

## The impact of slaughter practices on the prevalence of *Salmonella* in poultry carcasses in slaughterhouses in Bamako (Mali)

Brahima Sacko <sup>1, 2, \*</sup>, Satigui Sidibe <sup>2</sup>, Ousamane Coulibaly <sup>3</sup>, Kadiatou Coulibaly <sup>2</sup>, Modibo Kouyate <sup>1</sup> and Amadou Hamadoun Babana <sup>1</sup>

<sup>1</sup> Department of Biology, Faculty of Science and Technology, University of Science, Technology and Technology, Bamako, Mali.

<sup>2</sup> Diagnostic and Research Service, Central Veterinary Laboratory, Bamako, Mali.

<sup>3</sup> Department of Mathematics, Faculty of Science and Technology, University of Science, Technology and Technology, Bamako, Mali.

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### Abstract

This study, carried out between October 2016 and June 2018, aimed to assess the impact of slaughtering practices on the prevalence of *Salmonella* in poultry carcasses slaughtered in Bamako markets. It involved 8 slaughterhouses grouped into two categories (A and B). Slaughterhouses classified in category A (75%) were characterized by unsatisfactory hygienic practices. On the other hand, those classified in category B (25%) respected certain principles and standards of slaughter. The prevalence of *Salmonella* observed in category A slaughterhouse (15.97%) is high compared to that of category B (7.29%). The results of this study have made it possible to establish that the risk factors at the origin of the contamination of poultry products are, among other things, the non-application of basic hygiene rules in the markets and at the level of poultry slaughterhouses, the non-application of good slaughtering practices and the use of rudimentary instruments for slaughtering.

**Keywords:** Prevalence; *Salmonella*; Slaughterhouse; Poultry; Bamako

### 1. Introduction

Poultry meat is the most balanced reference food for humans [8, 9]. It is an excellent source of high quality protein, vitamins and mineral salts [5]. However, the poultry slaughterhouse is one of the major critical points of poultry meat hygiene [6, 10, 11]. During slaughter operations, inter-contamination phenomena occur, which induces a proliferation of pathogens on initially healthy carcasses [2]. In Mali, despite the development of poultry farming in recent years, slaughtering practices are lagging behind considerably in technology. At present, there is very little data available on the impact of slaughtering practices on the contamination of poultry meat by *Salmonella* in Mali.

### 2. Material and methods

#### 2.1. Material

##### 2.1.1. Biological material

As biological material we mainly used poultry organs (liver, intestine, skin of the neck).

\* Corresponding author: Brahima Sacko

Department of Biology, Faculty of Science and Technology, University of Science, Technology and Technology, Bamako, Mali.

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## 2.2. Methods

### 2.2.1. Characteristics of the study area

Located on the banks of the Niger River, called Djoliba (the blood river), the city of Bamako is built in a basin surrounded by hills. It extends from west to east over 22 km and from north to south over 12 km, for an area of 267 km<sup>2</sup>. The district of Bamako has a classified forest, that of Koulouba, which covers an area of 2,010 ha.

### 2.2.2. Choice of study sites

We chose four slaughterhouses on the left bank (Hamdallaye, Boukassoumbougou, Medina-coura, Bamako-coura) and four on the right bank (Niamakoro, Badalabougou, Kalabancoro, Banankabougou). The choice of these slaughterhouses was made on the basis of certain criteria, which are: the number of poultry available for slaughter, the responsiveness of the personnel in charge of the slaughter and the level of sanitation of the sites.

### 2.2.3. Study type and period

This is an exploratory study that took place during the period from June 2016 to October 2018.

### 2.2.4. Sampling and sample collection

The study focused on the analysis of 384 samples of organs from slaughtered poultry carcasses in the various markets of Bamako. Before going to the slaughterhouses, we provided ourselves with a sterile cooler containing ice, sterile gloves and sample bags with labels. These samples were put under ice and sent to the Central Veterinary Laboratory for laboratory examinations.

### 2.2.5. Questionnaires

We visited each slaughterhouse to answer a number of questions relating to the characteristics of slaughter, cleaning and disinfection processes and the hygiene of the establishment.

## 2.3. Experimental protocol

The samples are first inoculated on liquid media (tetrathionate broth and rapaport broth) incubated in an oven at 37°C for 24 h. On the second day, the cultures obtained on the liquid media are inoculated on solid media (Mac Conkey agar and *Salmonella* shigella agar). Then the suspicious *Salmonella* colonies that appeared on these agars are subcultured onto the trypticase soy agar in order to obtain pure cultures. Pure cultures obtained on trypticase soy agar are subcultured onto standard identification media for biochemical identification.

## 2.4. Data analysis

The data was entered with Excel 2010, and analyzed by SPSS.20 software. To compare the values of the different variables, we used the Pearson chi-square test at the probability threshold  $p=5\%$

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## 3. Results

The surveys carried out during our visits to the slaughterhouses allowed us to observe the state of the infrastructures and slaughtering practices. These results are shown in Tables 1 and 2.

### 3.1. Characteristics of slaughter practices in slaughterhouses

The analysis of the questionnaires allowed us to classify the slaughterhouses into two categories (A and B). Category A (75%) is characterized by unsatisfactory hygiene practices. Category B (25%) is characterized by compliance with certain slaughtering principles and standards. All category B slaughterhouses (100%) clean their slaughterhouse compared to 16.66% of those in category A. In both categories of slaughterhouses, bleeding is done horizontally and plucking is done manually. All the people in charge of category B slaughter regularly clean their knife after each slaughter, while only 33.33% of category A do so. 50% of category B slaughterhouses renew the scalding water per day compared to 33.33% of category A.

**Table 1** Characteristics of slaughter practices in poultry slaughterhouses

Slaughter practices	Killing	
	Category A (N=6)	Category B (N=2)
Slaughtering room cleaning	1 (16.66%)	2 (100%)
Horizontal kerf	6 (100%)	2 (100%)
Manual plucking	6 (100%)	2 (100%)
Regular blade cleaning	2 (33.33%)	1 (50%)
Renewal of scalding water	2 (33.33%)	2 (100%)

### 3.2. Prevalence of *Salmonella* according to the category of slaughterhouse

**Table 2** Distribution of *Salmonella* according to poultry slaughterhouses

First campaign	Positive	Negative	p- value
category	32 (22.22%)	112	0.1
category B	3 (6.25 %)	45	
Total	35 (18.22%)	157	
Second campaign			
Category A	17 (11.80%)	127	
Category B	1 (2.08 %)	47	
Total	18 (9.37%)	174	

The results showed that the prevalence of *Salmonella* varies significantly depending on the nature of the sample ( $p < 0.05$ ). In fact, during the first campaign, out of 192 samples, 35 gave positive cultures for *Salmonella*. The highest contamination rate was observed in category A slaughterhouses (22.22%) against 6.25% for those in category B. During the second campaign, out of 192 samples, 18 gave positive cultures of *Salmonella*. Category A slaughterhouses recorded a prevalence rate of 11.80% against 2.08% for category B.

## 4. Discussion

Statistical analysis carried out during slaughter shows that slaughterhouses that do not apply strict hygiene measures [1] obtain carcasses more contaminated with *Salmonella* than those from slaughterhouses where hygiene rules are respected. Bleeding in both slaughterhouse categories is done using a knife that is rarely cleaned or disinfected, which can allow the introduction of microorganisms into the circulatory system and into the muscles [3]. The frequent rupture of the digestive tract is a source of contamination of the carcass. Manual plucking, as well as the many contacts of carcasses with soiled surfaces (tables, bags, knives, tea towels, etc.) can also be the source of cross-contamination during storage operations [1]. Slaughtering is carried out in inappropriate places, so that cleaning and disinfection are poorly carried out and facilitate contamination from one slaughter to another [7]. Evisceration can cause soiling of the carcass following rupture of the intestine by the handlers [4]. Faeces are the main reservoir of *Salmonella* because the rupture of the intestinal wall leads to contamination of the carcass, equipment and personnel. The latter can then be important vectors for the dissemination of *Salmonella* by handling the carcasses or by lack of hygiene when humans are healthy carriers of *Salmonella*.

## 5. Conclusion

The results of this study indicate that the level of compliance with good slaughter practices at slaughterhouses has a significant effect on the hygienic quality of poultry carcasses. In order to improve the health safety and hygienic quality

of poultry meat, the application of good hygiene practices as well as the implementation of principles at the level of poultry slaughterhouses is an absolute necessity.

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## Compliance with ethical standards

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### *Disclosure of conflict of interest*

Brahima SACKO coordinated the design and planning of the study, the implementation of the laboratory analyses and the writing of the article; Satigui Sidibe, Kadiatou Coulibaly, Amadou Hamadoun Babana participated in the design, planning and implementation of the study; Ousamane Coulibaly, Modibo Kouyate participated in the statistical analysis of the data.

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