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# **RESEARCH PAPER**

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# Prevalence of pathologies encountered in dairy cattle in Côte d'Ivoire

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### Abstract

On dairy farms, disease is one of the main causes of poor performance, given its biological and economic consequences. The aim of this study was to determine the prevalence of pathologies encountered in mixed-breed dairy cows in Côte d'Ivoire. The study involved 132 crossbred cows, including 104 Montbeliarde crossbreds and 28 Holstein crossbreds. For three years, the herd was inspected daily to identify and record cases of pathology. The overall prevalence of pathologies, as well as the effect of breed, generation, production level and season, was determined using the Chi-square test of independence. A total of 448 symptoms were recorded and grouped into seven (7) pathologies. These were mastitis, lameness, metritis, dystocia, placental retention, trypanosomiasis and "other pathologies", the respective proportions of which were: 50.54%, 18.08%, 14.96%, 4.02%, 7.14%, 0.45% and 4.91%. Montbeliarde cows of all generations were significantly susceptible to pathologies. First-generation cows were significantly more affected by pathologies than second-generation cows. In terms of milk production, whatever the breed, cows with a production of over 15 liters were significantly affected by mastitis and lameness, while cows with a production of over 15 liters were significantly affected by pathologies.

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### Introduction

Côte d'Ivoire has a deficit in milk and dairy products due to its production system and exploited genetic resources (Bosson, 2021). This deficit has been increasing with population growth since independence in 1960 (RGPH, 2021) and the urbanization of production areas.

To make up the shortfall, the country imports 86% of its milk and dairy product requirements (Dovonou, 2018). With a view to achieving food security, the Ivorian government has adopted a policy of genetic improvement by crossing local breeds with exotic breeds since independence (Bakayoko, 2016). Thus, the N'dama breed has been crossed with European breeds such as Montbéliarde, Holstein, Normande and Jersey. These various crosses have enabled us to meet our production targets. The dairy performance of these crossbreds has led some private individuals to import seeds and animals from exotic breeds, and then to use them under uncontrolled conditions. Despite their performance, there is a real problem of adaptation and even survival in tropical conditions.

Some authors point to the resurgence of certain pathologies such as mastitis, dermatophilosis and infertility (Poivey, 2007). These pathologies have a major impact on zootechnical performance (lower production, infertility) and economic performance (veterinary costs, early culling, etc.). Analysis of the incidence of these diseases and of intrinsic and extrinsic factors (breed, generation, lactation number, season of onset, production level, etc.) is an important point. In fact, numerous research studies throughout the world bear witness to this fact (Faye et al., 1994). Unfortunately, in Côte d'Ivoire, there is no existing data on the vulnerability of dairy crossbreds, most of which are the result of genetic selection to improve production. However, particular attention should be paid to their health.

The general aim of this work is therefore to provide information on the problems of adapting mixed breeds to breeding conditions. Specifically, the aim is to study the prevalence of dairy cow pathologies observed in dairy crossbreds.

### Materials and methods

### Study area and duration

The study was carried out on a private farm located in the sub-prefecture of Kpouébo, in the Department of Toumodi from 2021 to 2023. Located between 6° 55' 12" North latitude and 5°3' 0" West longitude, with a population of 41,379 (RGPH, 2021), mainly of Baoulé ethnicity, Toumodi is a town in central Côte d'Ivoire. It is 45 km from Yamoussoukro, the political capital of Côte d'Ivoire, and 199 km from Greater Abidjan. The farm is the largest dairy farm in Côte d'Ivoire, with a surface area of around 700 ha. It specializes in breeding crossbred N'dama, Zebu Peulh and Goudali dairy cows with Montbeliarde and Holstein breeds.

#### Experimental animals

This study was carried out on 132 dairy crossbred cows. These crossbred cows were produced by crossing the parent breeds Montbéliarde and Holstein for the European breeds, and N'dama, Goudali and Peulh zebu for the African breeds found in Côte d'Ivoire. The cows are divided into six groups according to the parents involved in the crossbreeding. Group HoG comprises eight (8) cows from Holstein × Goudali crosses. The HoN group is made up of nine (9) Holstein × N'dama cows, while the HoZ group comprises eleven (11) Holstein × Zebu Peulh cows. For crosses with the Montbéliarde breed, there are groups MbG with 13 Montbéliarde × Goudali cows, MbN with 54 Montbéliarde × N'dama cows and MbZ with 37 Montbéliarde × Zébu Peulh cows. These animals were all kept in the same way and under the same conditions.

### Identification of pathologies

Pathologies were identified through the use of health registers and direct observation of symptoms after herd inspection. The herd was inspected every morning before service, and the symptoms observed were recorded with the subject's identity in the aforementioned register. The symptoms of the pathologies were characterized taking into account

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their description by some authors (Touré, 1977; Sheldon, 2006; Belkarfa and Badji, 2015; Hazen, 2016; Proaction, 2017; Bouaziz, 2021).

In addition to these symptom-based observations, a CMT reagent test on milk was performed (Lévesque, 2004). The various pathologies identified were recorded, taking into account the period that could be before or during a given lactation and the season.

#### Determining prevalence

The overall prevalence for each pathology was calculated as the ratio between the number of positive cases and the total population (Vikou *et al.*, 2018). Thus, the prevalence of different pathologies according to certain factors was calculated as the ratio between the number of positive cases of the factor in question and the total population.

 $PreVg = (sum of positive cases / total population) \times 100$ 

PreVi = (sum of cases of pathology I / total population)×100

With PreVg: general prevalence and PreVi: prevalence of a given disease.

This prevalence was determined as a function of the parents involved in the cross, the generation (F1 halfblood and F2 ¾-blood European breed), the production level and the season (dry season; rainy season). Production level was defined as poor (FB), average (MY) and good (BN) for cows that produced less than 10 liters, between 10 and 15 liters and more than 15 liters respectively.

#### Organization and statistical analysis of data

The data collected in the field and from the archives were recorded in a single sheet of Excel version 2021 software, in which each pathological event is associated with its date of occurrence, the number of the animal concerned, the breed, the generation and the production level.

At the end of the study, descriptive analyses of the variables were carried out using Excel software version 2021. A descriptive study of the frequencies of each type of pathology per lactation and their hierarchy was first carried out on the entire reference population. R software version 4.2.3 was then used to perform a multivariate analysis on the effect of variables such as breed, generation, production level and season, on the diseases recorded. When a significant difference was noted, a univariate analysis was carried out between the variables in pairs, using a Chi-square test.

### Results

### Prevalence of the various pathologies inventoried

A total of 448 cases of pathologies were recorded over the three years of the study (Table 1). Pathologies identified on the basis of clinical signs included lameness, dystocia, mastitis, metritis, retained placenta and trypanosomiasis. Skin infections and abscesses were also observed, as were many other conditions recorded under the heading "other pathologies". By far the most frequent pathologies were mastitis and lameness, at 50.45% and 18.08% respectively of the 448 cases recorded. Next came metritis (14.96%), placental retentions (7.14%), "other pathologies" (4.91%), dystocia (4.02%) and trypanosomiasis with a proportion of 0.45%.

**Table 1.** Overall prevalence of pathologies observedover three consecutive years

Pathologies	Prevalence (%)		
Other pathologies	4,91 <sup>e</sup>		
Lameness	18,08 <sup>b</sup>		
Dystocia	4,02 <sup>f</sup>		
Mastitis	<b>50,45</b> <sup>a</sup>		
Metritis	14,96°		
Placental retention	7,14 <sup>d</sup>		
Trypanosomiasis	0,45 <sup>g</sup>		
P-value	0,001		

Values with the same letters in the same column show no significant difference.

# Effect of breed on the prevalence of pathologies encountered

Considering the European parent breed, Montbeliarde crossbreds were the most affected by all pathologies (Table 2). Taking pathologies individually, Montbeliarde × N'dama crossbreds had

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significantly higher prevalences for the different pathologies (p<0.001). HoN crossbreds, on the other hand, had the lowest prevalence of lameness (1.23%), and were free from mastitis and retained placenta. Also, all crossbreds were free from trypanosomiasis,

with the exception of MbN crossbreds, which were 100% affected. HoG and HoN offspring were free from placental retention and all other pathologies grouped under the heading "other pathologies". Finally, HoG offspring were free of dystocia.

Table 1. Prevalence of p	athologies	by genetic type	į
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Pathologies	Prevalence of pathologies (%)					P-value	
	HoG	HoN	HoZ	MbG	MbN	MbZ	
Other pathologies	0	0	13,67 <sup>c</sup>	0	50,00 <sup>a</sup>	36,36 <sup>b</sup>	0,001
Lameness	2,47 <sup>e</sup>	$1,23^{\mathrm{f}}$	4,94 <sup>d</sup>	16,05 <sup>c</sup>	40,74 <sup>a</sup>	$34,57^{b}$	0,001
Dystocia	0	5,56 <sup>d</sup>	5,56 <sup>d</sup>	16,7 <sup>c</sup>	$50^{\mathrm{a}}$	$22,\!22^{\mathrm{b}}$	0,001
Mastitis	1,77 <sup>e</sup>	$\mathbf{O}^{\mathrm{f}}$	16,81°	15,04 <sup>d</sup>	44,70 <sup>a</sup>	21,68 <sup>b</sup>	0,001
Metritis	14,93 <sup>c</sup>	11,94 <sup>d</sup>	5,97 <sup>e</sup>	11,94 <sup>d</sup>	<b>32,8</b> 4ª	$22,39^{b}$	0,001
Placental retention	0	0	9,38 <sup>d</sup>	21,88°	40,63 <sup>a</sup>	28,13 <sup>b</sup>	0,001
Trypanosomiasis	0	0	0	0	100,00	0	0,001

HoG: Holstein × Goudali cross; HoN: Holstein × N'dama; HoZ: Holstein × Zébu peulh; MbG: Montbéliarde × Goudali; MbN: Montbéliarde × N'dama; MbZ: Montbéliarde × Zébu peulh. Values with different letters on the same line show a significant difference.

### Table 3. Prevalence of pathologies by generation

Pathologies	Prevalence of pathologies (%)			
	F1	F2	P-value	
Other pathologies	54,55 <sup>a</sup>	45,45 <sup>a</sup>	0,3628	
Lameness	66,67 <sup>a</sup>	$33,33^{\rm b}$	0,001	
Dystocia	77,78 <sup>a</sup>	22,22 <sup>b</sup>	0,001	
Mastitis	62,62 <sup>a</sup>	$39,38^{b}$	0,021	
Metritis	50,75 <sup>a</sup>	49,25 <sup>a</sup>	0,881	
Placental retention	59,38ª	40,63 <sup>a</sup>	0,061	
Trypanosomiasis	100,00 <sup>a</sup>	0,00 <sup>b</sup>	0,001	

F1: first-generation cows; F2: second-generation cows. Values with different letters on the same line show a significant difference.

### **Table 4.** Prevalence of pathologies by production level

Pathologies	Prevalence of pathologies (%)			
	FB	MY	BN	
Other pathologies	9,10 <sup>b</sup>	45,45 <sup>a</sup>	45,45 <sup>a</sup>	0,001
Lameness	4,94 <sup>c</sup>	41,98 <sup>b</sup>	53,09 <sup>a</sup>	0,001
Dystocia	$16,67^{\mathrm{b}}$	66,67 <sup>a</sup>	$16,67^{\rm b}$	0,001
Mastitis	18,14 <sup>b</sup>	22,12 <sup>b</sup>	59,73 <sup>a</sup>	0,001
Metritis	$17,91^{\mathrm{b}}$	62,69ª	19,40 <sup>b</sup>	0,001
Placental retention	21,88 <sup>b</sup>	40,63 <sup>a</sup>	37,5 <sup>a</sup>	0,048
Trypanosomiasis	<b>0,00</b> <sup>b</sup>	100,00 <sup>a</sup>	$0,00^{\mathrm{b}}$	0,001

FB: cows with low milk production (production<10 liters); MY: cows with average milk production (10<production<15 liters); BN: cows with good milk production (production > 15 liters). Values with different letters on the same line show a significant difference.

# Effect of generation on the prevalence of pathologies encountered

There was no significant difference between generations for the other pathologies, metritis and retained placenta (Table 3). However, prevalences were higher (p<0.05). For F1 concerning lameness, dystocia, mastitis and trypanosomosis.

# *Effect of production level on the prevalence of pathologies encountered*

The prevalence of various pathologies showed no significant differences between average and good production animals, except for placental retention and other pathologies (Table 4). For both types of production, the prevalences of lameness and mastitis were higher in BN cows. Prevalences were significantly similar between the FB and BN groups for trypanosomosis, dystocia and metritis. For the rest, prevalence values were lower in BN cows.

# Effect of season on the prevalence of pathologies encountered

There were no significant seasonal differences in the prevalence of lameness, dystocia or retained placenta. Other pathologies" and mastitis were more frequent in the dry season, with proportions of (72.73% vs. 27.27%) and (61.95% vs. 39.38%) respectively. Trypanosomiasis and metritis were the most frequent pathologies in the rainy season.

### Discussion

Mastitis was by far the most frequent pathology, followed by lameness and metritis. These results concur with those obtained by Faye *et al.* (1994). In fact, these authors ranked mastitis cases at the top of the hierarchy. However, there is a divergence in the hierarchy between lameness and metritis, and this follows the results of Barnouin *et al.* (1983) and Faye *et al.* (1986). These authors ranked lameness fourth after clinical mastitis, non-delivery and metritis. This discrepancy may be due to the fact that these authors separated out the various ailments that can cause lameness in cows, such as panariasis, seimes, poor legs and forks.

This distinction was not made in this study. Thus, the prevalence of pathologies varies considerably from one author to another (Faye *et al.*, 1994). In most cases, mastitis accounts for between 20% and 35% of pathologies, but its prevalence varies from 14% according to Barnouin (1983) to 49% according to Little *et al.* (1987). The prevalence of lameness varies from 1% (Solbu, 1983) to 50% (Faye *et al.*, 1994). These variations in prevalence could be linked to animal characteristics, environmental conditions and preventive measures taken (Faye *et al.*, 1994).

In general, we can see that Montbeliarde crossbreds were significantly more affected by mastitis cases, and more particularly MbN crossbreds, which were twice as affected by mastitis cases, followed by lameness, and MbZ crossbreds, which were more affected by other "other pathologies". These results are at odds with those obtained by Landais et al. (1989) and Faye et al. (1994), who worked on purebred parents. These authors showed that Holstein cows were almost twice as affected by pathology as Montbeliardes. This discrepancy could be due to the composition of the herd, particularly in terms of genetics, number of lactations and time of recording. In fact, our study covered a total of 132 crossbred cows, including 104 Montbéliardes and 28 Holsteins, with a total of 134 lactations over a three-year period. The study by Landais et al. (1989), on the other hand, involved 190 cows of the Montbeliarde and Holstein breeds, 487 lactations and a period of six consecutive years. The study by Faye et al. (1994) involved 1169 cows, 3851 lactations over 20 years.

Generation had a significant effect on all disorders, with the exception of "other pathologies", metritis and retained placenta. However, we note a significant sensitivity of first-generation cows, i.e. half-bloods, compared with second-generation cows. This could be explained by complete dominance of the improver breed in the first generation. In this case, half-bloods that tend towards their sire's blood (Montbeliarde or Holstein) will have difficulty adapting to the environmental conditions of our study environment, unlike the N'dama, Goudali and Zebu breeds used in the various crosses. The latter are better adapted to breeding conditions in a hot, humid climate infested by tsetse fly. For example, the N'dama breed has been described by authors (Sokouri et al., 2009) as a trypanotolerant breed that adapts better to the breeding conditions of our study environment. Numerous studies have shown that trypanotolerant cattle are resistant to much other bovine pathology (Claxton and Leperre, 1991; Mattioli et al., 1992; Mattioli *et al.*, 2000).

In terms of production level, the prevalence of the various pathologies was significantly higher in cows considered to be good producers, and this could be due to the number of liters produced. These results

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corroborate those described by Brochart and Fayet (1981). Indeed, the latter established a relationship between production level and lameness rates, showing a 5.8% increase in the frequency of lameness for an increase of one liter of milk produced compared with the average. Barnouin and Karaman, (1986) found that Black Pie cows in third lactation and above with higher production were more affected by mastitis, metritis, lameness, foot infections and milk fever.

As far as seasonal variability is concerned, it had an effect on the pathologies grouped under the term "other pathologies", mastitis and metritis. Other pathologies" and mastitis were significantly more frequent in the dry season. Metritis, on the other hand, was more frequent in the rainy season. This could be explained by the difficulty of adapting to the climate and continuous confinement (free stalling all year round). This is supported by Faye and Brochart (1986), who demonstrated a greater frequency of certain pathologies during the stabling period than during the grazing period. The same results were observed by other authors such as Rowlands et al. (1983) and Dohoo et al. (1984). The latter also observed an increase in the frequency of pathologies during the months of October to December, which corresponds to the short rainy season in our study environment.

### Conclusion

At the end of the work on the prevalence of pathologies in dairy farming, the results showed the effect of breed, generation, production level and season on these pathologies. Mastitis was found to be the most frequent. In terms of genetic type, Montbeliarde crossbreds were more susceptible to the pathologies studied than Holstein crossbreds. What's more, first-generation cows and those with a good the production record were most affected. Prevalences of "other pathologies" and mastitis were high in the dry season, while metritis was highest in the rainy season. Given the scale of the economic losses these pathologies can cause, it would be crucial for farms to be aware of them, so as to take steps to avoid them and minimize major economic losses. Finally, other studies based on observation of the

clinical signs of all the pathologies could be carried out to provide more detail and certainty.

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