Original Research Article

PREVALENCE AND ECONOMIC IMPACTS OF EIGHT (8) REASONS FOR SEIZURE OF SMALL RUMINANT MEAT AT THE PORT-BOUËT SLAUGHTERHOUSE OF THE AUTONOMOUS DISTRICT OF ABIDJAN, CÔTE D'IVOIRE

ABSTRACT

Aims : This study intends to contribute to the improvement of the quality of small ruminant meat produced at the Port-Bouët slaughterhouse in order to protect consumer health and facilitate the implementation of prophylactic measures.

Study Design : This was a retrospective study conducted at the Port-Bouët slaughterhouse on data produced from July, 2019 to June, 2020 on small ruminants received.

Place and Duration of Study : This study was conducted from January to May 2021 at the Port-Bouët slaughterhouse which receives small ruminants (sheep, goats) from neighboring countries and Ivorian farms. The animals slaughtered in this slaughterhouse come from the small ruminant market at the Port-Bouet slaughterhouse.

Methodology : Data were collected from the digital database of the operating system called "Système de Gestion et d'Identification des Animaux à Port-Bouët" (SYGIAP 3.1). These data concerned the origin of the animals, the number of animals slaughtered, the type of seizure, the reasons for the seizures and the organs seized.

Results: The results indicate that the slaughterhouse is supplied with small ruminants by four (4) countries with proportions of 68.14% (Burkina Faso), 29.29% (Mali), 2.44% (Côte d'Ivoire) and 0.13% (Niger).The proportion of animals slaughtered at the slaughterhouse is 31% and the prevalences of the causes for carcass condemnation are 0.35% (Cysticercosis), 3.32% (echinococcosis), 5.07%

(hepatic cirrhosis), 5.46% (tuberculosis), 9.43% (abscesses), 13.25% (congestion), 28.97% (distomatosis), and 34.15% (hemosiderosis). For the organs seized, the proportions are 0.05% (3 seizures), 0.06% (4 seizures), 0.18% (12 seizures), 0.27% (18 seizures), 0.32% (21 seizures), 23.01% (1,517 seizures) and 76.11% (5,019 seizures) for intestines, muscle, spleen, kidney, heart, lung and liver respectively ; no total seizure (seizure of the whole carcass) is observed. Financial losses linked to all the seizures amount to 8,074,000 XOF.

Conclusion: The Port-Bouët slaughterhouse should report the information obtained during inspections to enable the implementation of prophylactic measures from the origin of the animals in order to reduce the financial and sanitary impacts of zoonoses.

Keywords : Small ruminants, Reasons for seizure, Zoonosis, Slaughterhouse, Côte d'Ivoire.

1. INTRODUCTION

One of the essential concerns of man is to satisfy his being (needs, desires) which must lead to well-being [1].The economic and nutritional needs are particularly mentioned. One of the solutions, since ancient times, to meet these two types of needs is the breeding of animals [2]. Animal and animal products are a major source of protein in the population.Among these commodities, meat from slaughterhouses and slaughter areas occupy a very important proportion [3]. In Côte d'Ivoire, livestock production was established after independence thanks to a proactive policy [4]. Today, it is practiced throughout the Ivorian territory but more in savannah than in forest areas. The coverage rate of local livestock production is 35.9% [5-6].This situation obliges the Ivorian government to import live animals from neighboring countries notably Mali, Burkina Faso and Niger [7].Meat from these animals, despite its food value, can be a danger to consumers [8].

Meat is a good medium for bacterial culture and can carry germs, parasites and toxins harmful to human health [8].This situation is said to be the result of many problems faced by livestock producers, including diseases and poor husbandry techniques [9-10].Thus, meat will only be useful to humans if certain safety conditions are met [8]. In addition, the concepts of quality of life and the environment are becoming increasingly important reasons for consumer demands [1].These findings imply a careful control of bacteriological, parasitological and organoleptic characteristics before marketing the meat [8].

In Côte d'Ivoire, in order to protect the health of consumers, a sanitary and qualitative inspection has been instituted at all critical stages of the supply chain (livestock, meat), such as land, air, port borders

and especially slaughterhouses.In slaughterhouses, ante-mortem and post-mortem inspections serve a triple purpose including protecting consumer health (removal of unsafe products), protecting livestock health (screening for contagious diseases), and ensuring fair trade (removal of unsafe products from sale) [11].Thus, in order to monitor the quality of the meat of small ruminants made available to the population by the slaughterhouse of Port-Bouët,this retrospective study was initiated with the general objective of contributing to the improvement of the quality of small ruminant meat produced in order to protect the health of consumers and facilitate the implementation of prophylactic measures among producers.

2. MATERIAL AND METHODS

2.1. Material

2.1.1. Study site

This study was conducted from January to May 2021 at the Port-Bouët slaughterhouse, which receives small ruminants (sheep, goats) from neighboring countries (Mali, Burkina Faso, Niger) and from Ivorian farms.However, the Port-Bouët slaughterhouse is a complex composed of two livestock markets (cattle and small ruminants), a stabling area, a slaughter room, a cold room, a butchery area and a commercial center. For this study, animals slaughtered in this slaughterhouse come from the small ruminant market.

2.1.2. Biological material

The biological material consists of small ruminants (Figures 1 and 2) received at the Port-Bouët slaughterhouse from July 1, 2019 to June 30, 2020.The study animals come from neighboring countries (Mali, Burkina Faso, Niger) and from Ivorian farms.

A B

C

Fig.1.Photographs of some breeds of sheep, Djallonké dwarf (A), savannah Djallonké (B) and Fulani (C)

A B

C

Fig.2.Photographs of some breeds of goats, Djallonké dwarf (A), Djallonké mossi (B) and Sahel fulani (C)

2.2 Methods

2.2.1. Data collection

The data were collected from the digital database of the operating system called "Système de Gestion et d'Identification des Animaux à Port-Bouët (SYGIAP 3.1)" set up by the management of the Port-Bouët slaughterhouse. They concerned the origin of the animals received by the slaughterhouse, the number of animals slaughtered per day, the type of seizure, the reasons for seizures (in particular tuberculosis, distomatosis, echinococcosis or cyst, cysticercosis, abscess, cirrhosis, congestion and hemosiderosis) and the seized organs.

2.2.2. Statistical analysis

Descriptive statistical analysis (percentage) and graphs (pie charts, curves) were performed using Excel software version 2016.

3. RESULTS AND DISCUSSION

3.1 Results

3.1.1. Supply of the slaughterhouse

Figure 3 shows the supply of small ruminants to the slaughterhouse by country. The slaughterhouse received 235,631 small ruminants of which 160,559 (68.14%), 69,021 (29.29%), 5751 (2.44%) and 300 (0.13%) came from Burkina Faso, Mali, Côte d'Ivoire and Niger respectively.

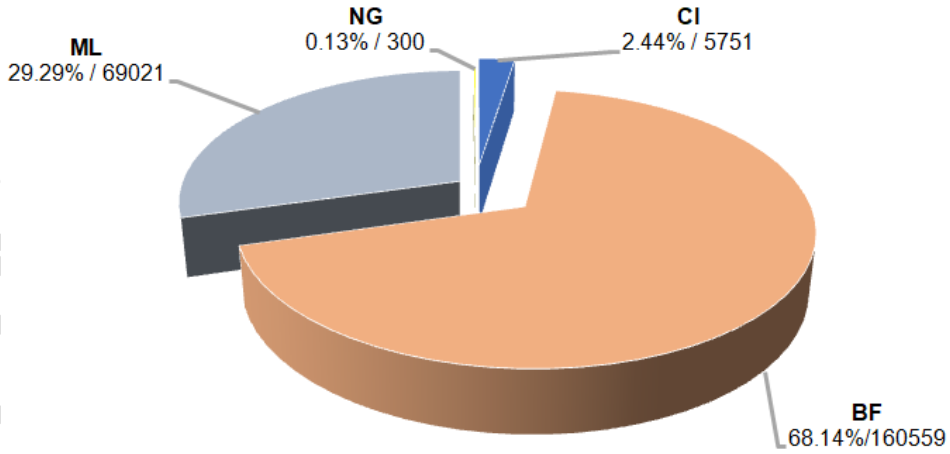

Fig.3. :Supply of small ruminants to the slaughterhouse by country.

CI : Côte d'Ivoire ; **BF** : Burkina Faso ; **ML** : Mali ;**NG** : Niger.

Monthly contribution of the countries in the supply of the slaughterhouse

The curve of the monthly evolution of Burkina Faso's contribution to the supply of the slaughterhouse decreases from July (100%) to June (60%) with a valley in April (49.89%).Regarding Mali, it has a two-

phase evolution, increasing from July (0%) to April (48.81%) and decreasing from April to June (0%).As for Côte d'Ivoire, it has an increasing contribution from July (0%) to June (40%).Niger contributes 0.41% only in August (Figure 4).

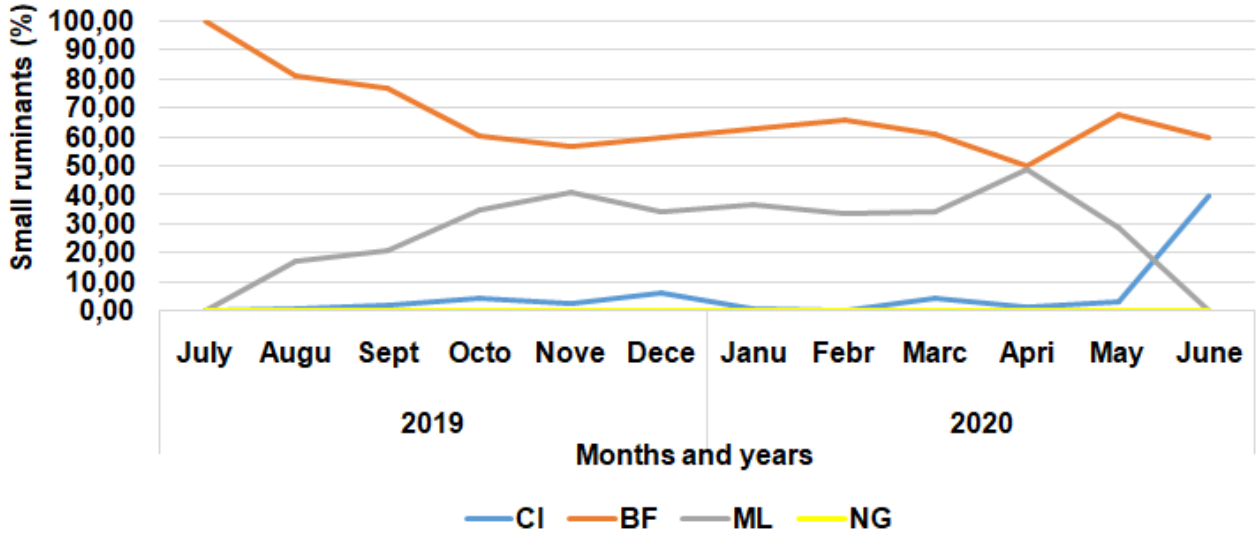

Fig.4. Monthly contribution of countries to the supply of small ruminants to the slaughterhouse

CI : Côte d'Ivoire ; **BF** : Burkina Faso ; **ML** : Mali ; **NG** : Niger.

Janu : January ; **Febr :** February ; **Marc :** March ; **Apri :** April ; **May :** May ; **June :** June ; **July :** July ; **Augu :** August ; **Sept :** September ; **Octo :** October ; **Nove :** November ; **Dece :** December.

Monthly evolution of supply by country

Figure 5 shows the monthly evolution of small ruminant arrivals by country.For Burkina Faso, this trend increases from July (0.19%) to August (37.47%) and then decreases until June (0.09%).It has fluctuated for Mali and Côte d'Ivoire, with peaks in August (18.51%) and October (20.88%) respectively.Valleys are reached in July and June (0%) for Mali and in July and February (0%) for Côte d'Ivoire.The arrival of small ruminants from Niger is 100% in August.

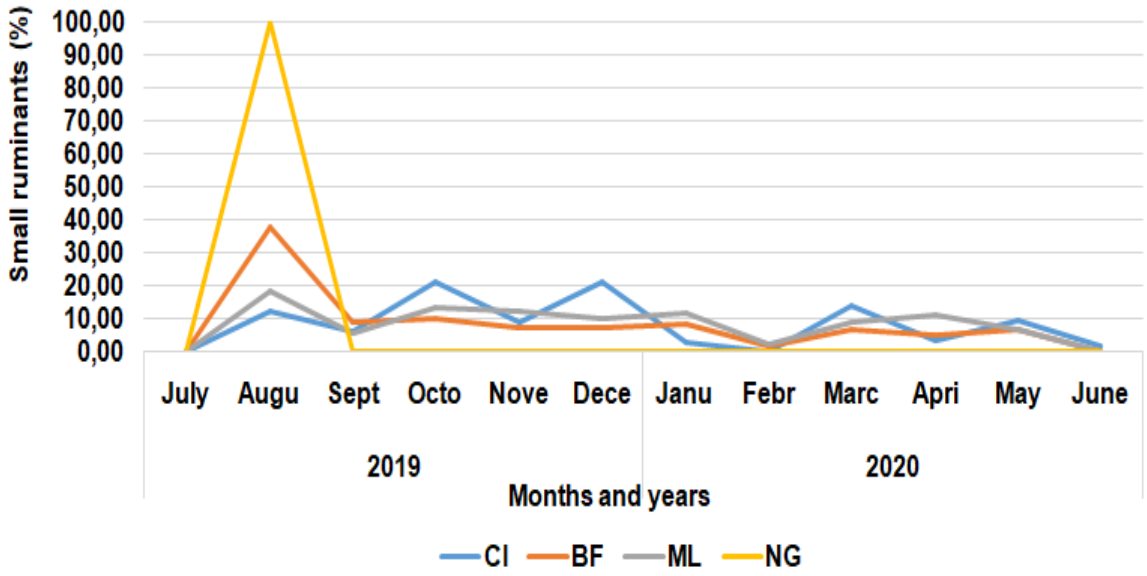

Fig.5. Monthly evolution of small ruminant arrivals by country

CI : Côte d'Ivoire ; **BF** : Burkina Faso ; **ML** : Mali ; **NG** : Niger.

Janu : January ; **Febr :** February ; **Marc :** March ; **Apri :** April ; **May :** May ; **June :** June ; **July :** July ; **Augu :** August ; **Sept :** September ; **Octo :** October ; **Nove :** November ; **Dece :** December.

3.1.2. Slaughter of small ruminants in the slaughterhouse

The proportion of small ruminants slaughtered at the slaughterhouse is 31% (73,136 head) compared to 69% of non-slaughtered animals (16,495 head) (Figure 6).

Fig.6. Proportion of small ruminants slaughtered or not in the slaughterhouse

3.1.3. Prevalence of reasons and bodies seized

All eight (8) seizure reasons considered, particularly tuberculosis, distomatosis, echinococcosis, cysticercosis, abscess, hepatic cirrhosis, congestion and hemosiderosis, were detected. Distribution of seizures according to these reasons shows that the proportions are 0.35% (Cysticercosis), 3.32%

(echinococcosis), 5.07% (hepatic cirrhosis), 5.46% (tuberculosis), 9.43% (abscesses), 13.25% (congestion), 28.97% (distomatosis), and 34.15% (hemosiderosis) (Figure 7A).

Figure 7B shows the proportions of seized small ruminant organs.These proportions are 0.05% (3 seizures), 0.06% (4 seizures), 0.18% (12 seizures), 0.27% (18 seizures), 0.32% (21 seizures), 23.01% (1,517 seizures), and 76.11% (5,019 seizures) for intestines, muscle, spleen, kidney, heart, lung, and liver respectively. No total seizure (seizure of the whole carcass) is observed.

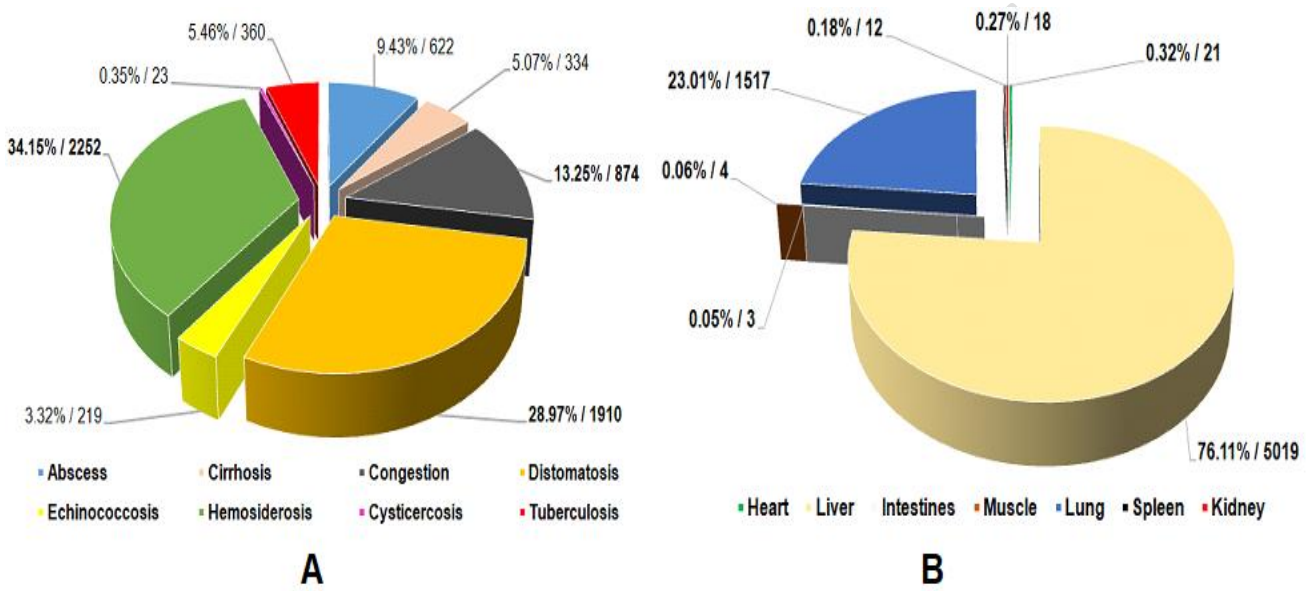

Fig.7. Proportions of seizure reasons (A) and seized small ruminant organs (B)

Figure 8 shows the manifestation of a few seizure patterns including tuberculosis, congestion, cirrhosis, hemosiderosis, distomatosis and echinococcosis. These reasons presented concern a congested carcass and an infected liver (tuberculosis, cirrhosis, hemosiderosis, distomatosis, echinococcosis).

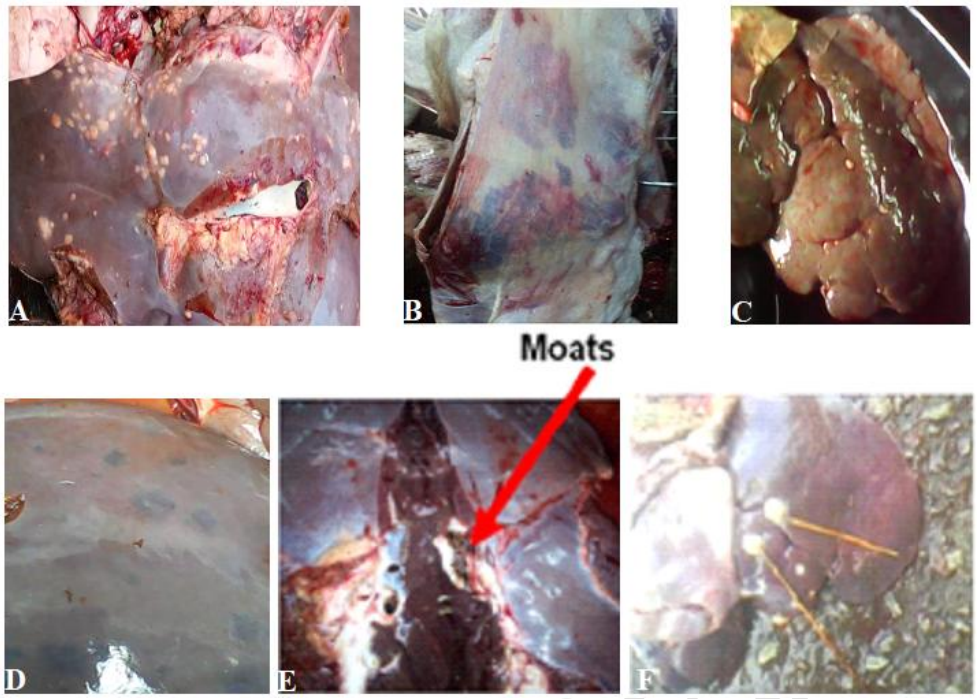

Fig.8.Photographs of a liver with tuberculosis (A), congested carcass (B), livers with cirrhosis (C), hemosiderosis (D), distomatosis (E) and echinococcosis lesions (F).

The causes of heart seizure are congestion (38.10%), cysticercosis (28.57%), echinococcosis (19.05%) and abscess (14.28%). Regarding the liver, the proportions of reasons for seizure are 0.22%, 0.34%, 2.27%, 4.26%, 6.65%, 38.06% and 44.27% respectively for congestion, cysticercosis, tuberculosis, echinococcosis, abscess, liver cirrhosis, distomatosis and hemosiderosis. As for the intestines, muscles and kidneys, they are 100% seized due to tuberculosis, congestion and echinococcosis respectively. Lungs are seized at 1.98%, 16.02%, 26.10% and 55.90% for hemosiderosis, tuberculosis, abscess and congestion respectively. While the spleen is seized for congestion (25.00%) and abscess (75.00%) (Table 1).

Table 1.Distribution of seized organs according to reasons for seizure.

Reasons for seizure	**Heart** (n/%)	**Liver** (n/%)	**Intestines** (n/%)	**Muscle** (n/%)	**Lung** (n/%)	**Spleen** (n/%)	**Kidney** (n/%)
Abscess	3/14,28%	214/4,26%	0/0%	0/0%	396/26,1%	9/75,00%	0/0%
Cirrhosis	0/0%	334/6,65%	0/0%	0/0%	0/0%	0/0%	0/0%
Congestion	8/38,10%	11/0,22%	0/0%	4/100,00%	848/55,9%	3/25,00%	0/0%
Distomatosis	0/0%	1910/38,06%	0/0%	0/0%	0/0%	0/0%	0/0%
Echinococcosis	4/19,05%	197/3,93%	0/0%	0/0%	0/0%	0/0%	18/100,00%
Hemosiderosis	0/0%	2222/44,27%	0/0%	0/0%	30/1,98%	0/0%	0/0%
Cysticercosis	6/28,57%	17/0,34%	0/0%	0/0%	0/0%	0/0%	0/0%
Tuberculosis	0/0%	114/2,27%	3/100,00%	0/0%	243/16,02%	0/0%	0/0%

3.1.4. Economic aspects related to the different organs seized

Table 2 provides an estimate of the economic losses due to partial seizures. Organs are sold individually and the amount lost per organ type is 10,500 F, 5,019,000 F, 10,500 F, and 3,034,000 F for heart, liver, intestines, and lungs respectively with a total of 8,074,000 F for all seizures.

Table.2. Economic losses associated with seized small ruminant organs

Seized parts		Number	Unit price (FCFA)	Total price/Parts (FCFA)	Subtotal (FCFA)
Offal	Heart	21	500	10 500	8 074 000
	Liver	5019	1000	5 019 000	
	Intestines	3	3500	10 500	
	Lung	1517	2000	3 034 000	

3.2. DISCUSSION

The Port-Bouët slaughterhouse complex is supplied with small ruminants (sheep and goats) from four (4) countries, namely Burkina Faso, Mali, Côte d'Ivoire and Niger.However, Burkina Faso remains the leading supplier of small ruminants to the slaughterhouse with 68.14%.This situation could be explained by Burkina Faso's position as a small ruminant breeding country and its easy access to the Ivorian market by both rail and land.These results corroborate those of Yao and Kallo [12] on the dynamics of supply to the livestock market in Abidjan District.These authors indicate that Burkina Faso was the leading supplier of small ruminants to the Abidjan District livestock market in 2000 and 2010 (67.56% and 73% respectively).

In addition, Burkina Faso remains the primary supplier of the Port-Bouët slaughterhouse's livestock market throughout the study period.Burkina Faso's contribution is over 50% in all months except April (49.89%).However, the peak arrivals of small ruminants by country at the gates of the Port-Bouët livestock market are observed in August for Burkina Faso (37.47%), Mali (18.51%), Niger (100%) and in October for Côte d'Ivoire (20.88%).This situation could be explained by the feast of Tabaski which took place on August 12, 2019.This is because this festival consumes small ruminants, particularly sheep [13-15]. The observation of Côte d'Ivoire peak in supply in October could be explained by the return to the market of unsold products from the festival that were fattened on Ivorian farms.

The proportion of small ruminants slaughtered at the Port-Bouët slaughterhouse is 31%. This would mean that the majority of small ruminants unloaded at the Port-Bouët livestock market are purchased by individuals for various ceremonies (weddings, baptisms, sacrifices) or directed to other slaughterhouses (Abobo, Yopougon, Anyama).Small ruminants market of Port-Bouet slaughterhouse is open to both peg farmers and individuals.This phenomenon would corroborate the thesis that small ruminants are mostly recommended for the Tabaski holiday [13].Some products that are not fit for consumption could end up on consumers' plates. Furthermore, the inspection of the carcass and offal of the slaughtered animals at the slaughterhouse revealed all eight (8) reasons for seizure.Those causing partial seizures with prevalences higher than 10% are hemosiderosis (34.15%), distomatosis (28.97%) and congestion (13.25%).These reasons for seizure (hemosiderosis, distomatosis, congestion) could be a source of illness for consumers. The organs concerned by these seizures with frequencies higher than 10% are the liver (76.11%) and the lungs (23.01%).These results are different from those of Diarrassouba [7] obtained during his study on the diagnosis of the conditions of preparation and inspection of meat in the slaughterhouses of the Autonomous District of Abidjan.This author reported that congestion (35.58%), abscess (18.05%) and distomatosis (16.86%) are responsible for partial seizures and the organs involved are lungs (44.05%) and liver (42.13%).This difference in the reasons for seizure could be explained by the duration and scope of the studies. Diarrassouba's [7] study covered all slaughterhouses in the District of Abidjan and data from three years (2007, 2008 and 2009).The incriminated motives could be a source of zoonoses, which highlights the urgency of implementing prophylactic measures upstream because more than 65% of small ruminants are killed outside the Port-Bouët slaughterhouse. This situation could be a source of illness for the consumer.It is interesting to mention that no total seizures were observed during this study. This would mean that the agents responsible for the mentioned seizure reasons did not have time to contaminate the entire carcass.

Partial seizures made at the slaughterhouse as a result of inspection of slaughtered small ruminants constitute a loss for both the peg farmers and the slaughterhouse.The financial losses, at the level of the peg farmers, linked to the various seizures amount to 8,074,000 FCFA.This financial loss to the peg farmers could have implications for the breeders and consumers of the meat.Indeed, it could lead to a decrease in the purchase price of the animals and an increase in the sale price of the meat.With regard to the slaughterhouse, the destruction of the seized organs could result in financial losses.The

reduction of these different losses necessarily requires the implementation of prophylactic measures at the origin of the animals (breeders, transporters).However, the sine qua non condition for the implementation of these prophylactic measures is the establishment of a reliable traceability system based on the identification of the animals.In this way, the slaughterhouse services could pass on information obtained during inspections, allowing better management of animal pathologies from the origin of the animals.

4. CONCLUSION

At the end of this retrospective study, it appears that Burkina Faso is the primary supplier of small ruminants to the Port-Bouët livestock market.Only 31% of the 235,631 small ruminants received underwent post-mortem inspection at the Port-Bouët slaughterhouse and this inspection revealed partial organ seizures.Regarding these partial seizures, the reasons for high seizures are hemosiderosis, distomatosis and congestion.The organs concerned by these partial seizures with high prevalences (above 10%) are the lungs and the liver.Furthermore, no total seizures were made for the eight (8) reasons considered. The financial losses related to partial seizures over the study period amount to 8,074,000 FCFA.The Port-Bouët slaughterhouse plays an important role in protecting consumers of small ruminant meat in the Autonomous District of Abidjan.However, the implementation of a reliable regional traceability system, based on animal identification, would allow the application of prophylactic measures at the origin of these animals in order to reduce the financial and sanitary impacts of zoonoses.

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