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PREVALENCE OF SUBCLINICAL MASTITIS IN DAIRY CATTLE FARMS IN THE WILAYA OF SKIKDA (EASTERN ALGERIA)

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Abstract

The objective of our study was to assess the prevalence of subclinical mastitis and the knowledge of risk factors in ninety-two dairy farms in the wilaya of Skikda. Screening results revealed that 404 dairy cows (67.2%) had subclinical mastitis; while 1055 quarters (44.8%) tested positive for CMT. It should be noted that this prevalence of subclinical mastitis is predominant at the end of lactation on the one hand and that the posterior quarters have the frequencies of the highest positive scores compared to the anterior quarters on the other hand. The results of the CMT test indicate a high prevalence of subclinical mastitis in the study area. This finding reveals both factors related to the animal (stage and lactation rank, breed) and factors related to the animal's environment (hygiene of housing and milking dairy cows and maintenance of milking equipment). Screening for subclinical mastitis must always be an integrated action in the health plan of dairy farms.

Keywords: CMT, Screening, Risk Factors, Hygiene, Milking, Dairy Cow.

1. INTRODUCTION

In Algeria, subclinical mastitis is one of the dominant pathologies in dairy farming, they are responsible for serious economic damage as a result of the decline in the production and hygienic and nutritional quality of milk and milk products, as well as high cellular levels.

Subclinical mastitis cannot be detected by the breeder because they are asymptomatic. But this type of mastitis could be easily diagnosed by increasing somatic milk cells (Poutrel 1985).

Although cell counting testifying to the presence of a uder infection is mandatory in developed countries, it is difficult to achieve in Algeria because of its high cost, for this the counting of milk cells could be replaced by the CMT (California Mastitis Test) which is a quick and easy test and can be performed by the breeder and could allow to have a follow-up of the evolution of the uder infection. Also the knowledge of risk factors is necessary to limit the economic losses of subclinical mastitis.

Systematic and early detection of subclinical mastitis by the CMT would help control these conditions, so good milking conditions and hygiene would preserve the health of the mammary gland (Boufaida, 2012).

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The objective of our research work is to evaluate the prevalence of subclinical mastitis in farms surveyed by the use of the CMT method and the analysis of risk factors (milking type, breed, rank and stage of lactation, housing of dairy cows and conduct and hygiene of milking).

2. MATERIALS AND METHODS

The study was carried out in the wilaya of Skikda which belongs to the upper subhumid bioclimatic stage under maritime influence. The average annual temperature is 18°C, the coldest month is February at 12.6°C and the warmest month is August at 26.4°C. Climate data indicate an average annual rainfall of 743 mm.

The farms detected (n=92) are distributed in 17 municipalities of the wilaya of Skikda, and hold a workforce of 839 dairy cows whose composition was dominated by the pure breed Holstein (55.7%). The remainder was distributed among other pure breeds including the Frisonne Pie (28.7%), the Montbéliarde (12.7%), the Fleckvieh, the Normande and the Brune des Alpes (2.9%).

Subclinical screening using the CMT method was applied to 601lactating cows from 92 dairy farms surveyed during the 2020 and 2021 crop years. For this purpose, the Schalm test (California Mastitis Test) was performed on the milk of the functional quarters of the cows concerned. The principle of the test is based on the use of a surfactant (Teepol: mastitis screening tester).

The reaction is numbered from 0 to 4 depending on the level of infection. In our study, neighborhoods with a CMT score of 2 are considered infected. Neighborhoods with a CMT score of 0 and 1 are classified as uninfected.

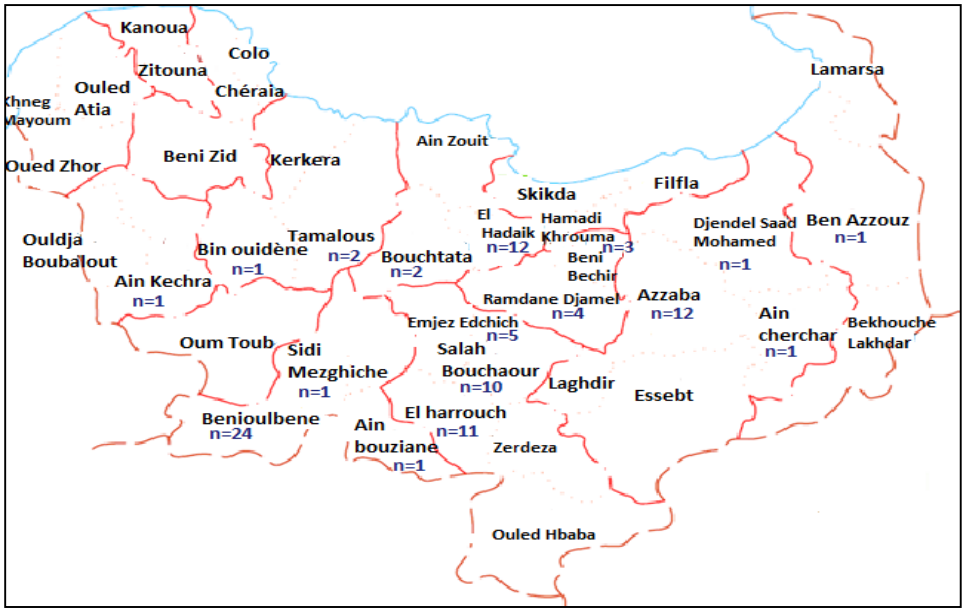

Fig 1: Distribution of farms detected (n=92) by Municipality of Wilaya de Skikda

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In this study, we were also interested in analyzing the risk factors of subclinical mastitis in the farms surveyed, for this we collected data on the hygienic state of housing and dairy cows, type of milking (manual milking, mechanical or whey), milking separately from cows with mastitis and on the control of the milking machine. We also collected information on the breed, stage and lactation rank of each dairy cow.

The prevalence of subclinical mastitis was calculated using the Excel software, then a series of one-factor analyses of variance by the Statistica software was performed for each of the risk factors considered (milking type, lactation stage, lactation rank, breed of cows, hygiene, milking apart from infected cows as well as milking machine control). Less than 5% probability was used to test significance.

3. RESULTS AND DISCUSSION

3.1. CMT results by ward and number of cows

This study was carried out on 601 dairy cows from a sample of 92 farms surveyed in the Wilaya of Skikda. Compared to the number of farms, cases of subclinical mastitis (at least one cow responding positively to CMT per farm) were present in 89 farms out of 92 farms detected; a rate of 96.73%.

Compared to the number of cows, the results revealed that out of 601 cows detected, 404 dairy cows (67.22%) have subclinical mastitis.

3.1.1 Distribution of tested quarters according to CMT scores

We found that out of 2355 neighborhoods tested, 1055 showed a positive CMT (score 2), a frequency of 44.80% and 1300 neighborhoods were negative (CMT score 0 and 1) (Table 1). They are divided into 629 neighborhoods with a score 0 with a frequency of 26.71% and 671 neighborhoods with a score 1 with a frequency of 28.49%.

In total, 55.20% of quarters had a negative CMT. These results from the farms surveyed show a high prevalence of subclinical mastitis in the study area.

Table 1: Distribution of Uder Quarters Tested by CMT Scores

Score CMT	Quarters number	Frequency (%)
Score 0 CMT -	629	26,71
Score 1 CMT-	671	28,49
Subtotal négative score (0 et 1)	1300	55,20
Score 2 CMT +	628	26,67
Score 3 CMT +	319	13,55
Score 4 CMT +	108	4,59
Subtotal positive score(score ≥ 2)	1055	44,80
Total	2355	100
Note: *Of 2355 screened quarters 49 were not detected including 37 non-functional (26 sterile + 11 atrophied) and 12 with clinical mastitis.*		

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3.1.2 Distribution of affected quarters according to their location on the udder

Posterior quarters have higher positive sores frequencies (12.27% and 11.34% respectively for both left and right posterior quarters) than anterior quarters (10.91% and 10.28% respectively for the left and right forequarters (Table 2).

The left posterior quarter had the highest prevalence of subclinical mastitis (12.27%), followed by the right posterior quarter (11.34%), followed by the left anterior quarter (10.91%) and the right anterior quarter (10.28%).

Thus, the prevalence of subclinical mastitis for the two posterior quarters is 23.61% against 21.19% for the two anterior quarters.

Table 2: CMT scores of the quarters tested according to their location on the udder

Quarters of the cow's udder	Number of quarters tested	Score values								
		0	1	2	3	4	Négative (0 et 1)		Positive (≥ à 2)	
							Nbr	%	Nbr	%
Left anterior	593	169	167	172	62	23	336	14,27	257	10,91
Prior right	592	164	186	136	78	28	350	14,86	242	10,28
Subtotal anterior quarters	1185	333	353	308	140	51	686	29,13	499	21,19
Left hind	583	138	156	161	98	30	294	12,48	289	12,27
Right hind	587	158	162	159	81	27	320	13,59	267	11,34
Subtotal posterior quarters	1170	296	318	320	179	57	614	26,07	556	23,61
Total	2355	629	671	628	319	108	1300	55,20	1055	44,80

Subclinical mastitis affects the posterior quarters (52.70%) more than the anterior quarters (47.30%) (Figure 2).

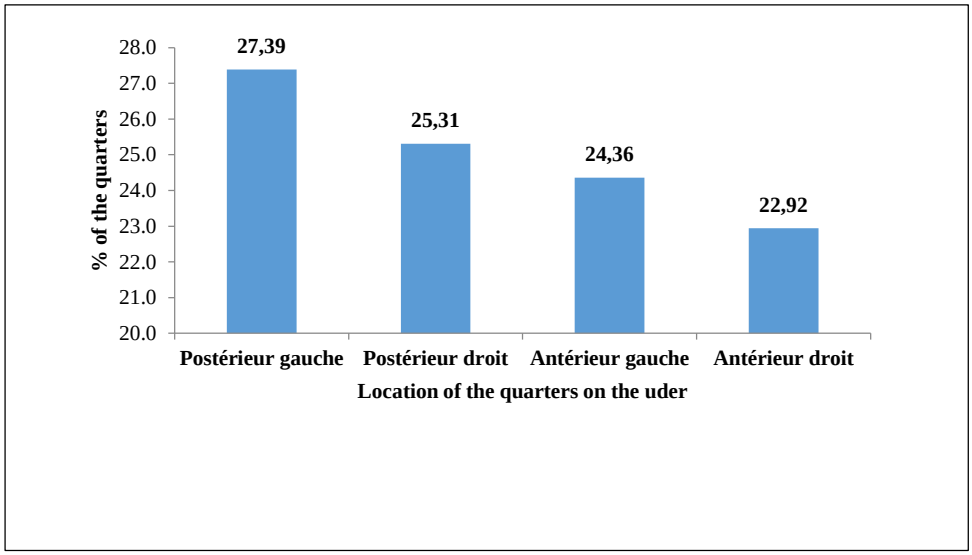

Figure 2: Distribution of affected quarters (scores +) according to the CMT test (n=1055)

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The analysis of variance revealed a significant difference ($p < 0.05$) in the positive scores of affected quarters according to their location on the udder (Table 3).

Table 3: Prevalence of subclinical mastitis according to their location

Parameters	Source of Variation	Sum squares	Degrees of freedom	Average squares	F	Probability
Prevalence	Quarters	2	3	1	3	0.021519

3.2. Effect of risk factors on the prevalence of subclinical mastitis in cows

A series of one-way analyzes of variance was carried out for each of the risk factors considered (type of milking, stage of lactation, lactation rank and breed of cows). A probability of less than 5% was used to test significance. The results of these analyzes are as follows (table 3):

- The prevalence of subclinical mastitis is higher (72.41% of cows) in farms milking with a milking trolley, while in those milking manually, it decreases to 67.97%. On the other hand, the prevalence of subclinical mastitis is the lowest (34.33% of cows) in farms milking using a milk pipeline;
- The distribution of subclinical mastitis according to physiological stage showed their preponderance (74.12%) at the end of lactation;
- The prevalence of subclinical mastitis increases with lactation rank;
- Holstein cows are more affected by subclinical mastitis (68.92%) than Friesian (65.96%) and Montbéliarde (65.28%) cows.

Table 3: Distribution of cases of subclinical mastitis according to type of milking, stage of lactation, lactation rank and breed

Factors	Modalities	Numbre of cows		Prevalence (%)
		Detected	Affected	
Type of milking	Milking trolley	406	294	72,41
	Milk pipeline	67	23	34,33
	Manual milking	128	87	67,97
Lactation stage	1 er months	40	20	50
	2 à 4 months	221	132	59,73
	≥ 5 months	340	252	74,12
Lactation Rank	1	140	82	58,57
	2 and 3	298	207	69,46
	4 and more	163	115	70,55
Breed of cow	Frisian	188	124	65,96
	Holstein	325	224	68,92
	Montbéliarde	72	47	65,28
Total		**601**	**404**	**67,22**

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The effects of milking type, lactation stage and lactation rank on the prevalence of subclinical mastitis are highly significant (p<0.000). However, a slight non-significant difference (p=0.05) in the incidence of subclinical mastitis was observed between the breeds used in the surveyed farms (table 4).

Table 4: Effect of some variation factors on prevalence subclinical mastitis in dairy cows

Paramters	Sources of Variation	Sum squares	Degrees of freedom	Average squares	F	Probability
Prevalence Subclinical mastitis	Type of milking	8	2	4	20	0,000000
	Lactation stage	4	2	2	9	0,000000
	Lactation rank	1	2	1	3	0,043812
	Breed	1,6	8	0,2	1	0,051075

3.3. Prevalence of subclinical mastitis according to the cleanliness of farms (Table 5)

3.3.1 Cleanliness of livestock buildings and dairy cows

In very clean livestock buildings, the prevalence of subclinical mastitis is lower (58.95%), but it increases (70.86%) in moderately clean buildings then to 79.59% in dirty buildings to reach the 81.93% in practically very dirty livestock buildings. Thus, the quality of stable maintenance and more particularly the cleanliness of the bedding can be indirectly assessed by evaluating the cleanliness of dairy cows.

The prevalence of subclinical mastitis is lower (57.40%) in farms where the cows are very clean or clean than in those where the cows are a little dirty (71.25%) or in those where the cows are practically dirty. and very dirty (84.07%).

3.3.2 Separate milking of cows with clinical mastitis

In farms that milk separately from infected cows, the prevalence of subclinical mastitis is lower (53.91%) compared to that (83.83%) of farms that do not milk separately from infected cows.

3.3.3 Annual inspection of the milking machine

Among the 92 dairy farms screened, 56 use milking trolleys. When the annual control of the milking machine is carried out on the latter, a lower prevalence of subclinical mastitis (60.95%) is observed in the farms concerned. On the other hand, on farms not carrying out this control, the prevalence of subclinical mastitis is higher (84.30% of cases).

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Table 5: Prevalence of subclinical mastitis according to 4 factors considered in the surveyed farms

Factors	Modalities	Number of breeding	Prevalence (%)
Cleanliness housing	Clean	24	58,95
	Moyen	30	70,86
	Dirty	20	79,59
	Very dirty	18	81,93
Cleanliness of the dairy cow	Very neat and clean	24	57,40
	A bit dirty	38	71,25
	Dirty and very dirty	30	84,07
Milking infected cows separately	No	55	83,83
	Yes	37	53,91
S/Total		**92**	
Milking machine control	No	28	84,30
	Yes	28	60,95
S/Total		**56**	
Prevalence (%) = (Number of cows affected by mastitis subclinical/Total number of cows screened per farm) x100			

An analysis of variance of the effect of 4 risk factors on the prevalence of subclinical mastitis was then carried out. It indicates that the practice or not of milking infected cows separately and the annual control of the milking machine have a highly significant effect ($p < 0.000$) on this prevalence of subclinical mastitis. Likewise, a slightly significant effect ($p<0.05$) of the state of cleanliness of livestock buildings and of the dairy cows themselves is noted on the prevalence of subclinical mastitis (table 6).

Table 6: Analysis of the effect of 4 factors (animal housing, cleanliness of cows, milking and milking machine) on the prevalence of subclinical mastitis

Sources of variation	Sum squares	Ddl	Average squares	F	Probability
Cleanliness of animal housing	7046,57	3	2348,86	3,58	0,016978
Dairy cow cleanliness rating	9506,70	2	4753,35	7,65	0,000854
Milking infected cows separately	19656,60	1	19656,60	38,96	0,000000
Annual inspection of the milking machine	7633,75	1	7633,75	12,96	0,000691

3.4. Discussion

Screening for subclinical mastitis carried out on the surveyed farms revealed that 67.22% of cows were affected. Our screening results are higher than those of Bouzid et al (2011) who report a value of (29.7%) in eastern Algeria and those of Boukhalfa et al (2021) who report a value of (47.32%). %) in 24 farms in Médéa and Blida.

The results are also lower than those of Boufaida et al (2016) who reported a value of 33.7% in 25 farms in the North East of Algeria.

Furthermore, for the CMT results on the mammary quarters, a positive CMT test (score ≥2) was observed with a frequency of 44.80%. Lower values of this positive test were

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observed 34.9%, 33.0% and 34.3%) respectively by Hocine et al (2012), Belkheir et al (2016) and Boukhalfa et al (2021).

However, the posterior quarters present higher frequencies of positive scores (23.61%) than those of the anterior quarters (21.19%). The values reported by Belmamoun (2017) are higher, 34.6% and 32.6% respectively. This observation seems to be explained by the fact that the hind quarters are relatively more in contact with droppings.

In the farms surveyed, the high prevalence (72.41%) of subclinical mastitis in farms milking with a milking trolley seems to be explained by the insufficient cleaning of this equipment, as confirmed by Roussel and Ribaud (2000). In fact, cleaning and maintaining the milking installation helps fight against the development of germs.

In the wilaya of Skikda, the observed value of the prevalence of subclinical mastitis at the end of lactation (74.12%) is too high compared to that reported (11.1%) by Saidi et al (2010).

Furthermore, the observations of Dudouet (2004) confirm that low milk production at the end of lactation leading to a concentration of cells seems to explain the prevalence of subclinical mastitis at this stage of lactation.

In the farms surveyed, the prevalence of subclinical mastitis increases with lactation rank, contrary to the observations of Bouzid et al (2011) who noted the regression in the prevalence of subclinical mastitis with lactation rank.

Poutrel et al (1983) explained the increase in infection frequency with lactation number by the fact that in older cows, the teat sphincter loses its elasticity.

This contributes to reducing the distance between the teats and the ground, thus promoting their contamination.

From the point of view of the breeds exploited, Holstein cows are more affected by subclinical mastitis than Friesian and Montbéliarde cows. This is consistent with the observations of Faye et al (1994) that the distribution of mastitis between cows of different breeds may be linked to their respective production levels.

Our observations also agree with those of Rupp et al (2000) who consider that the milk of cows of less productive dairy breeds is less concentrated in cells than that of cows of more productive breeds.

Livestock buildings play an important role in keeping cows clean. In the farms surveyed, the prevalence of subclinical mastitis is higher (81.93%) in “dirty” and “very dirty” buildings. Such an observation had already been reported by Serieys (1985) and Kebbal et al (2020) who reported a lack of knowledge in the management of dairy farming and good animal hygiene and milking practices in 92 dairy cattle farms. Surveyed in the wilaya of Blida.

Indeed, the housing conditions of dairy cows play an important role in the epidemiology of mammary infections by largely determining the frequency of teat injuries and the extent

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of contamination of litter by environmental microorganisms. The prevalence of subclinical mastitis is lower on farms where the cows are: “very clean” and “clean”.

The cleanliness of dairy cows reflects a sufficient supply of straw which plays an important role in the prevention of mastitis as reported by Barnouin et al (2020).

The prevalence of subclinical mastitis is lower (53.91%) compared to that (83.83%) of farms not milking except infected cows, Kebbal et al (2020) reported that in certain farms the Cows with mastitis are milked by hand while on half of the farms no distinction is made during milking between cows affected and not affected by mastitis. For this, we recommend milking cows affected by mastitis at the end to limit contamination.

Finally, the prevalence of subclinical mastitis is lower in farms which carry out annual checks of the milking machine compared to those which neglect it. Our results agree with the observations of Barnouin et al (2020) who consider that the absence of at least one annual check of the milking machine constitutes a risk factor for mastitis.

Therefore, reducing the risk of mammary infections, milking hygiene and regular monitoring of the milking machine remain essential measures.

Dairy organizations such as the Littoral Normand Breeding Council recommend to reduce the results of somatic cell counts in the milk from the storage tank, using well-adjusted milking machines with milking liners in good condition. Seeking as much as possible to limit cross-infections from one cow to another.

The results of the CMT test demonstrate a high prevalence of subclinical mastitis in the study area and in particular in the farms carrying out milking with the milking trolley. It should be noted that this prevalence of subclinical mastitis is predominant at the end of lactation on the one hand and that the hindquarters present the highest frequencies of positive scores compared to the forequarters on the other hand.

4. CONCLUSION

The results of screening for subclinical mastitis revealed that 404 dairy cows (or 67.22%) were affected by subclinical mastitis; while 1055 neighborhoods (or 44.8%) tested positive for CMT.

This observation on subclinical mastitis in the farms surveyed reflects both factors linked to the animal (stage and rank of lactation, breed) and factors linked to the animal's environment (housing and milking hygiene). Dairy cows and maintenance of milking equipment).

Therefore, the management of mastitis, or any other health problem, should be done by applying preventive measures in conjunction with local veterinary services.

Screening for subclinical mastitis must always constitute an integrated action in the health plan of dairy farms.

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Conflicts of interest

The authors should state: the authors have no conflicts of interest to declare.

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