Completeness of milking

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What is undermilking?

Undermilking (or incomplete milking) means that an unacceptable amount of milk is left in the udder after teatcups are removed. Milk left in the alveoli is called "residual milk". Milk left in the ducts or udder cisterns is referred to as "available milk" or "strippings".

"Residual milk" cannot be removed, even by careful machine stripping or hand-stripping, without an intramuscular injection of oxytocin. Typically, residual milk may be 1-3 kg or about 10-20% of total milk in the udder. Higher amounts of residual milk may result from incomplete milk ejection associated with poor milking routines, frightened or nervous cows, sore teats or uncomfortable milking equipment.

Incomplete removal of the "available" or "strippings" milk occurs when:

- teatcups are removed before the last of the available milk drains into the udder cisterns, or
- the milk pathway between the udder cistern and teat sinus, in one or more of the four quarters, becomes blocked near the end of milking. Such blockages occur when clusters do not hang evenly on the udder and/or when one or more of the four teats moves too deeply into its teatcup (referred to as "teatcup crawling").

The most common causes of incomplete milking due to such flow restrictions near the end of milking are:

- poor type or condition of the liner;
- clusters that do not hang evenly on the udder because the connecting hoses are too long, too short, twisted, or poorly aligned in relation to the cow;
- clusters that are too light in relation to the bore of liner used and/or the system vacuum;
- high milking vacuum levels;
- a mismatch between the claw inlet and the short milk tube causing partial closure of the short milk tube where this tube joins the claw.

Effects of incomplete milking on mastitis

Published evidence on the relationship between completeness of milking and new mastitis infection rates is conflicting. Most of the older publications reviewed by O'Shea (1987) show that mastitis increased when machine stripping was omitted. In contrast, at least nine studies indicated that small quantities of milk left in the udder did *not* increase new infection rate or clinical mastitis, and at least three studies found higher levels of infection associated with machine stripping. The latter findings are not surprising. It is likely that the new mastitis infection rate would be increased by vigorous machine stripping which causes sudden air admission into one or more teatcups just before the teatcups are removed. Furthermore, extra weights placed on claws affect their balance and may increase cup slippage. Any increase in frequency of cup slippage can increase the risk of mastitis.

Effects of incomplete milking on milk yield
Experiments cited by Dodd and Griffin (1979) dating back to 1936 indicated that lactational yields were reduced by about 3% when 0.5 kg of milk was left in an udder after milking.

Monitoring the completeness of milking
As a guideline, Mein and Reid (1996) suggested that:

- If milking clusters are correctly designed, well maintained, correctly applied and adjusted, then the mean strippings yield is typically less than 0.25 kg per cow.
- A problem exists if an average of more than 0.5 kg of strippings milk is left in a cow's udder when teacups are removed. The average volume remaining in cows at the end of milking can be estimated by measuring the hand-strippings of at least 10 cows.

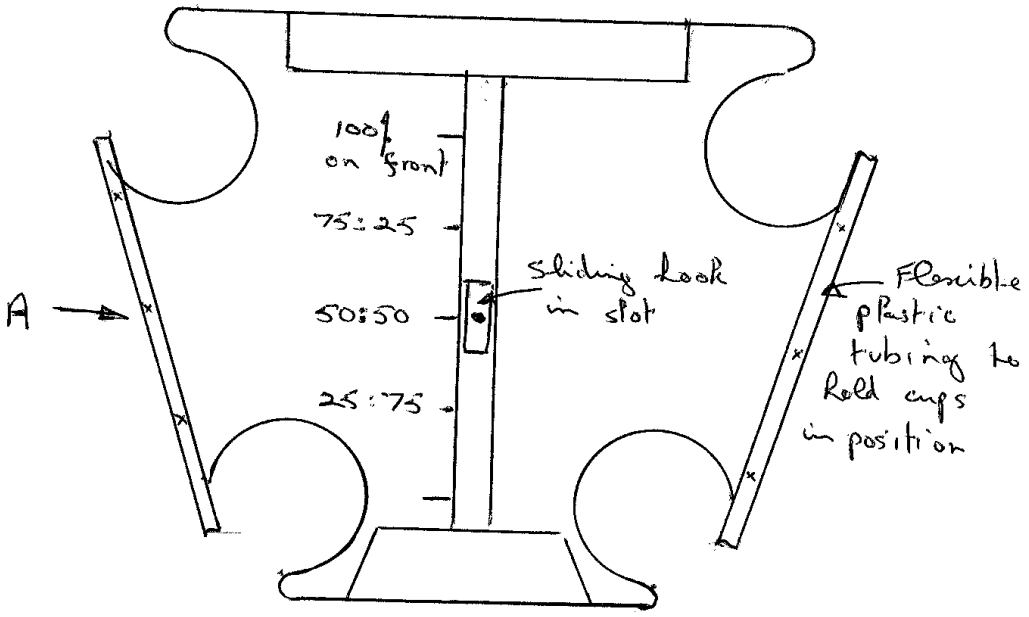
Because new research at the University of Wisconsin indicates that strip yields are not normally distributed, it seems more appropriate to express strip yields as a frequency distribution for individual quarters rather than as an average value per cow.

Consequently, completeness of milking should be estimated by hand-stripping at least 20 cows or 80 quarters. As an interim guide, assume that a problem of incomplete milking exists if more than 20% of quarters contain strip yields of about 100 ml or more. Consistent differences between strip yields from rear versus front quarters, or between quarters on the right versus the left side of udders, usually indicate a problem of poor cluster positioning or uneven weight balance between the four teatcups.

Demonstrating the uniformity of weight distribution between the four teatcups
Uneven weight distribution between the four quarters of an udder is one of the most common causes of incomplete milking, uneven milk-out, and liner slips. Ideally, the milking unit should hang squarely on the udder so that about 25% of the total cluster weight is applied to each udder quarter throughout milking. This rarely occurs in practice. The uniformity of distribution of the effective weight of any cluster between the four teatcups can be measured easily with a simple device that suspends the milking unit in the approximate position as if on a cow's udder. The effects of twisting or pulling of the milk hose can be demonstrated with this simple device which is little more than a square of plywood with slots cut at the four corners to hold the top of each teatcup securely. In its simplest form, the device is suspended at its center of gravity by a cord so that it is free to rotate, twist or tilt, thereby indicating non-uniform weight distribution (Fig 1).

References
Dodd FH, Griffin TK. Milking Routines. In: Thiel CC, Dodd FH, editors. *Machine Milking Technical Bulletin 1*, Chapter 7, National Institute for Research in Dairying, Reading, England, 1979;179-200.
Mein GA, Reid DA. Milking-time tests and guidelines for milking units. In: *Proceedings of the 35th National Mastitis Council Annual Meeting*, Nashville, Tennessee, 1996:235-244.
O'Shea J. Machine milking factors affecting mastitis. In: *Machine milking and mastitis, Bulletin of the International Dairy Federation No. 215*, Brussels, Belgium, 1987:5-32.

Fig 1. Sketch of device for measuring weight distribution between the four teatcups of a cluster.



Distance between teatcup hole centres

Front to front: 220 mm
Rear to rear: 130 mm
Front to rear: 140 mm.

Cross-Section A