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EVALUATION OF A MASTITIS CONTROL PROGRAMME ADOPTED IN SMALL DAIRIES IN THE DISTRICT OF COLOMBO

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Abstract: In this programme on the control of mastitis, dairy farmers were advised on correct milking procedure and good hygiene at milking time. All milking cows were individually tested by means of the California Mastitis Test (CMT) and the animals were arranged in the correct milking order. All the sub-clinical and clinical cases of mastitis were treated during the first two rounds of testing. All clinical cases were treated throughout the programme. A teat dip was used. All milking cows going dry, were infused with a Dry Cow antibiotic infusion. The status of mastitis in ten small dairies supplying milk to National Milk Board, Narahenpita selected at random, was 30.7% cows positive and 14.1% quarters positive. The control programme was carried out for a period of one and half years period reducing the status to 13.1% cows positive and 5.2% quarters positive. By the end of the programme, the status of mastitis was reduced by 57.3% in cows and 63.1% in quarters from the original status at the beginning of the programme. The cost of the programme for a Farm Unit for a year was reasonable and the estimated benefit was over double the cost of the programme, for a year. Therefore the programme is recommended.

1. Introduction

In a previous study,[8] to assess the animal husbandry status of the dairies and the attitude of dairy farmers towards modern farming methods, it was seen that a majority of dairy farmers in Colombo and Gampaha districts do not adopt modern methods in dairy farming.

A preliminary survey on incidence of mastitis in Sri Lanka revealed an estimated loss of Rs. 4.3 million occurring annually due to this condition.[7] The estimates were based mainly on data from large Government Farms, although a large percentage of milk (about 80%) in this country is produced in small farms.

The purpose of this study was to ascertain the mastitis status among cattle and buffaloes in small holdings and to evaluate the efficacy of a simple programme for control.

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2. Materials And Methods

The list of milk suppliers to the National Milk Board in the district of Colombo was obtained from its Head Office at Narahenpita, in June 1977. Out of a total of 200 dairies on the list, ten were selected at random for the study. These ten dairies had a total of 101 milking cows and she buffaloes and the herd size in each ranging from 9—15 milking cows.

All quarters of cows lactating at the time of conducting the study, were tested by the California Mastitis Test (CMT) twice within a period of three weeks. The quarters that were clinically affected and those that gave positive reaction to both tests were considered positive (i.e. one round of testing). There were five rounds of testing at two to three months intervals. Effects of the programme were evaluated after the conclusion of the fifth round of testing.

At the time of the second visit in the first and the second rounds of testing, all sub-clinically affected and all clinical cases at all times during the programme were treated with one of the following antibiotic intramammary infusions, Streptopen Milking Cow (Glaxo) containing penicillin and streptomycin, Orbenin L.A. (Beecham International) containing Cloxacillin and Terramycin (Pfizer) containing Oxytetracycline HCl, at random. A sample of milk was collected aseptically before the infusion and sent to the Veterinary Research Institute (V.R.I.), Gannoruwa for bacteriological tests, namely, for isolation of organisms and antibiotic sensitivity tests.

In addition, on the first visit, the farmers were requested to adopt the following mastitis control programme: (a) washing and cleaning of milkers' hands with soap and water before milking, (b) washing and cleaning of the udders with soap and water before milking, (c) quick and complete milking of cows, (d) alternate milking of right and left side of the quarters (after the observations made at first round of testing), (e) Dipping of teats immediately after milking in a disinfectant (0.5% Hibitane —ICI with 5% glycerine as emolient), (f) treatment of sub-clinical cases at first and second rounds of testing and treatment of all clinical cases at all times, (g) milking order design on basis of C.M.T. , i.e.(i) heifers in first lactation, (ii) healthy cows without history of mastitis, (iii) cows recovered from mastitis, (iv) subclinical cases of mastitis under treatment, and (v) clinical cases of mastitis under treatment, (h) use of clean water in the dairy, and (i) use of Dry Cow antibiotic infusions on all cows going dry.

The dairies were closely supervised to ensure that the farmers adopt the recommended programme. Four farmers who did not cooperate were dropped out of the programme.

All cows going dry were infused with either Streptopen Dry Cow (Glaxo) containing penicillin and streptomycin or Orbenin Dry Cow

Table 1. Prevalence Of Sub-clinical And Clinical Mastitis.

Farm No.	1st testing				2nd testing				3rd testing				4th testing				5th testing			
	Cows		Teats		Cows		Teats		Cows		Teats		Cows		Teats		Cows		Teats	
	+/No	%	+/No	%	+/No	%	+/No	%	+/No	%	+/No	%	+/No	%	+/No	%	+/No.	%	+/No	%
1	0/12	–	0/48	–	3/13	23.1	6/52	11.5												
2	5/12	41.7	5/48	10.4	5/13	38.5	5/52	9.6	1/9	11.1	3/36	8.3	0/11	–	0/44	–	0/14	–	0/56	–
3	4/9	44.4	5/36	13.9	2/7	28.6	4/28	14.3	0/6	–	0/24	–	0/6	-	0/24	–	1/7	14.3	3/28	10.7
4	1/12	8.3	2/28	4.2	4/18	22.2	9/72	12.5	3/11	27.3	7/44	15.9	1/9	11.1	4/36	11.1	1/6	16.7	1/24	4.2
5	4/9	44.4	7/36	19.4	1/6	16.7	1/24	4.2	1/7	14.3	1/26	3.9	0/5	–	0/20	–	0/7	-	0/27	–
6	2/6	33.3	4/24	16.7	2/6	33.4	2/24	8.3	1/3	33.3	1/11	9.1	1/3	33.3	1/11	9.1	3/5	60.0	5/19	26.3
7	2/7	28.6	6/28	21.4																
8	6/13	46.2	12/52	23.1	4/10	40.0	7/10	17.5	2/12	16.3	4/48	16.7	3/10	30.0	3/40	7.5				
9	7/15	46.7	16/60	26.7	2/8	25.0	2/32	6.3	2/7	28.6	2/28	7.2								
10	0/6		0/24	–	1/5	20.0	1/19	5.3	0/5	–	0/20	–	0/7	–	0/27	–	1/7	14.3	1/27	3.7
	131/101	30.7	57/404	14.1	24/86	14.1	37/313	11.8	10/60	16.7	18/237	7.5	7/51	13.9	10/202	4.9	6/46	13.11	0/181	5.2

Table 2 – Incidence Of Mastitis (Clinical & Sub-Clinical)

Farm No.	1st–2nd test				2nd–3rd test				3rd–4th test				4th–5th test			
	Cows	%	Teats	%	Cows	%	Teats	%	Cows	%	Teats	%	Cows	%	Teats	%
1	3/13	23.1	6/52	11.5												
2	1/13	7.7	5/52	9.6	1/9	11.1	3/36	8.3	1/11	9.2	2/44	4.5	0/14	0	0/56	0
3	2/17	28.6	4/28	14.3	0/6	0	0/24	0	0/6	0	0/24	0 0	1/7	14.3	3/28	10.7
4	1/18	5.6	2/72	7.8	1/11	9.1	2/44	4.5	1/9	11.1	2/36	5.5	1/6	16.7	1/24	4.2
5	0/6	0	0/24	0	1/7	14.3	1/26	3.8	0/5	0	0/20	0	0/7	0	0/27	0
6	0/6	0	1/24	4.2	0/3	0	0/11	0	0/3	0	0/11	0	2/5	40	2/19	10.5
7																
8	3/10	30	4/40	10	2/12	16.7	3/48	6.3	1/10	10	1/40	2.5				
9	1/8	12.5	1/32	3.1	2/7	28.6	2/28	7.1								
10	1/5	20	1/19	5.3	1/5	20	3/20	15.0	1/7	14.3	1/27	3.7	0/7	0	2/27	0
Overall Incidence	12/86	13.9	24/343	7.0	8/60	13.3	14/237	5.9	4/51	7.8	6/202	2.9	4/46	8.7	6/181	3.3

Table 3 — Incidence Of Clinical Mastitis

Farm No.	1st – 2nd test				2nd – 3rd test				3rd – 4th test				4th – 5th test			
	Cows	%	Teats	%	Cows	%	Teats	%	Cows	%	Teats	%	Cows	%	Teats	%
1	1/12	8.3	1/48	2.1	1/10	10	2/40	5								
2	1/12	8.3	3/48	6.3	2/13	15.4	2/42	3.9	2/9	22.2	4/36	11.1	0/11	–	0/44	–
3	0/9	–	0/36	–	0/7	–	0/28	–	0/6	–	0/24	–	0/6	–	0/24	–
4	0/10	–	0/40	–	0/18	–	0/72	–	0/11	–	0/44	–	1/9	11.1	2/36	5.6
5	0/9	–	0/36	–	1/6	16.7	1/22	4.5	0/7	–	0/26	–	0/5	–	0/20	–
6	0/6	–	0/26	–	1/6	16.7	1/24	4.2	1/6	16.7	2/24	8.3	0/3	–	0/11	–
7	0/13	–	0/28	–												
8	1/13	7.7	1/52	1.9	0/10	–	0/40	–	0/12	–	0/48	–	0/10	–	0/40	–
9	1/15	6.7	1/60	1.7	0/8	–	0/32	–	0/7	–	0/28	–				
10	0/6	–	0/24	–	1/5	20	3/19	15.8	1/5	20	1/19	5.3	0/7	–	0/27	–
	4/92	4.4	6/368	1.6	6/83	7.2	9/329	2.7	4/63	6.4	7/249	2.8	1/51	1.9	2/202	0.9

Table 4. – Percentage Reduction Of Prevalence of Mastitis*

At 2nd testing		At 3rd testing		At 4th testing		At 5th testing	
Cows	Teats	Cows	Teats	Cows	Teats	Cows	Teats
9.1	16.3	45.6	46.8	54.7	65.2	57.3	63.1

* Reduction from its original status at first testing.

(Beecham International) containing benzathine cloxacillin, at random. The mastitis status of each quarter before infusion was known.

Sixty samples of milk collected aseptically, at random, from clinical cases and sub-clinical cases were sent to the V.R.I. for bacteriological examinations and antibiotic sensitivity test (ABS).

3. Results

At the beginning of the programme there were ten dairies with a total of 101 milking cows and she buffaloes. Due to lack of cooperation from farmers, the programme was carried out to an end (upto fifth round of testing) only in six dairies, with 46 milking cows in all.

The overall prevalence of mastitis (sub-clinical and clinical) at the beginning of the programme was 30.7% cows and 14.1% quarters positive (Table 1). The prevalence was reduced to 13.1% cows and 5.2% quarters positive at the fifth and the final round of testing. The incidence of mastitis (sub-clinical and clinical) was calculated between the periods between 1st–2nd, 2nd–3rd, 3rd–4th, 4th to 5th rounds of testing as shown in Table 2. It was observed that overall incidence of mastitis was reduced from 13.9% cows and 7.0% quarters positive from 1st–2nd round, to 8.7% cows and 3.3% quarters positive at 4th–5th round. Likewise, incidence of clinical mastitis at the beginning of the programme was 4.4% cows and 1.6% quarters positive (see Table 3) and was reduced to 1.9% cows and 0.9% quarters positive at the end of the proramme. Table 4 shows overall percentage reduction of prevalence from one round of testing to another as compared to status at the beginning of the programme.

It was found that at the first round of testing, the prevalence of mastitis was higher in the left side quarters (left front 21.3% and left rear 14.1%) than the right side (right front 12.8% and right rear 12.8%). Also prevalence of two front quarters were higher than the two rear quarters (front quarters 34.1% and rear quarters 19.4%).

Of the sixty samples of milk examined at V.R.I., the organisms isolated from samples in the descending order were streptococci spp., staphylococci spp., Gram negative rods and Gram positive rods (see Table 5). No isolations were made from seven samples.

Table 5. Organisms Isolated

	No. of Isolations	% of Isolations
Streptococci spp.	19	35.9%
Staphylococci spp.	16	30.2%
Gram – ve rods	15	28.3%
Gram + ve rods	3	5.7%
	53	100.0

It was seen that most isolates streptococci spp. were sensitive to penicillin and streptomycin (see Table 6) while most isolates of staphylococci spp. were sensitive to penicillin, streptomycin and chloramphenicol.

Table 6. – Antibiotic Sensitivity Test

Isolate.	Total No. of isolate.	Penicillin.	Streptomycin.	Chloramphenicol.	Oxytetracycline.
Streptococci spp.	18	15(83.3%)	16(88.9%)	12(66.7%)	7(38.9%)
Staphylococci spp.	16	13(81.3%)	15(93.8%)	13(81.3%)	9(56.3%)
Gram –ve rods	14	6(42.9%)	10(71.4%)	12(85.7%)	6(42.9%)
Gram +ve rods	3	1(33.3%)	3(100%)	3(100%)	3(100%)

Results of antibiotic therapy on clinical and sub-clinical cases of mastitis using penicillin and streptomycin intramammary infusion (Streptopen-Glaxo), cloxacillin intramammary infusion (Orbenin –Beecham International) and oxytetracycline HCl infusion (Terramycin-Pfizer) are shown in Table 7.

Table 7. – Antibiotic Therapy (Clinical and sub-clinical cases)

Antibiotic.	No. of Quarters Treated.	No. of Quarters which Recovered	% Reduction of Mastitis
Penicillin-Streptomycin	24	17	70.8
Cloxacillin	26	16	61.5
Oxytetracycline	20	11	55.0

All animals that were treated with an antibiotic infusion were tested with CMT after 3–4 weeks of infusion and quarters that were negative for both tests were regarded as recovered.

The effects of the use of Dry Cow infusion is shown in Table 8.

Table 8. – Antibiotic Therapy (Dry Cow Treatment)

Antibiotic	No. of Quarters infused.	No. of Quarters positive at drying off.	No. of cases of mastitis eliminated.	No. of new cases of mastitis.	% reduction of mastitis during dry period.
Cloxacillin	95	15	14(93.3%)	1	86.7
Penicillin – Streptomycin	80	13	13(92.3%)	1	84.6

All cows infused with dry cow infusions were tested with CMT three weeks after calving and again in two to three weeks time. Quarters that were negative for both tests were regarded as those which had been cured.

4. Discussion

The presence or absence of organisms in the milk sample conveys little information regarding the status of mastitis in an udder. It has been observed 70% and 80% quarters at any time were shedding pathogenic staphylococci, though there were very little mastitis in the herds concerned[5] and the milk production appeared to be normal. Somatic cell levels were comparable with the normal levels which had been previously reported.

An exudation and emigration of cells are the first sign of inflamatory reaction in the udder and the California Mastitis Test (CMT) which gives an indication of cell count, is a satisfactory diagnostic tool in a control programme.

It has been observed by some workers that the incidence of mastitis was higher in rear quarters. In Sri Lanka, Rupasinghe and Kulasegaram[6] observed that the incidence of mastitis was higher in the anterior quarters, but no explanation was given. In the present study, higher incidence of mastitis was recorded on the left side than on the right side of the udder. All these cows were hand milked. The reason is probably incorrect milking method. Almost all these milkers sit on the left side of the cow and drag down the thumb and the forefinger along the teat squeezing milk out instead of bending down the four fingers in a rhythmical manner against the thumb. These milkers first milk the left side quarters first to finish and start milking the right side quarters without giving rest to the fingers. So that the trauma on the udder due to incorrect milking procedure is higher on the left side than on the right side. This is probably a major factor causing mastitis on the area.

Streptococcal spp. were the most predominant type of infection causing mastitis in different countries. But lately, with the intensive use of penicillin in the treatment of mastitis, use of milking machines, and use of teat-dips has changed the picture from streptococcal infections to staphyloccal infections. But in this country, in the area under study, the picture still remains the same as streptococcal infections were the predominant type. In this area farmers do not misuse antibiotics to the level to that which happens in certain countries and also a considerable number of dairy farmers resort to indigenous treatment.[8] These farmers do not use milking machine and disinfection teat-dips.

In the antibiotic sensitivity test (ABS), it was found that most isolates of streptococci spp. are sensitive to penicillin and streptomycin. Most isolates of staphylococci spp. are sensitive to penicillin, streptomycin and chloramphenicol (Table 6). According to Linton,[4] sensitivity shown on artificial media *(in vitro)* depends on factors such as concentration of antibiotics on discs, rate of diffusion of a drug in medium, Gram negative and positive organisms (same drug required to produce standard zone with

Gram negative organisms is usually much greater than is required to produce a comparable reaction with Gram positive organisms), size of antibiotic molecule (chloramphenicol has a smaller molecular size and produce a greater zone of inhibition, giving false impression of sensitivity). As such, action of antibiotics such as penicillin, streptomycin, cloxacillin and oxytetracycline were estimated by infusing into the affected quarters. During this programme treatment of sub-clinical cases were tried during the first two rounds with success. This is because the average cow in this area is not a high yielding cow[8] and as such there is no dilution of antibiotic to an extent that would happen in a high yielding cow.

Intramammary infusions containing combinations of penicillin and streptomycin were the best in treatment of mastitis in the area. This is expected as mentioned earlier, dairy farmers in the area do not use antibiotics intensively.

The use of Dry Cow infusions showed that cloxacillin (Orbenin Dry Cow-Beecham International) reduced 86.7% of mastitis during dry period and penicillin and streptomycin combination (Streptopen Dry Cow-Glaxo) by 84.6% which is very satisfactory. Though farmers may believe that it is expensive to use dry cow infusions, it is evident on cost-benefit analysis, that its use is justified in spite of its cost (see below).

The primary aim of the programme was to reduce the incidence of mastitis. The different level of reduction of incidence (see Table 2) in different farms were due to differences in management practices, interest of farmers in listening to advice on control measures, beliefs of farmers, economic conditions, closing down of farms, etc. Some farmers attend to animals personally but some live elsewhere giving the responsibility of looking after the animals to others. With all types of differences, the overall incidence of mastitis was reduced satisfactorily, from 13.9% cows and 7.0% quarters positive to 8.7% cows and 3.3% quarters at the end of the programme. This is a reduction in incidence of mastitis from its original level (1st – 2nd test) by 39.2% cows and 52.9% quarters. The prevalence was reduced from 30.7% cows and 14.1% quarters positive to 13.1% cows and 5.2% quarters positive. This is a reduction from its original level (at first testing) by 57.3% in cows and 63.1% in quarters.

Cost-Benefit Analysis

Cost of the Programme to farmer :—

An average farm in the area has 9 cows and the average milk yield per day is 3.5 litres.[8] Price of intramammary infusion as Rs. 17/- per tube.

Cost of intramammary infusions at 1st & 2nd rounds	= Rs. 17x9.3x3
(three tubes for each affected quarter)	= Rs. 474.30
Cost of treatment of clinical cases 1st to 5th round	= Rs. 17x2.3x3
	= Rs. 117.30
Cost of Hibitane solution for one year	= Rs. 50.00
Cost of dry cow infusions (for 9 cows)	= Rs. 17x4x9
	= Rs. 612.00
Total cost to farmer	= Rs. 1203.60

Benefit:-

Assuming that the loss of milk due to sub-clinical mastitis as 20% of the total production,

Loss per farm Unit = 9 x 3.5 x 20% = 6.3 litres.

Taking average price of milk as Rs. 3/- a litre and assuming that average lactation period is 200 days.

The loss for one year from 9 cow unit = 6.3 x 200 x 3 = Rs. 3780.00
At incidence of 1.6% clinical mastitis no. of quarters affected in a farm Unit = 9 x 4 x 1.6% = 0.6 quarters.
Loss due to 0.6 quarters per year = Rs. 3 x 0.5 lit. x 200 days
= Rs. 315.00
Total loss per year from one farm Unit = Rs. 3780 + Rs. 315
= Rs. 4095.00
Net profit per year = Rs. 4095 – Rs. 1203.60 = Rs. 2891.40
Total income from an average cow = Rs. 3x3.5x200 = Rs. 2100.00

Therefore the profit a farmer gets from the recommended mastitis control programme is roughly the profit of maintaining two more cows.

If the mastitis situation was not arrested, the intensity of the disease would have progressed throughout subsequent lactations and would have resulted in a total loss or further loss in milk production.

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