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Meat contaminations (Corynebacterial) due to actors in slaughterhouses in the Mountain District, west of Côte d'Ivoire

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Abstract - A study was conducted on meat from regional slaughterhouses in the Mountain District, in western Côte d'Ivoire. The overall objective was to help prevent contamination of beef in slaughterhouses. Post-mortem inspection enabled health and veterinary checks to carry out on all beef carcasses with abscesses. Indeed, 188 samples were taken from muscle abscesses before the carcasses were transported to market.. All open abscesses were sampled and sent to the laboratory for culture in solid and liquid media with added serum. In addition, corynebacteria were isolated. To characterise the causative agent, the samples were stained using May-Grünwald Giemsa (MGG). Laboratory results revealed the presence of Corynebacterium pyogenes in the abscesses. It was observed that the prevalence of corynebacteriosis was very high on average (81%) in meat from slaughterhouses in particular, with 84% in Man, 80% in Duékoué and 73% in Guiglo. This disease is one of the emerging zoonoses and opportunistic diseases found in immunocompromised individuals. The comparison of prevalence rates between slaughterhouses in the Mountain District proved to be insignificant (p>0.05).

Keywords: Meat, prevalence, cryptosporidiosis, slaughterhouses, consumers.

INTRODUCTION

Meat from slaughterhouses is subject to inspection, which is carried out throughout the entire meat supply chain, from primary production to the consumer. (Marabellia et al., 2003). It appears that some actors in the livestock and meat sector are unaware of good hygiene practices and contribute to the spread and multiplication of pathogenic germs during the production and marketing of meat (Mariska et al., 2008). This lack of hygiene is the cause of contamination that can lead to food poisoning in consumers (Yougbaré, 2014). Inspection knives used to cut into carcasses and organs to look for signs of disease. Butchers and veterinary service inspectors systematically open traumatic abscesses. Unfortunately, there is little documentation on the contents of these traumatic abscesses, which harbor pathogens in slaughtered cattle (Aboly, 2022). It therefore seems appropriate to ask whether carcasses pose a potential public health risk to consumers.

To answer this research question, the objective of this study is to help prevent contamination of beef from slaughterhouses in the Mountain District.

MATERIALS AND METHODS

1. Study area

The study was conducted in the Mountain District, which has ten (10) slaughterhouses, including three (3) regional slaughterhouses, in western Côte d'Ivoire (Figure 1). The district has an estimated population of 3,027,023, most of whom live in rural areas and work in agriculture. The climate is characterized by two dry seasons (a long dry season from November to March and a short dry season from July to the end of August) and two rainy seasons (a long rainy season from March to June and a short rainy season from September to October) (INS, 2022).

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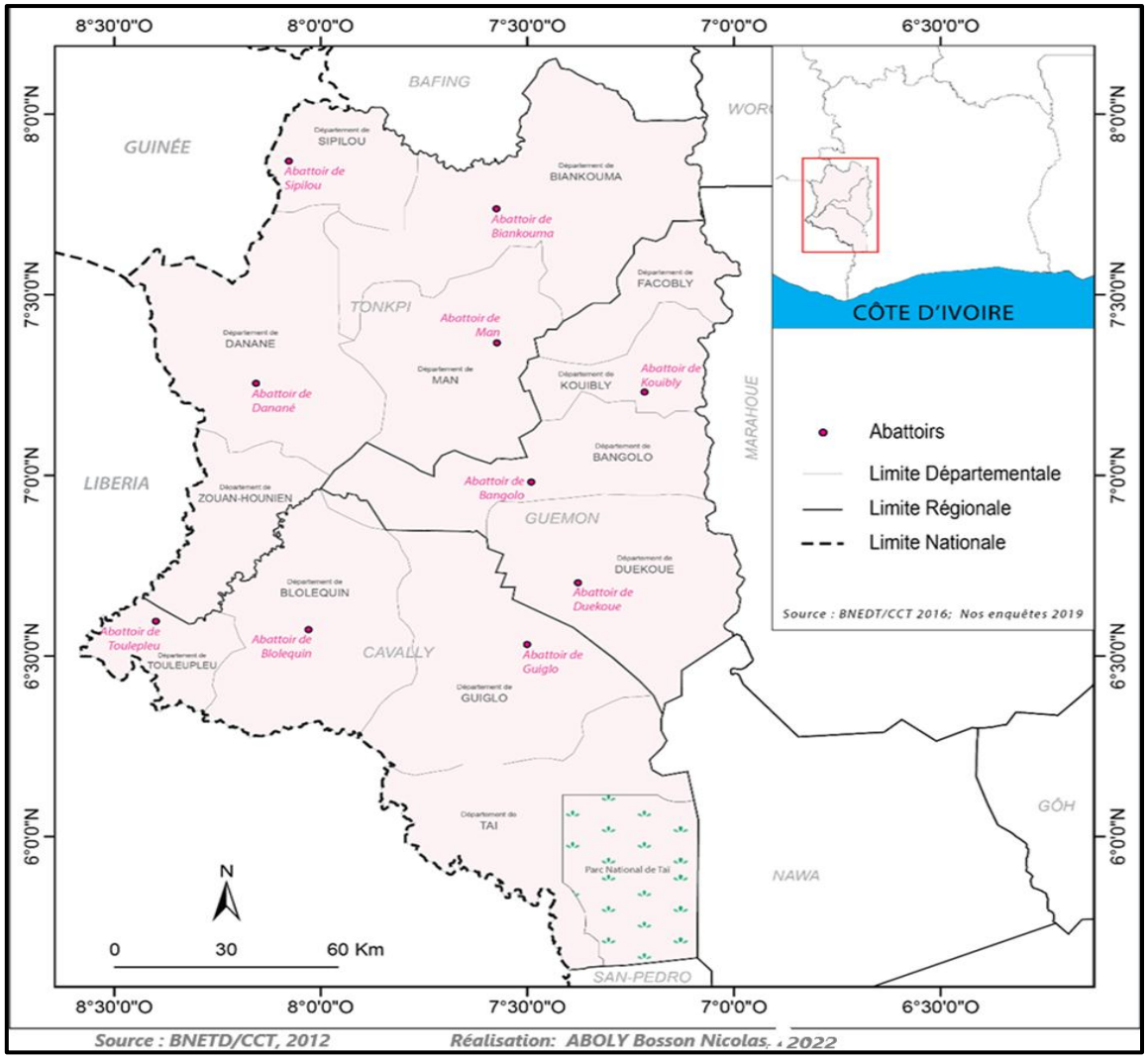

Figure 1: Map of the Mountain District showing study sites

2. Sampling

All animals slaughtered at the three regional slaughterhouses were included during the study period. A total of 18,066 cattle were slaughtered, of which 94 abscesses were observed (Table I). Simple random sampling was the method used. Each individual in a population has an equal probability of being included in the sample in this sampling technique.

3. Samples taken from muscle abscesses

Muscles affected by injection sites during treatment and accidental injuries caused by objects such as branches, thorns, and barbed wire were involved. Abscesses are caused by an influx of white blood cells, partially destroyed bacteria, and inflammatory cells, which together form pus (Aboly, 2022). If opened, the contents of the abscess may leak out and contaminate a large area of the carcass, leading to a larger seizure. Inspection officers or butchers took samples from all muscle abscesses that were deliberately opened. These samples were preserved in 10% formalin before being sent to the laboratory. First, cultures were grown in solid and liquid media with added serum. This was followed by the isolation of corynebacteria. Samples were taken from all open abscesses. A total of 188 samples were taken across the district and sent to the laboratory (Table I).

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Table I : Sample collection by slaughterhouse

Regions of the Mountain District	Regional slaughterhouses	Number of cattle slaughtered	Number of abscesses observed	Number of samples collected
Cavally	Guiglo	4437	15	30
Guémon	Duékoué	3472	33	66
Tonkpi	Man	10157	46	92
Total		**18066**	**94**	**188**

4. Specific staining of samples

After bacterial culture, which is a laboratory technique that involves growing bacteria under controlled conditions to identify them or study their behavior, the samples were specially stained with May-Grünwald Giemsa (MGG) for corynebacteria. The slides were read and interpreted using a LEICA DM 1000 optical microscope.

5. Data collection and analysis

The collected data were entered into the Microsoft Excel 2013 database system. The data were analyzed using R Version 3.4.0. and Stata 14.2 statistical software. The determinants of corynebacteriosis were studied using percentage values, and the chi-square test was performed with a significance threshold set at 5% ($p < 0.05$).

RESULTS AND DISCUSSION

1. Risk factors for carcass contamination at the slaughterhouse

The risk factors for carcass contamination relate to the incision knife and purulent fluid from abscesses. They result from the actions of technical staff and butchers following the systematic opening of traumatic abscesses during the dressing of slaughtered cattle. It has been observed that the contents of these abscesses flow onto the carcasses, causing contamination (Figure 2).

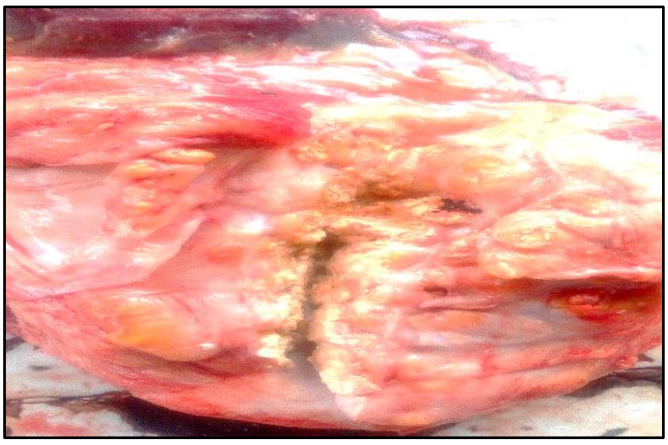

Figure 2: Bovine carcass with abscess opened

2. Results of samples sent to the laboratory

Of a total of 188 samples sent to the laboratory, 152 were reported positive, representing a rate of 81%. These samples were stained with May-Grünwald Giemsa (MGG). Of the three regional slaughterhouses, the Man slaughterhouse recorded the highest rate of positive samples (Table II).

When viewed under a LEICA DM 1000 optical microscope, the pathogen observed in the samples was Corynebacterium at 100x magnification (Figure 3).

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Table II: Results of samples sent to the laboratory by slaughterhouse

Slaughterhouses	Number of samples	Laboratory results		Correspondence
		Négative	Positive	
Duékoué	66	13	53	80%
Guiglo	30	8	22	73%
Man	92	25	77	84%
Total	188	46	152	81%
Ki^2				0,7543
p-value				0,686

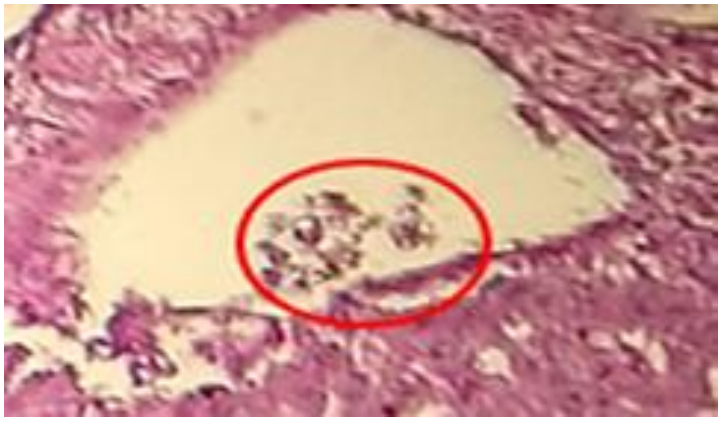

Figure 3: *Corynebacterium pyogenes* observed at 100x magnification.

DISCUSSION

Slaughterhouse workers act out of ignorance or carelessness when they open abscesses in muscles caused by trauma so that their contents can drain out. This practice may pose a risk of meat contamination. If the abscess is opened unintentionally, its contents may drain and contaminate a larger area of the carcass, resulting in a larger seizure (OIE, 2018). This could be explained by the fact that pathogenic germs such as corynebacteria pose a danger to meat consumers and could be pathogens present in these abscesses. Characteristic lesions include muscle abscesses and suppurative infections in various organs and tissues, endometritis, pyometra and arthritis in calves. It should be noted that Shortcomings in the slaughter and distribution of beef could give rise to multiple hazards linked to the marketing of meat that may be unfit for consumption (Toma et al., 2002). According to Torgerson and Budke (2003), meat can easily be contaminated by germs that are hazardous to health during transport from the slaughterhouse to the markets. In addition, the unregulated presence of butchers in the carcass distribution chain encourages deliberate manipulation without restriction or prohibition (Yougbaré, 2014). A total of 94 traumatic muscle abscesses were examined and samples taken for laboratory analysis. Bacterial cultures were performed to determine the pathogenic germs contained in the pus that had dripped onto the carcass intended for human consumption. Laboratory tests have identified Corynebacterium pyogenes as a pathogen that can cause corynebacteriosis, which is a potential zoonosis (ANOFEL, 2016). This zoonosis develops when the host's natural defences are weakened or when there is a change in the competitive flora. Indeed, contamination from animals to humans seems very likely. It should be noted that these abscesses are very common in slaughterhouse animals and their aetiology is highly varied (Diarrassouba, 2011). Our results are similar to those of Benyoucef (2017), who estimated that the lack of administrative and health controls, combined with a thriving commercial activity, can only exacerbate the carelessness of unscrupulous butchers with regard to contaminated meat and offal (Aboly, 2022).

CONCLUSION

Beef from slaughterhouses is prone to contamination. The prevalence of corynobacteriosis was estimated by regional slaughterhouse, with 84% in Man, 80% in Duékoué and 73% in Guiglo. Analysis of the comparison of prevalence rates between slaughterhouses revealed a non-significant difference ($p > 0.05$). In fact, some of the meat produced in regional slaughterhouses and

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sold in butcher shops posed a real risk to consumers in terms of corynebacteriosis. These risks mainly include contamination via knives and the discharge of purulent content from open abscesses on carcasses intended for human consumption.

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DECLARATION OF AUTHORS' CONTRIBUTIONS

The study and writing of the manuscript were carried out collaboratively. However, according to the following steps, ABN and TA participated in the design and planning of the study. ABN and ACM collected the data and drafted the first version of the manuscript. BGKG, ACM and ABN performed the statistical analyses and interpretation of the data. TA and BGKG critically reviewed the manuscript.

CONFLICTS OF INTEREST

The study was conducted without any conflicts of interest.

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