

# Prevention of Occupational Diseases: Evaluation of Hygiene Practices among Staff Working in the Livestock Sector in the South-east of the Ivory-Coast

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**Abstract:** The occupational disease, such as anthrax, is a public health problem in Ivory-Coast, especially among the populations working in the field of livestock. This study was conducted in southeastern of Ivory-Coast. Its purpose is to evaluate the hygiene practices of the population practicing in the field of livestock. The survey involved 130 people. It consisted in the administration of a questionnaire. The analysis of the questionnaire revealed that the drovers and butchers are the populations most exposed to anthrax. This study made it possible to take stock of the hygiene practices of this population and will allow to consider adequate means for the fight against this zoonosis.

**Index terms:** Ivory Coast, anthrax, hygiene, livestock

## 1. INTRODUCTION

Anthrax is a worldwide zoonotic disease [1]. This pathology affecting livestock has repercussions on human health. It is a major public health problem with a greater incidence among people working in the livestock sector [2] [3]. Epidemiological knowledge of the disease, and in particular its distribution, remains low due to weak surveillance systems and underreporting [4]. Overall, it is estimated that the number of reported cases of anthrax in both cattle and humans is decreasing [3].

In sub-Saharan Africa, this pathology still occurs in animals and humans [5], [6], [7]. It mainly affects pastoralist communities with poor socio-economic conditions [7].

In Côte d'Ivoire, it is endemic in the north-east of the country [8]. The large meat deficit in Ivorian territory has opened the way for imports of animals mainly from Mali and Burkina Faso [9], [10]. Many people in the Livestock sector or work in slaughterhouses and killings are regularly in direct contact with animals, blood, carcasses and offal. To this must be added the close relations between the cattle herders. This entire population constitutes a population at risk for this pathology. The study made it possible to understand risk behaviors related to their activities. It will ultimately help improve prevention and control measures that will increase compliance with community control measures.

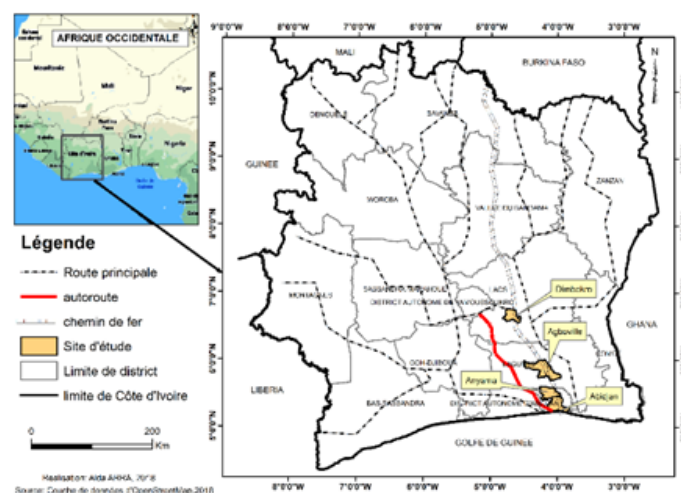
The objective of this study is to evaluate the risk factors of anthrax related to the behavior of people working in the field of cattle breeding in the southern area of Côte d'Ivoire.

## 2 MATERIAL AND METHOD

### 2.1 Description of the study site

The study concerned slaughterhouses and breeding sites in four (04) towns in south-eastern Côte d'Ivoire, namely: Abidjan, Dimbokro, Agboville and Anyama (Figure 1). These cities were chosen because they are important trading places for cattle entry into Côte d'Ivoire. These cities are located in the extension of the railway axis. They all have a granitic type soil, then ferrallitic with presence of clay and sand.

By their geographical positions, the cities benefit from the humid tropical climate with four seasons: a long dry season from December to January, a long rainy season from February to June, a short dry season from July to August and a small rainy season from September to November.



During the period of the study the temperature varied between 27.16 ° C and 30.4 ° C; precipitation is between 1,660 – 2,000 mm of rain per year and an average temperature of 28 ° C [11].

Figure 1: Mapping study areas

### 2.2 Type of study and choice of study population

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This is a cross-sectional survey of at-risk populations in the localities visited. The participants in the study are those who have contact with animals or work in the veterinary field (slaughterhouse workers, breeders, animal sellers, meat breakers, etc.) and who are in contact with live animals or with animal products and by-products. Participation in the study was voluntary. For minors or children, prior consent has been obtained from parents. The exclusion criterion was applied to any person who had no contact with animals, animal products or by-products and the non-volunteer professionals under study.

### 2.3 Methodology of the survey

This study was conducted from September 2016 to January 2017. Preliminary information meetings were held with the personnel managers of each slaughterhouse and the veterinary officials of the city to obtain their authorizations for the realization of the investigation in the different localities. A presentation of the study and its objectives was made by each participant of the study and his written and oral consents were obtained. A questionnaire sheet to be filled in has been given to each participant who consent to fill it out anonymously. For those who were illiterate, we completed their form with the help of a translator. The data collected included sex, nationality, age, exact occupation, and hygiene measures applied in their daily activities. The survey collected both quantitative and qualitative data in order to better understand the risk factors of the pathology.

### 2.4 Data exploitation and analysis

Data entry was done with the Excel software. The KHI-TWO test (X<sup>2</sup>) was used to compare the proportion values of individuals. Interpretations are based on the value of p and within a 95% confidence interval (CI). The digital map of the locality was produced using ArcGIS software.

## 3 RESULTS

### 3.1 Description of the study population

Table 1 describes the characteristics of the population studied. It shows a predominance of the male sex. Malian nationality represents the majority population with 67.1%. The age group [31 - 50] represents the majority portion of our study population (43.6%). The majority of subjects in our study (83.1%) have no level of education.

The slaughterhouses and breeding places of these cities bring together a cosmopolitan human population, mostly foreign and Muslim.

Table 1: Characteristics of the studied population

Variables	Study population			X <sup>2</sup>
	n	%	[IC 95%]	
<b>Sex</b>				
Male	125	96,15	[90,22 ; 98,28]	79,54*
Female	5	3,85	[00,45 ; 06,59]	
<b>Age</b>				
12 – 30	30	22,55	[16,14 ; 31,12]	6,07
31 – 50	58	43,62	[35,89 ; 53,58]	
51 and over	19	14,28	[09,03 ; 21,87]	
Not defined	26	19,55	[13,50 ; 27,91]	
<b>Nationality</b>				
Ivoirian	26	0,20	[13,50 ; 27,91]	19,95*
Burkinabe	22	16,92	[10,92 ; 24,49]	
Malian	82	67,08	[54,17 ; 71,37]	
<b>City surveyed</b>				
Abidjan	106	81,54	[73,78 ; 87,79]	57,07*
Agboville	10	7,70	[03,75 ; 16,69]	
Anyama	3	2,30	[00,47 ; 06,59]	
Dimbokro	11	8,46	[04,29 ; 14,63]	
<b>Level of study</b>				
Schooled	22	16,92	[10,92 ; 24,49]	38,49*
Unschoolled	108	83,08	[75,50 ; 89,07]	
<b>Profession</b>				
Drover	92	77,77	[62,15 ; 78,41]	28,48*
Butcher	23	17,70	[11,55 ; 25,35]	
Health worker	15	11,53	[06,60 ; 18,31]	

\*p < 0,05

The main factors of exposure of anthrax have been identified (Table 2). It shows that health workers are less exposed. Butchers and Bouviers are the most exposed population of our subjects of study. At the level of butchers and drovers, we noted a low level in terms of knowledge of the pathology.

Table 2: Variation of Exposure Factors of Anthrax Based on Study Population

Variables	Drover			Butcher			Health worker		
	n	%	p	n	%	p	n	%	p
<b>Do you know Anthrax?</b>									
Yes	5	5,20	<0,05	3	12,5	0,045	15	100	<0,05
No	91	94,80		21	87,5		0		
<b>What do you do when the animals die?</b>									
Bury	6	6,52	<0,05	20	83,33	0,013	15	100	0,002
Give to the population	86	93,48		4	16,67		0		
<b>Do you wash your hands after touching the carcasse?</b>									
Yes	91	98,91	<0,05	19	79,16	0,032	15	100	0,002
No	1	1,09		5	20,84		0		
<b>What are you washing your hands with?</b>									
Soap and water	90	98,91	<0,05	18	94,73	0,001	15	100	0,002
Simple water	1	1,09		1	5,27		0		
<b>Do you know the procedure of hand washing?</b>									
Yes	4	4,34	<0,05	5	20,83	0,033	15	100	0,002
No	88	95,56		19	79,17		0		

Risk behaviors of our population such as the level of knowledge of the disease ( $X^2 = 54.44$ ,  $p < 0.05$ ), their response to the population when the animals die ( $X^2 = 48.75$ ,  $p < 0, 05$ ) and their knowledge of the effective handwashing procedure ( $X^2 = 54.36$ ,  $p < 0.05$ ) indicates a population at risk.

Table 3 illustrates the exposure factors for *Bacillus sp.* in drovers. It shows that the majority of parks are community-type. The breeding type of our population is predominantly mono-specific. Their batches are mostly grazing. They consume mostly grass added to agricultural products.

Table 3: Main exposure factors of anthrax among drover

Variables	n	%	Drover IC95%	p
<b>Breeding system</b>				
Semi-traditional	89	96,69	[90,76 ; 99,32]	< 0,05
Traditional	3	3,41	[00,67 ; 09,24]	
<b>Breeding mode</b>				
Mixed	3	3,41	[00,67 ; 09,24]	< 0,05
Mono	89	96,69	[90,76 ; 99,32]	
<b>Breeding type</b>				
Domestic	4	4,34	[01,19 ; 10,75]	< 0,05
Community Park	88	95,56	[89,24 ; 98,80]	
<b>What do your animals consume?</b>				
Herbs and agricultural products	92	100	[96,06 ; 100]	< 0,05
Various	0	0		
<b>Do they go to pasture</b>				
Yes	91	98,91	[94,09 ; 99,97]	< 0,05
No	1	1,09	[0 ; 05,90]	
<b>What do you do when animals are sick?</b>				
Inform the veterinarian	80	86,95	[78,32 ; 93,07]	< 0,05
Treat yourself	12	13,05	[06,92 ; 21,67]	

The main offending factors for butchers are illustrated in Table 4. At this level, it should be noted that 37.5% of subjects use walking and 41.67% use a tuft. We found no statistically significant differences in the different modes of meat transport identified ( $X^2 = 0.70$ ,  $p = 0.404$ ).

Table 4: Main Exposure Factors of Anthrax among Butcher

Variables	n	%	Butcher IC95%	p
<b>Are the animals examined before being slaughtered</b>				
Yes	24	100	[85,75 ; 100]	<0,05
No	0	0	-	
<b>What do you transport meat with ?</b>				
Bourrette	10	41,67	[22,10 ; 63,35]	0,404
Cart	5	20,83	[07,13 ; 42,15]	
Walk	9	37,5	[18,79 ; 59,40]	
<b>Do you wash after touching the meat?</b>				
Yes	24	100	[85,75 ; 100]	<0,05
No	0	0	-	

## 4 DISCUSSION

The study showed that the majority of people working in the livestock field have risky behaviors that expose them to the transmission of *Bacillus anthracis* health workers. It

should be noted that human behavior plays a very important role in the transmission of several zoonoses, in particular that of anthrax, as Doreen's work [12] has shown. This is mainly due to a lack of knowledge of the right attitudes and their implementation. Indeed, most people working in the livestock sector have received no basic training related to good practice and attitudes in this area and therefore constitute a vulnerable population.

Despite the many recent awareness campaigns promoting hygiene standards, this survey highlights shortcomings probably related to a lack of access to information by those surveyed. Health education sessions to get them to adopt the necessary hygienic measures against anthrax may be recommended. This observation is similar to that of Taverne who indicated that epidemics in a population precede the behavior of this population [13]. All this represents several risk factors for transmission of this pathology in the community

Our study has demonstrated the existence within this population of behavior that can promote the risk of transmission of anthrax. These results corroborate with several authors who state that populations near livestock or handling domestic animals or their products such as skin, meat, skin and bone are most at risk. [14] [15].

Similar studies have been conducted in India. They have shown that most cases of human anthrax occur in agricultural workers because of the handling of meat or skins of sick animals in India [16], [17], [18]. It should be noted that in Côte d'Ivoire, agriculture is the main source of income for the population. Transmission of anthrax is transmitted by spores [19], [20], [21], [22], which are extremely resistant to natural conditions and can survive for several decades in the environment [23], [24]. This population constitutes a population at risk if rigorous measures are not taken. Spores can remain viable for a prolonged period in the soil [25], [26].

The survey showed that the proportion of males was statistically significant to the proportion of females ( $p < 0.05$ ). This attests that this activity centered on the cattle is more a work of man. This result was also found by Doreen et al. In a study in Zambia in 2017 [12].

The fact that the majority of butchers transport the meat on foot or with ewes exposes them to the transmission of anthrax. This finding was made by Eurich which states that blood contamination is the important factor in the transmission of this pathology [27].

The study showed that most herdsman drive their cattle on pasture. This behavior exposes them to anthrax. It corroborates with the results of some authors who have shown that these areas are places where herbivorous animals are most likely to be exposed to *B. anthracis* spores by inhalation or ingestion [5].

Most breeders indicated that they gave the dead animal to the population for consumption because they are Muslim this is forbidden at their level. This population who engages in such a practice is exposed to a risk of transmission of anthrax. This result is consistent with that of Thappa and Karthikeyan and Tumbull which states any handling of dead animals [25], [26] should be prohibited.

## 5 CONCLUSION

Our study has revealed that the population working in slaughterhouses and breeding grounds is a population at risk in the transmission of anthrax, particularly drovers and butchers. It is therefore important to carry out awareness campaigns for the good practice of hygiene in order to prevent this pathology. They should take an eco-health approach, with the participation of the community, sociologists and health personnel. It would also be important to focus on decentralized awareness campaigns to make it more accessible to communities.

## REFERENCES

- [1] OMS, 2018. *Bacillus anthris* site who.int accessed March 23, 2018
- [2] Siamudaala VM, Bwalya JM, Munang'andu HM, Munag'andu HM, Sinyangwe PG, Banda F, et al. Ecology and epidemiology of anthrax in cattle and humans in Zambia. *Jpn J Vet Res.*; Vol 54, no 1: pp 15 – 23. May 2006
- [3] Molyneux David, Zuhair Hallaj, Gerald T Keusch, Donald P McManus, Helena Ngowi, Sarah Cleaveland, Pilar Ramos-Jimenez, Eduardo Gotuzzo, Kamal Kar, Ana Sanchez, Amadou Garba, Helene Carabin, Amal Bassili, Claire L Chaignat, Francois-Xavier Meslin, Hind M Abushama, Arve L Willingham and Deborah Kioy, 2011- Zoonoses and marginalised infectious diseases of poverty: Where do we stand? *Parasites & Vectors* Vol 4, no 106, 2011, <https://doi.org/10.1186/1756-3305-4-106>
- [4] Hendricks KA, Wright ME, Shadomy S V, Bradley JS, Morrow MG, Pavia AT, et al. Centers for disease control and prevention expert panel meetings on prevention and treatment of anthrax in adults. *Emerg Infect Dis*, Vol 20, no 2, February 2014.
- [5] Dragon DC, Rennie RP. L'écologie des spores de l'anthrax: difficile mais pas invincible. *Can Vet J*, Vol 36, pp 295-301, 1995
- [6] NT G, Nkomo BMM, Chadambuk A, Shambira G TM. Risk factors for contracting anthrax in Kuwirirana ward, Gokwe North, Zimbabwe. *Afr Health Sci*, Vol 10, no 2, pp 159–64, 2010
- [7] Mebratu AT, Hailu Z, Weldearegay YH. A Retrospective Survey and Assessment of Farmers Indigenous Knowledge on Anthrax in and Around Tanqua-Abergelle District. *Acad J Anim Dis*. 2015; Vol 4, no1, pp 10– 6, 2015
- [8] Boutin JP, Debonne JM, Rey JL , Appearance of human anthrax in Ivory Coast forests, *Med Trop*, no1, pp 79-81, 1995
- [9] Yao B. D., Etude de la distribution de la viande importée par voie maritime en Côte d'Ivoire, thèse unique de Doctorat de géographie, Université de Cocody, 258 p, 2010
- [10] Yao B. D., Kallo V., Dynamique de l'approvisionnement du marché à bétail du District d'Abidjan; *Revue de Géographie Tropicale et d'Environnement*, n° 2, 2015
- [11] Anonyme, accessed on line <http://www.hydrosociences.fr/sierem/produits/AtlasCi/Francais//Pluviom%C3%A9trie%20mensuelle.pdf>, March 2016
- [12] Doreen Sitali C, Mumba C, Skjerve E, Mweemba O, KabonesaC, Mwinyi MO, et al, Awareness and attitudes towards anthrax and meat consumption practices among affected communities in Zambia: A mixed methods approach. *PLoS Negl Trop Dis* Vol 11, no 5, 2017, [doi.org/10.1371/journal.pntd.0005580](https://doi.org/10.1371/journal.pntd.0005580)
- [13] Taverne B. Preparing for Ebola outbreaks: not without the social sciences! *Glob Health Promot*, Vol 22; no 2, pp 5–6, 2015
- [14] Dixon TC, Meselson M, Guillemin J, Hanna PC. Anthrax. *N Engl J Med*, Vol 341, pp 815-826, 1999
- [15] Santelli Eugenio, Laurie A. Bankston, Stephen H. Leppla & Robert C. Liddington, 2004- Crystal structure of a complex between anthrax toxin and its host cell receptor *Nature* Vol 430, pp 905–908 (19 August 2004)
- [16] Herriman R. Inde: au moins 35 personnes ont écopé d'anthrax suspecté à Odisha. Indian Express. Online to <http://www.theglobaldispatch.com/india-at-least-35-people-sickened-with-suspected-anthrax-in-odisha-92049/> consulté le 10/06/2018
- [17] Goswami B. Frayeur de l' anthrax à Midnapore Ouest: Neuf personnes, dont des enfants, ont été touchées. Le Statesman. Online to: <http://www.thestatesman.net/news/62264-anthrax-scare-in-west-midnapore.html> accessed 10/06/2018
- [18] Turner WC, Kausrud KL, Krishnappa YS, Crooms JP, Ganz HH, Mapaure I, et al. Fatal attraction: vegetation responses to nutrient inputs attract herbivores to infectious anthrax carcass sites. *Proceedings Biological sciences / The Royal Society*, Vol 281, no 1795, 2014
- [19] Vaissaire, Josée; Mock, Michèle; Patra, Guy; Valognes, Aurèle; Grenouillat, Daniel; Pion, Isabelle; Gauthier, Dominique; Ricart, Jean; Le Doujet, Claudine; Weber, Martine; Pedaille, Francine; Patty, Roland; Prudhomme, Christiane; Game, Yvette, charbon bactérien; bovin; homme; carnivore; lait; anthrax; cow; man; dog; milk; p.c. r.; multiplex;

- bacillus anthracis Bulletin de l'Académie vétérinaire de France [ISSN 0001-4192], Vol 4, pp 445-456, 1997
- [20] Kamboj DV, AK Goel, Singh L. agents de guerre biologique. *Défense Sci J*, Vol 56 : pp 495-506, 2006
- [21] Jernigan JA, Stephens DS, AD Ashford, Omenaca C, Topiel MS, Galbraith M, Tapper M, TL Fisk, Zaki S, Popovic T. anthrax par inhalation bioterrorisme: les 10 premiers cas signalés aux États-Unis. *Emerg Infect Dis*, Vol 7, pp 933-944, 2001
- [22] Atlas RM. Bioterrorisme: de la menace à la réalité. *Annu Rev Microbiol*, Vol 56, pp 167-185, 2002
- [23] Goel AK. Anthrax: Une maladie de biowarfare et d'importance pour la santé publique. Journal mondial des cas cliniques. 2015; *PubMed* Vol 3, no 1, pp 20-33, 2015
- [24] Josée Vaissaire, Le charbon bactérien: accident professionnel d'hier, et toujours, *Bull. Acad. Vét. de France*, Vol 70, pp 93-100, 1997
- [25] Thappa DM, Karthikeyan K. Anthrax cutané: une perspective indienne. *Indian J Dermatol Venereol Leprol*, Vol 68, pp 316-319, 2002
- [26] Turnbull PC. Introduction: histoire de l'anthrax, maladie et écologie. *Curr Top Microbiol Immunol*, Vol 271, pp 1-19, 2002
- [27] Eurich FW. Anthrax dans l'industrie de la laine, avec une référence spéciale à Bradford. *Proc R Soc Med*, Vol 6, pp 219-240, 1913