).

During the study period, the communal authorities

of Koudougou collected a total of 3 496 950 CFA francs in slaughter taxes for all animals slaughtered and inspected on the slaughter floor. The contribution of cattle to these taxes was 1 029 600 CFA francs for all cattle, including 18 000 CFA francs for cattle with TB lesions.

Table 1: TB prevalence and risks factors in cattle inspected in the study.

Variables	Number of cattle		Percent- age of positive (%)	Chi ²	P (Chi ²)
	in- spected	positive cases			
Cattle breed				0.854	0.8364
Goudali	2	0	0		
crossbreed	30	1	0.06		
Taurus	104	1	0.06		
Fulani zebu	1580	28	1.63		
Sex				0.394	0.5304
Female	875	17	0.99		
Male	841	13	0.76		
Age				2.660	0.2645
Very young	26	1	0.06		
Young	744	9	0.52		
Adult	946	20	1.17		
Body condition score				1.255	0.7398
Bad	278	6	0.35		
Medium	451	9	0.53		
Good	561	10	0.58		
Very good	426	5	0.29		
Origins of cattle				42.659	0.0283
Sourou	148	2	0.12		
Boulkiemdé	795	10	0.58		
Sissili	21	2	0.12		
Sanguié	416	9	0.52		
Boucle du Mouhoun	236	4	0.23		
Passoré	72	3	0.18		

Table 2: Organs seized from TB cattle in the study.

Seized organs	Number of organs	Percentage (%)
Liver	13	17.57
Lungs	52	70.28
Kidneys	6	8.10
Head	3	4.05
Total	74	100

For the seizures made, [Table 3](#) presents the average

unit prices of the seized organs based on estimates obtained during interviews with butchers. The results reveal that livers are the organs that cause the most losses to butchers.

Table 3: Financial impact of the seizure of organs affected by TB.

Seized organs	Number	Unit prices (F CFA)	Total losses (CFA francs)
Liver	13	7750	100 750
Lungs	52	893,269	46 449,99
Kidneys	6	791,66	4 749,99
Head	3	18 333,33	54 999,99
Total			206 949,97

1dollar US = 500 F CFA.

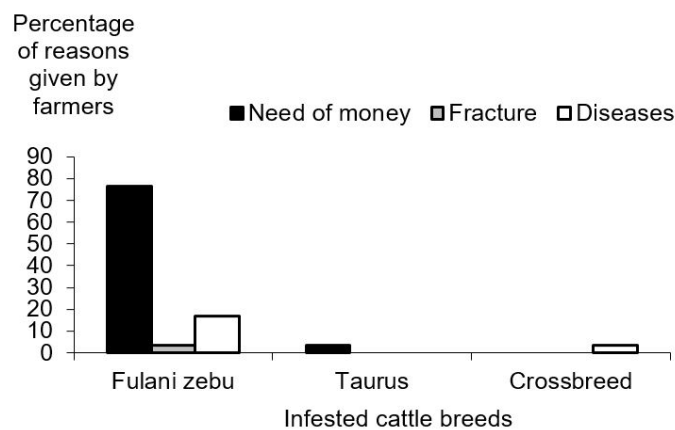


Figure 1: Main reasons for selling tuberculous cattle by farmers.

Through the seizures made, the inspector protects the health of the consumer and reduces the quantity of meat available for consumption by the population. In addition, these seizures are made at the expense of the butchers without any possible compensation. They alone bear the related losses. This situation often makes butchers incomprehensible and sometimes puts them in conflict with the veterinary inspector and the farmers who sell them on credit the animals that are slaughtered in the slaughterhouse of the urban commune of Koudougou.

Despite the apparent public health concerns about bovine tuberculosis in Burkina Faso, little has been done to address the zoonotic importance of the disease and to raise awareness of its prevention. Bovine tuberculosis is a potential zoonosis that can infect various hosts, including humans. In order to draw the attention of the Burkinabe population to the disease so that they adopt good prevention practices to avoid contamination, the campaign was carried out in

the urban commune of Koudougou, which is located about 100 km from the capital city of Ouagadougou.

At the end of the study, an overall prevalence of 1.75% was observed in the cattle population studied after inspection by the veterinary inspectors of the urban commune. This prevalence is lower than those observed in Mali (3%) by Dao (2005), Cameroon (13.5%) by Mebenga *et al.* (2018), Addis Ababa (5.83%) by Ewnetu *et al.* (2012) and Chad (11.8%) by Ngandolo *et al.* (2009) However, it is higher than that obtained in Senegal (0.0185%) by Diagne (2009).

Cattle affected by tuberculosis came from several different breeding origins. Of these, cattle from the Boulkiemdé province, outside the Sanguié province, had a significantly higher prevalence of tuberculosis than those from other provinces in terms of the origin of the animals purchased by the butchers. In Boulkiemdé province, the affected cattle came from the surrounding villages of Koudougou, Nadiala and Ramongo. In the province of Sanguié, the affected cattle came from the communes of Réo, Tita and Tenado where the village of Tiogo is located. From an epidemiological point of view, this information is of paramount importance for the regional and even national authorities in conducting traceability studies to identify the origin of the disease in order to put in place operational strategies to control its spread. It should be noted, however, that during our interviews with butchers, some of them had difficulty giving us the exact origin of an animal. This poses a problem of traceability of contaminated livestock and constitutes an obstacle in the fight against tuberculosis in the region.

The study also reports that the cattle slaughtered at the slaughter site were extensively reared and are mostly of local breeds, consisting of Fulani zebu and taurine, where the prevalence of the disease was higher in Fulani zebu than in taurine. This result was expected because the rearing system to which the animals were subjected before their arrival at the slaughter area and the rearing of local breeds are strongly correlated in rural areas of the different central regions of the country (Gnanda *et al.*, 2016).

The results of the analysis of the collected data reveal that as many females as males are slaughtered in the slaughter area. In addition, they report that females are more affected by TB than males without sex having

a significant effect on the prevalence of the disease in the study. Similar observations were made in Mopti by Dao (2005) in contrast to those of Diagne (2009) in Senegal. Our result could be explained by the fact that the animals were subjected to the extensive rearing system and exposed to the same risks of contamination in their environments of origin.

The study also reports that the age categories of the affected cattle have no significant effect on the prevalence of TB. This finding is in agreement with the results reported from Akaki Municipal Slaughterhouse in Addis Ababa (Ewnetu *et al.*, 2012). The predominance of TB observed in adults can be explained by the fact that older cattle have been exposed to the disease for longer than younger cattle.

The prevalence of TB was not influenced by the body condition of the affected cattle in the study. But animals in good body condition were more affected. In contrast, a study conducted at Akaki Municipal Slaughterhouse in Addis Ababa (Ewnetu *et al.*, 2012) showed that animals with average body condition were the most affected.

On post-mortem inspection, the pathological lesions of tuberculosis on organs are characterized by the formation of granulomas (tubercles) which are usually yellowish, caseous or calcified and sometimes encapsulated (Leslie *et al.*, 2002). In our study, the lungs were the most affected organs (70.28%), indicating pulmonary involvement in cattle affected by the disease and inhalation as the main route of contamination. This observation is in agreement with previous studies by Dao (2005) and Ewnetu *et al.* (2012) who obtained 68% and 69.79% respectively in their study settings. At the Sarh slaughterhouse in Chad, a lower frequency of 8.25% was observed by Ngandolo *et al.* (2009) and in Cameroon (Kousseri) with a rate of 12.8% by Mebenga *et al.* (2018). Also, in Burkina Faso Tialla *et al.* (2021) obtained a prevalence of partial lung seizure of 2% with their study in the rural commune of Tanghin-Dassouri. These results show that the lungs are the preferred site for the tuberculosis bacillus. This a priori involvement of the lungs by the tuberculosis bacillus can be explained by the fact that the bacillus generally takes the respiratory route when virulent aerosols are present (Diagne, 2009). After the lungs, other organs such as the liver (17.57%), kidneys (8.10%) and head (4.05%) are also affected to a significant extent. This diversity of organs

affected by tuberculosis lesions calls for a study of the determination of the tubercle bacilli germs involved. This will allow us to deepen our epidemiological knowledge of the germs circulating in the sites of origin of the cattle for the implementation of consequent control strategies for the disease. Indeed, it is accepted that bovine tuberculosis is caused by *Mycobacterium bovis* and sometimes by *Mycobacterium tuberculosis*, which is the most common cause of the disease in humans (WHO, 2010).

The direct financial losses caused by the seizures were estimated at 206,949.968F CFA. This result is lower than that reported at the Kousseri slaughterhouse by Mebenga *et al.* (2018), at the Bamako and Mopti slaughterhouses by Dao (2005) and at the Cape Verde slaughterhouses by Gueye (1981). However, it is higher than that obtained at the Tanghin-Dassouri slaughterhouse in Burkina Faso by Tialla *et al.* (2021). The differences between the financial losses obtained in the different slaughterhouses could be explained by the number of animals slaughtered, the market price per kilogram of meat and the duration of the study.

Conclusions and Recommendations

The study revealed a prevalence rate of 1.75% among 1,716 cattle slaughtered and inspected at the slaughterhouse in Koudougou during the five months of inspection. Risk factors such as breed, age, sex and body condition studied had no statistically significant difference on the prevalence rate during the study, while the breeding origins of the animals showed a significant difference. The organs seized were the lungs, liver, kidneys and head. The inspection of all slaughtered animals resulted in a total of 3,496,950 CFA francs in slaughter taxes for the urban commune of Koudougou, of which 1,029,600 CFA francs came from slaughtered and inspected cattle. The seizures made by the inspection agents resulted in considerable losses of animal protein and financial losses related to the seizures estimated at 206,949.968 CFA francs. These financial losses directly affect the butchers because they have not received any compensation.

The presence of tuberculosis in the study area shows the need to conduct a study to detect the pathogen involved, coupled with an epidemiological survey of the human population, in order to put in place an integrated strategy to control and fight the disease.

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Novelty Statement

This study identified the prevalence and incidence of tuberculosis in cattle slaughtered in the commune of Koudougou. This will allow the various actors in the meat production chain to be made aware of the dangers associated with the existence of tuberculosis.

Author's Contribution

KA initiated the study, proposed the methodology and participated in the field supervision. OO conducted the butcher survey and drafted the manuscript with TDF. SM, KA, THH, BAMG proceeded to the correction of the manuscript and bring their scientific criticisms.

Conflict of interest

The authors have declared no conflict of interests.

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