CHAPTER IV

RESULTS

The effects of milking machine on quarter somatic cell count

The small holder dairy farms in this study were 11 farms. All farms used the bucket type of milking machine. The descriptive statistics of milking machine performances were showed in table 1.

The range of the vacuum level were 35.60 – 67.50 kPa with the mean of 52.20 kPa. The pulsation ratio were 58.10: 21.40 to 78.10: 41.90 with the mean of 62.54: 37.47. Furthermore, the highly range of the pulsation rate was 52.20 – 86.70 cycles/min. with the mean of 62.63 cycles/min. and the limping percentage was 0.10 – 10.80 % with the mean of 2.85 %, respectively.

There were found the highly significant difference ($P < 0.01$) in milking machine performances between the high quarter somatic cell count group (≥ 200,000 cells/ml.) and the low quarter somatic cell count group (< 200,000 cells/ml.). The comparison of both groups are show in the table 2.

Almost of performance parameters were found significant difference except limping percentage. In general, the performance of both group were approximated in standard range.

Table 1 The descriptive statistic of milking machine performance data from the small holder dairy farms in Chiang Mai and Lamphun provinces. (n = 11)

Performance parameters	Minimum	Maximum	Mean	S.D.
Vacuum level (kPa)	35.60	67.50	52.20	9.36
A %	2.30	7.30	4.48	1.65
B %	52.90	75.80	58.06	6.72
C %	2.10	5.50	3.27	1.19
D %	18.70	39.20	34.21	6.19
A+B %	58.10	78.10	62.54	6.10
C+D %	21.40	41.90	37.47	6.16
Pulsation rate (cycles/min.)	52.20	86.70	62.63	11.07
Limping %	0.10	10.80	2.85	3.13

Table 2 Comparison of milking machine performances between the high quarter somatic cell count (≥ 200,000 cells/ml, n = 46) and the low quarter somatic cell count (< 200,000 cells/ml, n = 147).

Variables	≥ 200,000 cells/ml		< 200,000 cells/ml		P-value
	Mean	S.D.	Mean	S.D.	
Vacuum level (Kpa)	48.21	11.56	52.92	8.49	< 0.01***
A %	3.52	1.24	4.54	1.59	< 0.001***
B %	62.28	9.15	57.69	5.13	< 0.001***
C %	2.80	0.75	3.33	1.26	0.012**
D %	31.23	8.60	34.48	5.00	< 0.01***
A + B %	65.81	8.42	62.23	4.83	< 0.01***
C + D %	34.03	8.59	37.80	4.79	< 0.001***
Pulsation rate (cycles/min.)	57.13	5.74	60.35	7.67	0.017**
Limping %	2.83	2.36	3.22	3.19	0.470

** = trend to significant (P < 0.10), ** = consider significant (P < 0.05), and *** = highly significant (P < 0.01)*

The effects of teat structures on quarter somatic cell count

The teat ultrasonography in this study was done in duplicate from 216 udders at before and after milking. The descriptive statistic of teat structures is shown in table 3.

The mean of teat structures (mean $\pm$ S.D.) were as follow, the teat-canal length 1.98 $\pm$ 0.30, the teat-diameter 3.22 $\pm$ 0.28, the teat-cistern width 1.73 $\pm$ 0.38, and the teat-wall thickness 0.96 $\pm$ 0.17, respectively.

Teat structures at before milking and after milking, there no significant differences between the high quarter somatic cell count group($\geq$ 200,000 cells/ml.) and the low quarter somatic cell count group (< 200,000 cells/ml.). The student's T-test of both groups at before milking were show in the table 4 and at after milking were show in the table 5.

In the contrary, there were highly significant differences ($P < 0.01$) in teat structures between before and after milking. The significant differences were founded in every structures of the teat and show in the table 6 and figure 7.

Only the teat diameter tended to be significant ($P = 0.078$) but other teat structures had highly significant. The teats have changed in almost structures at after milking but the teat diameter still be in trended the change.

Table 3 The characteristics of teat structures from the cows belonging to the small holder dairy farms in Chiang Mai and Lamphun provinces.(n = 216)

Teat structures	Minimum (cm.)	Maximum (cm.)	Mean (cm.)	S.D.
Teat-canal length	1.25	3.24	1.98	0.30
Teat-diameter	2.17	3.91	3.22	0.28
Teat-cistern width	0.88	2.83	1.73	0.38
Teat-wall thickness	0.67	1.74	0.96	0.17

Table 4 Comparison of the teat structures at *before* milking between the high quarter somatic cell count (≥ 200,000 cells / ml, n = 46) and the low quarter somatic cell count (< 200,000 cells/ml, n = 147).

Teat structures	≥ 200,000 cells / ml		< 200,000 cells / ml		P-value
	Mean (cm.)	S.D.	Mean (cm.)	S.D.	
Teat-canal length	1.27	0.21	1.30	0.22	0.374
Teat-diameter	2.18	0.16	2.16	0.22	0.510
Teat-cistern width	1.26	0.29	1.22	0.28	0.397
Teat-wall thickness	0.63	0.16	0.63	0.14	0.850

Table 5 Comparison of the teat structures at *after* milking between the high quarter somatic cell count (≥ 200,000 cells / ml, n = 46) and the low quarter somatic cell count (< 200,000 cells / ml, n = 147).

Teat structures	**≥ 200,000 cells / ml**		**< 200,000 cells / ml**		**P-value**
	Mean (cm.)	**S.D.**	**Mean (cm.)**	**S.D.**	
Teat-canal length	1.33	0.21	1.37	0.18	0.179
Teat-diameter	2.16	0.13	2.15	0.18	0.642
Teat-cistern width	1.04	0.21	1.05	0.29	0.962
Teat-wall thickness	0.66	0.09	0.65	0.13	0.781

Table 6 The comparison among the teat canal length (n = 213), the teat diameter (n = 213), the teat cistern width (n = 211), and the teat wall thickness (n = 212) in milking cows between *before* and *after* milking.

Teat structures	**Mean before milking (cm.)**	**S.D.**	**Mean after milking (cm.)**	**S.D.**	**P-value**
Teat-canal length	1.3011	0.2314	1.3578	0.19082	< 0.001***
Teat-diameter	2.1516	0.20503	2.1372	0.16955	0.078 *
Teat-cistern width	1.2116	0.27888	1.0356	0.26866	< 0.001 ***
Teat-wall thickness	0.6282	0.13644	0.6537	0.11544	< 0.01 ***

** = trend to significant (P < 0.10), ** = consider significant (P < 0.05), and *** = highly significant (P < 0.01)*

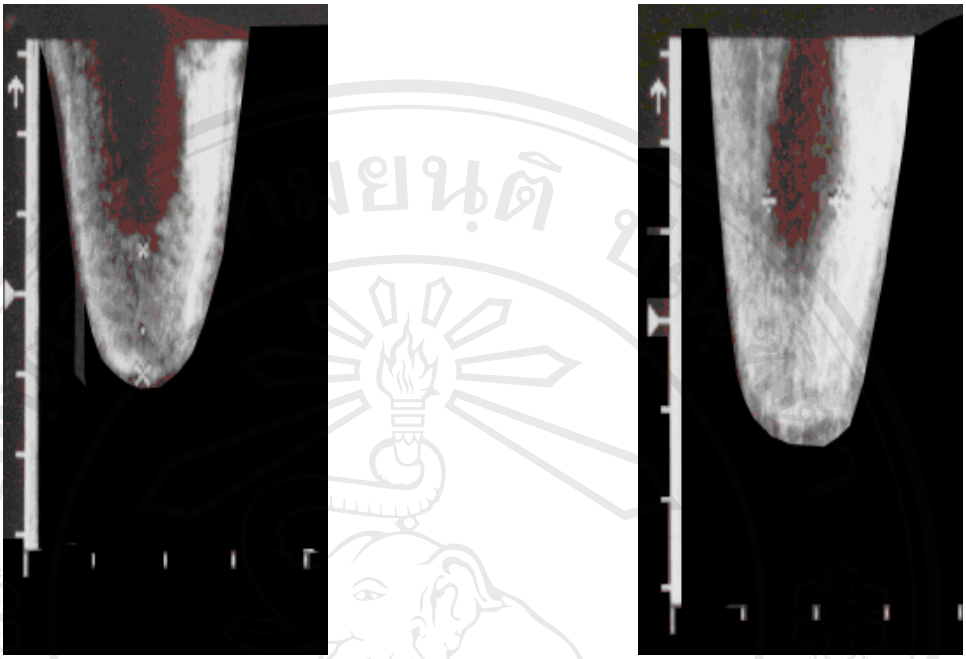

Figure 7 The comparison of teat ultrasonoghaphy between before milking (left side) and after milking (right side) with 5 MHz linear probe.

The teat end scoring system was investigated at before attaching and after detaching the teat cup immediately to determine the healthy of the teat end. After that, the teat ultrasonographies was followed to investigate inside the teat structures.

The mean difference of teat structures with teat end score are shown in the table 7. The mean difference came from the mean of teat structure dimension at before milking minus that of after milking. If the mean difference show the minus value, the teat structure increase in size or edema. If the mean difference show the plus value, the teat structure decrease in size.

The teat end score 3 indicated the bad condition of the teat end. There were found the tend to lowest decrease of teat cistern width. In other teat structures were not clear.

The correlation between teat end scores before attach and after detach were found highly significant changing on table 8. Almost of the teat score were stay in same score but some were changed after detachment.

The descriptive statistic and significant difference between quarter somatic cell count and teat end score after detachment show on table 9. There were not found significant difference among teat end score after detach and log of quarter somatic cell count ($P = 0.407$).

The somatic cell data were translated to log of SCC for normally distribution. The means and standard deviations of SCC can expressed in different units (crude SCC values, logarithm base 10, natural logarithm or scores of SCC), (Djabri, et al., 2002).

Table 7 The mean difference (n = 211) of the teat canal length, the teat diameter, the teat cistern width, and the teat wall thickness between before milking and after milking with the teat end score (score 1, n = 83; score 2, n = 73; and score 3, n = 55)

Teat end score	Teat canal length		Teat diameter		Teat cistern width		Teat wall thickness	
	Mean (cm.)	S.D.	Mean (cm.)	S.D.	Mean (cm.)	S.D.	Mean (cm.)	S.D.
1	-0.05	0.18	+0.02	0.10	+0.19	0.22	-0.03	0.11
2	-0.07	0.18	+0.02	0.12	+0.18	0.23	-0.03	0.09
3	-0.06	0.19	+0.00	0.11	+0.15	0.21	-0.01	0.17

Table 8 The teat end score changing between before attachment and after detachment of the teat cup.

Before attachment	**After detachment**			**total**	**P-value**
	Score 1	Score 2	Score 3		
Score 1	65	27	12	104	< 0.001 ***
Score 2	19	44	19	82	
Score 3	1	5	24	30	
total	85	76	55	216	

** = trend to significant (P < 0.10), ** = consider significant (P < 0.05), and *** = highly significant (P < 0.01)*

Table 9 The descriptive statistic and significant difference between log of quarter somatic cell count and teat end score after detach teat cup.

The teat end score	N	log of QSCC	S.D.	P-value
Score 1	63	4.18	1.90	0.407
Score 2	62	3.73	1.91	
Score 3	48	3.92	1.77	

The effects of individual cow management and farm management on quarter somatic cell count

The results can be divided according to the characteristics of the data into two main groups. First, individual continuous cow data were composed of the lactation numbers, the days in milk (day), the cleaning time (min.), the milking time (min.), the milk yield (kg), the milking rate (kg/min.) and the order to milking, respectively. The significant differences of individual continuous cow data between the high and the low somatic cell count groups were shown in the table 10.

There were found the considered significant difference ($P = 0.05$) between both groups on the milk yield and tended to be significant ($P \leq 0.01$) on the milking time and the lactation number, respectively.

Second, categorical farm management data were composed of the cleaning cloth (yes/no), the disinfectant (yes/no), the dry cloth (yes/no), the strip milk test (yes/no), the slipping teat cup (yes/no), the teat cup fall off (yes/no), the vacuum pump (dry/wet), the regulator type (spring/weight), the pipeline (close/open), the pipe diameter (1 ½ "/1"), the replace liner (yes/no), the pulsator type (water/air), the sodium hydroxide (NaOH) cleaning (yes/no), the acid cleaning (yes/no), the pipeline cleaning (yes/no) and the pulsator cleaning (yes/no) respectively. The significant differences of categorical farm management data between the high and the low somatic cell count groups were shown in the table 11.

There were the highly significant difference ($P < 0.01$) between both groups on disinfectant, dry cloth, strip milk test, teat cup fall off, pipe diameter, and liner replacement. There were the considered significant ($P < 0.05$) on NaOH cleaning and

trended to significant (P = 0.05) on pipeline cleaning. In addition, there was found the odd ratio of teat cup fall off about 6 times more than if not.

Table 10 Comparison of individual cow management data between the high somatic cell count (≥ 200,000 cells / ml, n = 46) and the low somatic cell count (< 200,000 cells / ml, n = 147).

Variables	≥ 200,000 cells / ml		< 200,000 cells / ml		P-value
	Mean	S.D.	Mean	S.D.	
Lactation number (1,2,3,..)	2.75	1.36	2.00	1.40	0.10*
Day in milk (day)	152.42	93.07	200.14	133.27	0.25
Cleaning time (min.)	0.84	0.70	0.76	0.92	0.79
Milking time (min.)	6.55	3.60	4.54	2.22	0.09*
Milk yield (kg)	7.41	3.00	5.66	2.66	0.05**
Milking rate (kg / min.)	1.47	0.93	1.43	0.83	0.88
Order to milking (1,2,3,..)	3.55	3.11	4.73	3.00	0.25

** = trend to significant (P < 0.10), ** = consider significant (P < 0.05), and*

**** = highly significant (P < 0.01)*

Table 11 The percentage and comparison of categorical farm management data between the high quarter somatic cell count (≥ 200,000 cells / ml, n = 46) and the low quarter somatic cell count (< 200,000 cells / ml, n = 147).

The categorical variables	≥ 200,000 cells /ml		< 200,000 cells/ml		P value	Odd ratio
	YES (%)	NO (%)	YES (%)	NO (%)		
Cleaning cloth	51.06	48.94	37.58	62.42	0.126	1.73
Disinfectant	31.91	68.09	85.91	14.09	< 0.01 ***	0.08
Dry cloth	68.09	31.31	85.91	14.09	< 0.01 ***	0.36
Strip milk test	14.89	85.11	35.57	64.43	< 0.01 ***	0.32
Slipping teat cup	65.96	34.04	57.05	42.95	0.311	1.46
Teat cup fall off	25.53	74.47	5.37	94.63	< 0.01 ***	6.04
Dry vacuum pump [a]	10.64	89.36	20.81	79.19	0.135	0.45
Spring regulator type [b]	38.30	61.70	38.93	61.07	1.000	0.97
Close pipeline [c]	38.30	61.70	41.61	58.39	0.736	0.87
1 ½ “ pipe diameter [d]	59.57	40.43	34.90	65.10	< 0.01 ***	2.75
Replace liner	53.19	46.81	77.18	22.82	< 0.01 ***	0.34
Water pulsator type [e]	40.43	59.57	38.26	61.74	0.864	1.10
NaoH cleaning	27.66	72.34	44.97	55.03	0.041**	0.47
Acid cleaning	19.15	80.85	31.54	68.46	0.138	0.51
Pipeline cleaning	91.49	8.51	78.52	21.48	0.052 *	2.94
Pulsator cleaning	25.53	74.47	32.21	67.79	0.469	0.72

Table 11 (Continued)

** = trend to significant (P < 0.10), ** = consider significant (P < 0.05), and*

**** = highly significant (P < 0.01)*

a = vacuum pump (yes = dry/no = wet), b = regulator type (yes = spring/no = brand),

c = pipeline (yes = close/no = open), d = pipe diameter (yes = 1 ½ "/no = 1"), and

e = pulsator type (yes = water/no = air), respectively

There were no significant differences between the typing barns and the quarter somatic cell count by ANOVA analysis as showed in the table 12. The typing barns consist of tied-stall, free-stall, and free in limited area, respectively.

The somatic cell data were translated to log of SCC for normally distribution. The means and standard deviations of SCC can expressed in different units (crude SCC values, logarithm base 10, natural logarithm or scores of SCC), (Djabri, et al., 2002).

Table 12 The comparison between the log of quarter somatic cell count and the typing barns in small holder dairy farms.

Typing barns	mean	S.D.	P-value
Tied-stall	10.60	2.10	0.12
Free-stall	11.40	1.84	
Free in limited area	11.02	1.78	