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MACHINE MILKING AND THE WELL-BEING OF THE DAIRY COW

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SUMMARY

A number of observable changes in cow behaviour during milking and visible changes in teat condition immediately after milking have been noted. They are probably related to a combination of milking conditions, equipment and operator technique. There is a need to understand the causes of these changes in order to evaluate the effects on the well being of the dairy cow.

In a series of on farm observations it was noted that heavy milking clusters and the associated technology gave more complete milking out and less liner slip but at the cost of an increase in agitation of the cows seen as fidgeting, unsuccessful attempts to remove the cluster by kicking and increased defecation and urination during the period of cluster attachment. Similar changes were observed with light clusters when pulsation faults were diagnosed. Indexing of cows in parlours produced benefits in terms of cow loading, cow position and cluster position during milking.

Under 'normal' conditions cows milked with the heavy cluster were more likely to exhibit red or blue teats with a palpable ring at the base of the teat after cluster removal.

INTRODUCTION

International standards have recently been revised by experts from 15 countries on behalf of the International Standards Organisation and these describe minimum specifications of design, installation, maintenance and testing of milking machines (1). The standards are not mandatory and in some countries variations in interpretation and even disagreement can lead to differences in operating conditions of the milking machine.

One type of milking machine has many features which are different from all other types. The most significant differences are a smaller claw bowl volume (150 ml), a narrower long milk tube diameter (14 mm), greater cluster weight (>3.2 kg), simultaneous pulsation with no ACRs used on a midi - line plant milking at a recommended system vacuum of 49 kPa.

An independent field study was undertaken to compare this milking philosophy with systems more frequently noted. These results can form the basis for practical advice to dairy farmers. Effects on cow behaviour, milking performance and teat condition were recorded. The comparisons have been made in line with International Dairy Federation recommendations (2).

METHODS

Agreement to co-operate was obtained from twenty farms to allow inspection of the milking equipment and observation of the milking within six months of installation with a second visit six months later. All the milking machines were intended to be compliant with the 1996 ISO standard (1). Twelve of the plants were fitted with a light cluster (approx. 2.4 kg) with a large claw bowl volume, 16 mm diameter long milk tube, alternate pulsation and milked with a system vacuum of 41-47 kPa. The other eight plants were of the alternative type using a heavier cluster.

Thirteen of the plants assessed were constructed with some degree of cow indexing, while seven of the plants were un-indexed having a straight breast and rump rail.

On the first visit a full static test was performed in accordance with ISO 6690 (3). The plant was fully inspected and the whole afternoon milking observed. An examination of the orifice of all teats of 50 cows was made during the visit for teat orifice hyperkeratosis (4).

Following the first visit all farmers received a verbal and written report of maintenance problems or major faults. Only a small number of selected items on a few farms were addressed before the second visit (5). The detailed assessments reported are therefore for parlours operating to the farmers selected criteria and reflect normal operating conditions and applications of the standards in practise.

During the second visit, full observations were made of the performance during milking. This included scoring on a basis of zero (could not be improved) to three (could not be worse) various parameters including cow entry, cow positioning, cluster positioning, liner slippage, cow behaviour during milking, cow behaviour during teat inspection and completeness of milking.

A more detailed assessment of teat condition of 50 or more cows on each farm was made. The most significant parameters of colour, response to touch, palpable ringing at the base of the teat and degree of openness of orifice were recorded after cluster removal.

RESULTS AND DISCUSSION

The total and average scores for each parameter assessed during milking are shown in Table 1, sorted according to relative cluster weight or presence of indexing. Lower scores indicate better performance.

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Table 1. Total and average parlour performance sorted by cluster weight and indexing of cow position

	Cluster weight				**Indexing of cow position**			
	Light		**Heavy**		**Indexed**		**None**	
Parameter	Total	Average	Total	Average	Total	Average	Total	Average
Cow entry	11	0.9	10	1.3	11	0.8	10	1.4
Cow position	8	0.7	10	1.3	3	0.2	15	2.1
Cluster position	13	1.1	11	1.4	13	1	11	1.6
Cow behaviour								
During milking	4	0.3	12	1.5	11	0.8	5	0.7
After milking	12	1	11	1.4	15	1.2	8	1.1
Liner slip	8	0.7	3	0.4	9	0.7	2	0.3
Milking completeness								
High yielders	5	0.4	0	0	5	0.4	0	0
Low yielders	14	1.2	3	0.4	7	0.5	10	1.4

Cow entry and loading were achieved more easily into an indexed parlour. It was common in non indexed parlours for the operator to leave the pit to bring cows from the collecting yard. Eleven of the farms used a crowd gate which eased loading. Cow position during milking was better in indexed parlours. Although cows appeared to be better positioned with light weight clusters, this effect is partly related to these parlours being more likely to have indexation and usually having a milking point per standing with the cow standing adjacent to the available cluster.

Cluster position during milking was better in indexed parlours as the cow position was more controlled. A heavy cluster did not ensure an adequate cluster position. Cluster position with heavy clusters was adversely affected in many cases by excessive length of long milk tube and position of the long milk tube riser.

Cows milked with a heavy cluster showed more agitation during milking than cows milked with a light claw. The behaviour was marked and included at least one cow in twenty defecating or urinating during milking and at least three cows in twenty stepping or kicking at the cluster. This effect may be related in part to average system vacuum applied (45 kPa for light claws and 47.3 kPa for heavy claws). Exceptions were noted with certain operators where overmilking was minimal.

The effect of cluster weight on cow behaviour after milking was less marked. Cows milked with the light claw were generally more amenable to handling although behaviour was more variable in this group.

Less liner slip was observed with heavy clusters.

Heavy clusters achieved more complete milking especially in low yielding (late lactation) animals. It was difficult to discover if only completion of milking was being achieved or to what degree over milking might have occurred. No determination of over milking was made although occasional cluster-on times of 15-20 minutes were observed in several parlours using heavy clusters. Extended unit on time was more noticeable when the operator had to leave the pit to load cows from the collecting yard, ensure the correct number of cows were loaded or spend time on teat preparation before cluster attachment. The under milking of low yielders noted with light clusters tended to be predominately front quarters. This may be a product of poor cluster position and poor end of milk flow determination.

Clusters and liners can only achieve complete milking and low strip yields under optimum conditions of cow behaviour and cluster position. Table 2 clearly shows a reduction in completeness of milking as cluster position deteriorates.

Table 2. Relationship between completeness of milking and average cluster position for High (H) and Low (L) yielding cows

		Completeness of milking score			
		0	1	2	3
Cluster position					
	0	1L			
Heavy	1	7L, 5H	2L		
	2	1L, 2H	1L		
	3				
	0	1L			
Light	1	4L, 4H	3L		2L, 2H
	2	3H		1L	1L
	3				

The physical condition of the teats after milking is related to the operating conditions within the milking cluster. The most significant of these are likely to be milking vacuum, cluster weight, liner type and duration of cluster attachment.

There are several easily observable changes to cows teats that occur during milking. These changes are transient but may be useful indicators of milking conditions within the clawpiece. These can be observed and broadly quantified without disruption to the milking routine.

Teat colour changed rapidly with time after cluster removal except where the teats showed a normal pink colour. Eleven of the twelve farms using a light claw recorded less than 50% of cows showing red or blue teats. Seven of the farms with the light claw had less than 25% of cows showing red or blue teats. In contrast, seven of the eight farms using a heavy clawpiece recorded between 76 and 100% of cows showing red or blue teats. The remaining farm using the heavy clawpiece showed only 59% of

cows exhibiting red or blue teats. This farm employed an efficient milking routine with less units installed therefore reducing the opportunity for over-milking.

Teat discolouration immediately after cluster removal could indicate impaired circulation and constriction to fluid transfer. It is not possible to say categorically whether this is causing pain or discomfort although experience sleeping on an arm would suggest the sensation is far from pleasant.

Wide variation was found between herds in the proportion of teats with a palpable ring at the base of the teat. 23% of teats showed no mark while more than 60% had a palpable ring. A number of farms using the heavy clawpiece had more than 90% of examined teats showing a palpable ring. This ring indicates localised oedema which accumulates during milk extraction and can take many minutes to disperse.

The exact significance of this oedema is not known although it has been suggested that if the ringing develops early in the milking, milk flow can be adversely affected. One farm with a light weight claw was using a liner which caused severe ringing. When the liner was replaced and the ringing removed, daily yield increased by 300 litres. There was a consistency in scores for teat colour and palpable ringing at the base of the teats of cows milked with the heavy clawpiece.

Teats which are unresponsive to touch can also indicate impaired circulatory action. After milking teats should remain soft and tactile. While 75% of teats examined were normal, 24% of teats examined were considered firm and 54% of teats on one farm were hard and 'wooden'.

CONCLUSIONS

The objective of any milking machine, irrespective of manufacturer or configuration, must be to milk cows safely, gently, quickly and completely. The results of this field study provide further evidence that the milking process and it's interaction with the cow is complicated and multi factorial.

While it is impossible to be precise as to when milking causes pain or discomfort to an animal, there are a number of key parameters which should give an early indication of an animal being milked in less than optimum conditions.

Many of the reported observations relating to the heavy clawpiece including increased agitation towards the end of milking, dunging and urination, higher proportion of red and blue teats and palpable ringing at the base of the teat were rare on farms using the heavy clawpiece where a smooth milking routine was employed or fewer units were installed per operator. This suggests the compounding effect of over-milking must be considered.

As herd size increases, there is a move towards more units per operator to improve efficiency. However, this increase in throughput must not be at the cost of a reduction in the well being of the dairy cow.

The market place increasingly demands that the industry responds to changing welfare requirements. An awareness from operators of the influence of the milking machine on sensitive teat tissue and how

some of the highlighted effects may adversely affect the well being of the dairy cow will allow the UK dairy industry to maintain it's competitive edge.

ACKNOWLEDGEMENTS

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