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Research Article

BIOSECURITY AND HEALTH INCIDENCE OF PATHOLOGIES IN PIG FARMS IN THE DEPARTMENTS OF MAN AND BIANKOUMA, TONKPI REGION (CÔTE D'IVOIRE)

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ABSTRACT

Pig farming is experiencing difficult development in the Tonkpi region, in western Côte d'Ivoire for several reasons. This study aimed to contribute to the improvement of pig farms in this region. To this end, a study was conducted between December 2023 and February 2024 with 44 pig farmers, including 28 farmers from the departments of Man and 16 farmers from Biankouma. The breeders were surveyed on the basis of breeding practices, hygiene rules applied, pathologies encountered and their incidence. The study shows that there is a high proportion of men (86.4%) who work in the activity for several reasons including entrepreneurship (86.4%). The farms were mostly of the traditional type (81.8%) built with beaten earth, cement or wood equipment. The level of hygiene of the farms was acceptable in 50% of cases. Disinfection varied between the two areas ($p = 0.020$) and was non-existent in 62.5% of the farms in the Biankouma department. Several disease symptoms were reported by farmers and the most mentioned were diarrhea (63.6%), scabies (54.5%) and mastitis (31.8%). The mortality rate was 6.0 ± 2.96 with high mortality reported after weaning (45.5%) and before weaning (31.8%). The pig industry is an alternative to resolve several types of difficulties. Pig farmers in these localities must be interested in training in order to acquire knowledge that will improve productivity.

Keywords: Pig farming, Biosecurity, Pathologies, Côte d'Ivoire, Tonkpi.

INTRODUCTION

The pig sector is growing today for several reasons. It contributes enormously to job creation, poverty reduction, and the country's GDP, and pig is a significant source of dietary protein (Chibuzor *et al*., 2021). Pig is one of the most consumed meats in the world despite some religious considerations and taboos. It provides approximately 40% of the meat in the form of animal protein in the world (Karaye *et al*., 2016). Since 2019, global pig consumption has increased from 100 to 114 million tonnes of carcass equivalent (Mtec), representing a growth of 14%. The world's largest pork consumer is China, with consumption exceeding 50 Mtec. In 2023, the top three pig producers were China (49.2%), the European Union (18.0%), and the United States (10.7%) (Zarnovican, 2024). Pork represents a strategic opportunity for Africa to ensure its protein food security and play a role in the global market through exports. Africa's contribution to global pork production remains low at 1.67%, with high production in West Africa (Adesehinwa *et al*., 2024). In Côte d'Ivoire, the livestock sector is characterized by the predominance of traditional practices, particularly in the pork (97%), beef (95%) and poultry (70%) sectors (MIRAH, 2014). Given an estimated need of 10 kg per inhabitant per year, local production of animal protein from these farms does not cover the entire demand of the Ivorian population. This situation makes the country dependent on imports of animal protein. In 2011, imports of pork products were estimated at 46% (MIRAH, 2014). The pig sector saw a 35% increase in its total population from 2014 (375,669 pigs) to 2019 (431,389 pigs). Unfortunately, this rate was strongly impacted by the appearance of African Swine Fever (ASF) in the San-Pedro

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area, in the Poro and Tchologo region and in the Tonkpi region with a loss of more than 55,000 pigs (MIRAH, 2022).

Currently, the bibliography shows that data on the characterization of pig farms in the Tonkpi region is almost non-existent. The breeding system applied in the different localities does not allow good productivity of the animals to satisfy the population. It is clear that livestock farming in general and pig farming in particular is not yet well developed in the area due to the dominance of agriculture such as coffee, cocoa, rice and cassava. However, pig farming constitutes an important economic source for breeders because it contributes to solving social problems (Klous *et al*., 2014). At the agricultural level, pigs also contribute to soil fertilization through their manure. The annual manure production of an adult pig is between 600 and 730 kg (Kone *et al*., 2022). Analyzing the situation of these pig farms would be very important for decision-making in order to guide the development of this type of breeding (Alkoiret *et al*., 2009). This study aims to contribute to the improvement of pig farms in the Tonkpi region. It involved, through a survey, characterizing the farms and evaluating the impact of breeding practices and pathologies on the animals.

MATERIEL AND METHODS

Study sites

The Tonkpi region is located in the mountainous west of Côte d'Ivoire, approximately 570 km from the economic capital Abidjan. It has five departments, namely Man (regional capital), Biankouma, Sipilou, Danané and Zouan-Hounien. The region borders Liberia and Guinea. Its total population is 1,387,909 inhabitants, including 740,936 men and 646,973 women (RGPH, 2021). This research was carried out in two departments of this region, namely the department of Man and Biankouma (Figure 1). The climate of the region is subequatorial. This climate is characterized by two seasons, a rainy season from April to October and a dry season from November to March. The average annual rainfall in the region is 1632 mm and the average annual temperature in the region fluctuates around 25°C (Ahoussi *et al*., 2018).

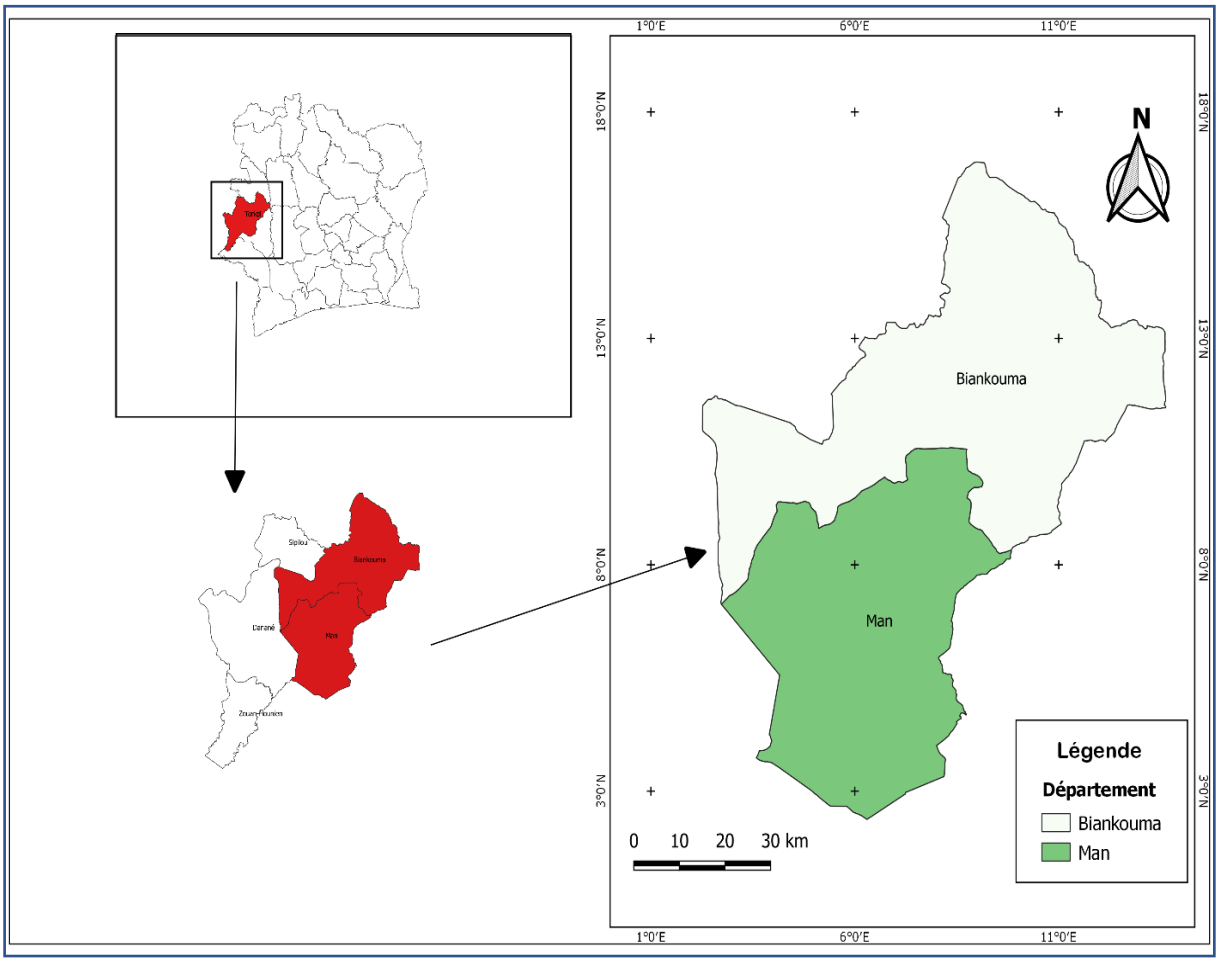

Figure 1. The map showing the investigation departments.

Survey method

The survey focused on pig farmers in the localities of Man and Biankouma. During the period from December 2023 to February 2024, a total of 44 pig farms were surveyed, including 28 farms in Man and 16 farms in Biankouma. Data were collected through a cross-sectional and retrospective survey coupled with direct observations on the farms visited. Direct observations consisted of taking a closer look at the farms visited, particularly the level of sanitation as evidenced by odor, the presence of harmful insects, the appearance of the soil, and the presence of footbaths. The survey was conducted using a short, structured questionnaire to avoid taking up farmers' time. The discussion with each farmer lasted a maximum of 10 minutes. Interviews and observations took place either early in the morning or late in the evening. In addition, the survey required the presence of a local language translator (Toura, Yacouba). Its role was to provide context for the survey among breeders and also facilitate exchanges between the respondents and the investigator. The points retained included, socio-demographic characteristics (sex of the breeder, duration of breeding and reason), characteristics of livestock buildings (nature of construction materials, type of ownership, type of building, presence of footbath), hygiene on farms (condition of the farm, odor level, cleaning of pens, frequency of disinfection, water source, quarantine, cleaning of feeders and waterers), symptoms of diseases and mortalities on farms.

Survey Data Processing

During this study, data collected from livestock farmers were entered into SPSS 20.0 software. The frequencies of the various variables were determined and expressed as percentages. Two statistical tests were used during data processing. These were the chi-square test to compare the relationships between variables at the p=0.05 threshold and the U-test of Mann-Whitney to compare the average mortality rates between the two survey areas.

RESULTS AND DISCUSSION

The farms visited during our work are managed and maintained by men and women. The survey shows that 38 farms are maintained by men, a percentage of 86.4%, and six farms maintained by women, a percentage of 13.6%. In addition, among the 44 farmers surveyed, 20 farmers (45.5%) had been engaged in pig farming for less than five years, and 24 farmers (54.5%) claimed to have more than five years of experience in the field. Regarding the level of education of the farmers, the majority of farmers were educated (63.64%) and 36.36% of farmers were illiterate. Pig farming was practiced by farmers for several reasons. The most cited reasons were entrepreneurship (86.4%) followed by social issues such as poverty (9.1%). Furthermore, 4.5% of breeders practiced this activity because it is part of their culture (Table 1). Concerning livestock buildings, the survey conducted among pig farmers revealed that the piggeries used were mostly of the traditional type (81.8%). Only 14 farmers (31.8%) among the 44 interviewed had improved livestock farming. Traditional farms were characterized by poorly maintained piggeries in which very little hygiene was observed. The buildings observed were mostly built with cemented brick (77.3%). Wooden buildings (Figure 2) were also observed in ten farms (22.7%). The rental of livestock buildings was rarely observed in the two survey departments (two farmers, or 4.5%) (Table 1).

Table 1. Characteristics of pig breeders and livestock buildings.

Variables		Number of farmers
Sex	Male	38 (86.4)
	Female	6 (13.6)
Education level	Illiterate	16 (36.4)
	Educated	28 (63.6)
During of farm	Less 5 years	20 (45.4)
	More 5 years	24 (54.5)
Reasons for breeding	Entrepreneurship	38 (86.4)
	Reduce poverty	4 (9.1)
	Cultural	2 (4.5)
Materials of breeding	Wood	10 (22.7)
	Cemented brick	34 (77.3)
Property type	Location	2 (4.5)
	Owner	42 (95.5)
Bulding type	Improved	8 (18.2)
	Traditionnal	36 (81.8)
Footbath	Absence	22 (95.5)
	Presence	2 (4.5)

Figure 2. Traditional wooden pig housing in the Biankouma department.

Taking into account the sanitary condition of the farms, four classifications were made: clean farms; acceptable farms; dirty farms; and very dirty farms. Half of the farms were in acceptable sanitary condition (n=22; 50%), while 10 farms (n=10; 22.7%) were in a clean condition. Dirty and very dirty farms with foul odors had respective frequencies of 18.2% and 9.1% (Figure 3). Animal quarantine was practiced by 34 farmers (77.3%). Regarding the cleaning of feeders, waterers, and breeding encloure, the 44 farmers surveyed cleaned all feeders and waterers (100%). The presence of footbaths at the entrance to the piggeries was observed on two farms (4.5%).

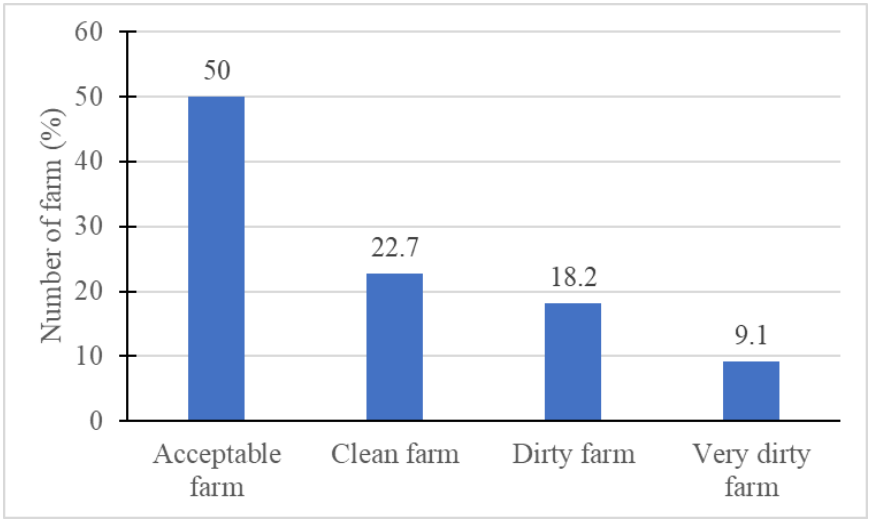

Figure 3. Frequency of health sanitary of pig farms.

The practice of disinfection was observed in 28 farms (63.6%) out of the 44 farms visited. Among those who practiced disinfection, 50% disinfected regularly, while 27.3% of the farms surveyed did not practice disinfection at all on their farms. The statistical results showed that the frequency of disinfection varied from one area to another (p = 0.020; chi 2 = 7.870). Regular disinfection was more practiced in several farms in the department of Man (64.3%) while it was non-existent in 62.5% of farms in the department of Biankouma. Three water sources were used by livestock farmers in the surveyed departments. These were well water, SODECI water, and river water. Well water was the most commonly used (86.4%). These waters were treated with products by 72.7% of livestock farmers,

while 27.3% did not treat the water before distributing it to the animals. During our farm survey, several disease symptoms were reported by farmers. The most common symptoms were: diarrhea (63.6%); scabies (54.5%); and mastitis (31.8%). Other disease symptoms such as wounds; lameness; vomiting; abortion; cough; and anorexia were also mentioned. These symptoms reported above were treated with modern treatments (90.9%), and 9.1% of farmers did not practice any treatment (Table 2).

Table 2. Frequency of occurrence of diseases in pig farms.

Symptoms	Number of appearances in farms	Frequency of appearance (%)
Scabies	24	54.5
Mastitis	14	31.8
Diarrhea	28	63.6
Wounds	6	13.6
Lameness	2	4.54
Vomiting	6	13.6
Abortion	12	27.3
Cough	10	22.7
Anorexia	10	22.7
Arthritis	0	0
Agalacite	4	9.1
Paralysis	13	29.4

Our results show that mortality cases were reported on 86.36% (n=38) of farms. The number of pig deaths per farm ranged from 0 to 12, with an average of 6.0 ± 2.96 pigs. The average number of pig deaths in Biankouma department was 7.5 ± 2.96, while that in Man Department was 5.14 ± 2.64 (Figure 4). Farmers reported that pig mortality was higher before and after the weaning period (Figure 5). Mann-Whitney's U-test showed that there was a significant difference between the two mean mortality rates ($p = 0.008$).

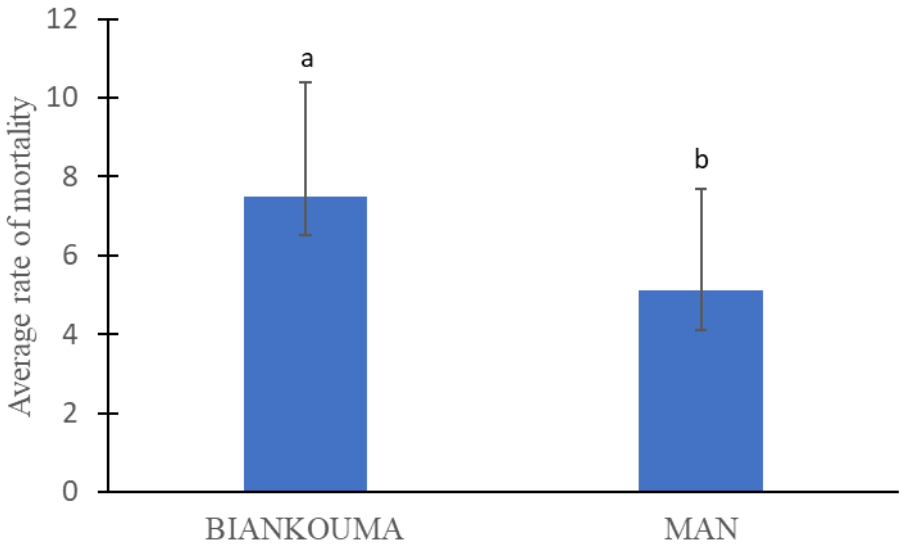

Figure 4. Average mortality rates on pig farms.

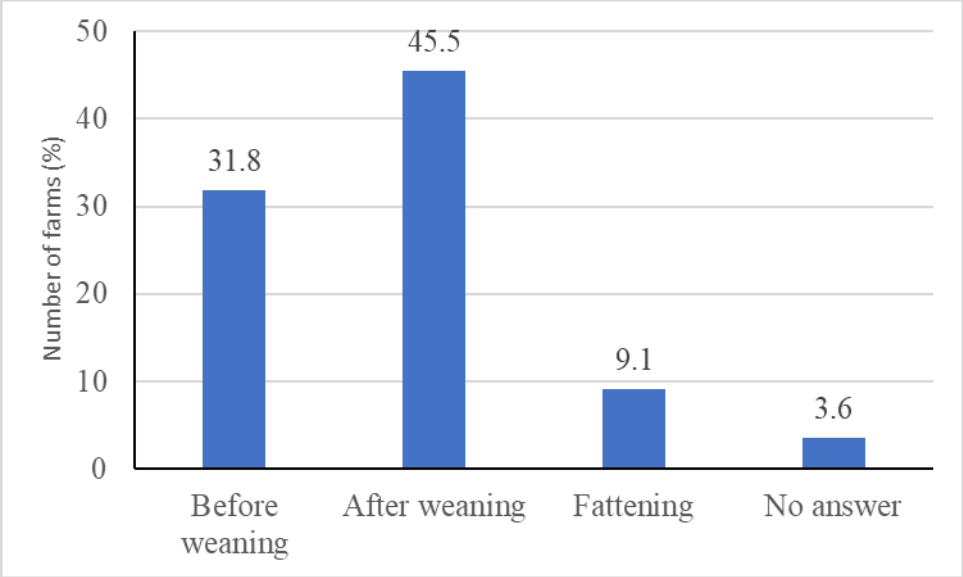

Figure 5. Disease frequency according to the physiological stages of animals.

DISCUSSION

The survey results showed that men (86.4%) are the majority in the pig farming sector in the Tonkpi region. Women are underrepresented in this field at 13.6%. Our results are similar to those of Ohouko *et al*. (2020) who in their work carried out in southern Benin recorded 91.43% of men working in pig farming. This low proportion of women could be explained by the fact that they find this activity really arduous. Moreover, in the region, livestock farming is not very developed, they prefer to turn to growing food. These pig farmers have been carrying out this activity for more than five years (54.5%), compared to pig farmers in Benin who had more than ten years of experience (Houndonougbo *et al*., 2012). Regarding the level of education of the surveyed breeders, 63.64% are educated. Our results are similar to those of Houndonougbo *et al*. (2012) and Ohouko *et al*. (2020) who, during their work in Benin, obtained 67% and 84.29% of educated breeders respectively. However, despite the high level of education of the majority of pig farmers in the Tonkpi region, pig farming remains precarious. This situation could be explained by the lack of professional training of farmers, most of whom work in this field to supplement their monthly income. This point of view is shared by Mopaté (2008), who, according to him, considers pig farming to be an alternative means of diversifying income to secure families.

The livestock buildings of the farms visited are mostly traditional (81.8%), built mainly from cement brick or earth. Our results are similar to those of Akilimali *et al*. (2017) who observed 85.80% of traditional livestock buildings in South Kivu in Congo. This high rate of traditional buildings observed in the two survey departments could be due to the social level of these breeders who use materials at hand that are less expensive. In addition, the lack of financial support for the livestock project does not allow these breeders to build modern buildings. The sanitary status mentioned in this study showed an acceptable level of the farms visited. Most pig farmers applied appropriate hygiene measures. However, in some farms visited, an advanced state of degradation of the buildings as well as the breeding environment was observed. These farms were mainly characterized by strong odors with worn building materials. This could be explained by the fact that some farmers consider pig farming as a secondary activity. They therefore devote less time to the application of hygiene measures in the premises.

Poor hygiene in piggeries was also mentioned by Brou *et al*. (2020) in Korhogo farms. In the farms surveyed, sanitary prophylaxis was limited to deworming, disinfection of premises and cleaning of feeders and waterers. Disinfection was practiced by 63.6 % of breeders on a regular basis and was non-existent in 36.4 % of farms. These results are lower than those of Brou *et al*. (2020) who obtained a disinfection rate of 78.8%. This difference could be explained on the one hand by the type of building used and on the other hand by the level of training. Indeed, in our study, the piggeries are of traditional types (81.8%) built of wood or beaten earth with cemented or non-cemented floors which does not facilitate the cleaning and application of disinfectants such as gresley and bleach on the surfaces and walls of the buildings.

However, statistical analyses showed that the frequency of disinfection was not related to the type of building ($p = 0.805$). Added to this is the lack of training of breeders on good breeding practices. They are often unaware of the importance of disinfection of farms and this was more observed in the Biankouma farms. The study reported that breeders in this locality practiced disinfection less. Disease symptoms reported by farmers were numerous. The most frequently reported in this survey were diarrhea, stillbirths, scabies, and cases of mastitis. Our results confirm those of several authors who mentioned the same pathologies in their study (Ohouko *et al*., 2020; Tra Bi, 2009; Brou.,

2020). Diarrhea cases were reported in 28 farms (63.6%) and was indicated as the most dominant pathology in the farms. Our results are roughly equal to those of Tra Bi (2009), who obtained 69.2% of diarrhea cases. Lower prevalences in our data we111re recorded by Ohouko *et al*. (2020) as well as by Brou *et al*. (2020) with proportions of 17.14% and 17.6%. The reasons that could explain the presence of these diseases in these farms are: the environment and the well water used could be a source of contamination and the ineffective disinfectants used. Irregularities in sanitary measures were observed during our visit to the farms. These include the presence of pests (rodents, cockroaches, geckos) which are vectors of transmission of pathologies. Almost all farms did not have a footbath at the entrance to the buildings. This biosecurity measure could reduce the entry of pathogens into the farms.

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CONFLICT OF INTERESTS

The authors declare no conflict of interest

ETHICS APPROVAL

Not applicable

FUNDING

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AI TOOL DECLARATION

The authors declares that no AI and related tools are used to write the scientific content of this manuscript.

DATA AVAILABILITY

Data will be available on request

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