



Factors affecting induction of milk let down in COWS

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INTRODUCTION

Induction of milk let down

Physical stimulation of the teats, either by the calf's suckling or the milkers hands, excite receptors from which nerve impulses are sending to the posterior pituitary gland causing secretion of the hormone oxytocin. The hormone is transported via the blood to the mammary gland. Because both hormones and nerve impulses are involved in the milk ejection reflex, it is called a neuro-hormonal reflex. Oxytocin stimulates the contraction of the alveoli and small ducts thereby emptying the milk into the larger ducts and the cistern. Hereafter the milk can be evacuated from the udder. The contraction of the alveoli may, to some extent, be enhanced by tactile stimuli of the udder (massaging, squeezing) the so called tap reflex. When calves suckle, they butt at the udder in order increase milk secretion. Manual massage of the udder during milking imitates this reflex.

Like cattle, buffaloes can get used to different stimuli. It is clear that also in buffaloes, oxytocin release is triggered by visual or audible stimuli, such as the sight of the milker, the noise of the vacuum pump or when entering the milking parlour. The animal becomes conditioned to let-down milk and has thus developed a conditioned reflex. (An unconditioned reflex is the suckling of the calf.) By letting the animals get accustomed to a strict routine, time of let-down is shortened. In cattle, it has been demonstrated that feeding concentrate during milking improves time of let-down. It has yet to be shown in buffaloes.

The milk let down reflex stimulates milk flow from the alveoli in the udder into the teat canal. It has to occur before a cow will milk out freely. A cow which has 'let down' prior to cup attachment /hand milking will milk out faster, and in many cases, more completely, as long as the let down does not occur too long before cup attachment / hand milking as this can slow the milking process. The let down reflex can be inhibited resulting in slow or interrupted milking of cows. The process of milk 'let-down' in the cow is of particular interest as the timing of let-down can be used to form an efficient routine to milk cows as quickly and efficiently as possible while minimising any teat damage that can be caused by 'overmilking' – when there is a high vacuum but little milk flow – and also by acknowledging that the time immediately following milking is crucial to controlling bacterial entry into the teat as the teat sphincter takes time to close post-milking. Milk let-down is controlled by unconditioned factors, most notably the response to tactile stimuli provided by a calf rubbing the udder or teat when suckling, or a similar stimulus provided by the milker when foremilking the quarter or otherwise preparing it for being milked. Other, conditioned factors, such as the psychological stimuli provided by the sounds, smells and routine the cow experiences at or around milking time also contribute to milk let-down. These stimuli result in the release of the hormone oxytocin from the cow's pituitary gland in the brain into the bloodstream, where it travels to the udder and causes several important processes to occur.

Oxytocin

Oxytocin release causes the mass of interconnecting blood vessels at the base of the teat to fill with blood, making the teat more erect and allowing milk to enter it from higher in the udder and pass through the teat. Oxytocin also encourages muscles throughout the udder to act to release milk. Most importantly, the muscle cells around the milk-producing alveoli deep in the udder contract and force the milk into the various ducts in the udder, down into the udder cistern and then into the teat cistern, ready for the milk to be removed by the suckling calf or the milking equipment. This is why during milking, for efficient let-down cows should be subjected to minimal stress, as this can cause the release of the hormone adrenalin (as a response to stress) which can counter the effect of oxytocin. The average time between beginning to prepare the cow for milking and the resultant let-down of milk is in the order of 60 to 90 seconds. During the period between milkings, an amount of milk will have already collected in the udder and teat cisterns, and will be released almost immediately upon attachment of the milking equipment. There then follows a period known as lag time, whereupon the oxytocin released into the bloodstream causes the release of milk deep in the udder. If the time between the first stimulus of the udder by foremilking or wiping the teats occurs approximately 60 seconds after beginning the process, the release of milk from higher in the udder will be practically continuous with the first release of milk stored in the teat and udder cisterns. Where a longer or shorter lag time occurs, the milk flow can become bimodal; there is effectively a gap where overmilking can occur, even at this early stage of the milking process. Here, the high vacuum from the milking machine/harsh handling of udders by fist, thumb or hand combined with a low or nonexistent flow of milk can cause significant damage to the teat end, making the cow more susceptible to mastitis, and likely also to lengthen the milking time significantly.

During milking, the teat lengthens while the teat canal opens up and becomes shorter, to allow faster removal of the milk from the cistern structures above it. Following milking, the overall teat length shortens, the teat canal lengthens and the teat sphincter begins to close, as the folds of skin around the opening close around one another, creating a tight seal, and the lipidised film around the sphincter stops a column of milk forming through which bacterial entry could occur. A waxy keratin seal begins to form in the teat canal to protect against bacterial entry after milking.

However, the sphincter muscle can take in the order of 20 to 30 minutes to close, and it is during this time that the risk of bacterial entry is greatly increased. This is why post-dip treatments play an important role, and also why cows should not be permitted to lie down for a 30 minute period post-milking.

BENEFIT OF LET DOWN

Maximize production .Cows that let down just prior to cup attachment/ hand milking will milk out more completely thus maximizing production. Improve milking efficiency.

An understanding of how milk let down occurs will help milkers manage the milking process in a way which encourages it.

1.Milk let down:

Milk is initially secreted into small sacs within the mammary gland called alveoli, from which it must be ejected for consumption or harvesting. Mammary alveoli are surrounded by smooth muscle (myoepithelial) cells which are a prominent target cell for oxytocin. Oxytocin stimulates contraction of myoepithelial cells, causing milk to be ejected into the ducts and cisterns above the teat. Oxytocin is released after the cow receives an appropriate stimulus, this can be visual, aural or physical, and should be predictable and consistent at every milking. Handling/massage of the teats for at least 15 seconds is a strong stimulus, but cows can also learn to let down through the association of the dairy environment to the milking process. The pressure of milk being forced into the ducts/cistern and down towards the teat causes the teat to swell with milk and become 'plump'. It takes 60 – 90 seconds for teats to become plump after let down has been initiated. Cows with well-filled udders require a shorter period of stimulation to elicit milk let down response than cows with less-filled udders. The action of oxytocin is essential for emptying of the udder during milking. As much as 80% of a cow's milk is unavailable if this oxytocin release is insufficient or does not occur. Its let down action lasts for about 5 minutes and is strongest for the first 3 minutes of milking. It is important to get the cups attached / hand milking quickly after let down has started to make full use of the increased udder pressure that occurs.

2. Factors which inhibit milk let down:

Slow milking time and incomplete milking out are indicators of interrupted milk let down. Agitated, fearful or stressed cows produce the hormone adrenaline which counteracts the activity of oxytocin and inhibits let down. It may take 20-30 minutes for the effects of adrenaline to subside. Pain during the milking process will affect milk let down. Ensure the gentle handling of udder in case of hand milking or milking machinery is not hurting cows.

Indications of a problem: There is no milk flow when the cluster has been attached for greater than 2 minutes in late lactation, sooner in early lactation.

Cows that are agitated during milking: The milk flow is ending when there is still a significant amount of milk in the udder. The flow can be interrupted part way through milking. In this case the milk flow at the start of milking is residual milk left in the cistern from the end of the previous milking and not milk which has been let down at this milking.

Damage to the teat end (hyperkeratosis):

Oxytocin Surge: The oxytocin concentration in the blood normally is increased within 1 to 2 min. after udder stimulation, but the amount released is declining during milking. The timing of oxytocin release relative to milk removal is an important factor affecting milk ejection. The sensitivity of the neuroendocrine reflex seems to decline as lactation progresses. Peak oxytocin seems to come later after mammary stimulation as lactation progresses. Peak oxytocin occurs at 1 min. at 1-2 weeks of lactation , 2 min. at 5-6 weeks, and 15-16 weeks. Maximum oxytocin concentration during milking also declines as lactation progresses. Extra-tactile stimuli often can release oxytocin before milking, but the occurrence of this declines as lactation progresses.

The dry or nonlactating period may serve to restore the sensitivity of the neuroendocrine reflex. Nonlactating cows will release oxytocin in response to udder stimulation. But, virgin heifers do not respond substantially to udder stimulation. Apparently maximum oxytocin release in response to udder stimulation occurs only if the mammary gland is lactating or has lactated.

Maximal prolactin release from the pituitary in response to tactile stimulation of the udder depends on the presence of a fully developed mammary gland. Oxytocin receptors on myoepithelial cells can respond to very low levels of oxytocin. Oxytocin has a short half-life in the blood = 0.55 to 3.6 min. This means that the removal of milk by machine or by nursing must be closely timed with stimulation of the teats.

INHIBITION OF MILK LET DOWN

Cows/Bufaloes are sensitive to changes in the environment. They may withhold the milk if they are uncomfortable with the situation. If the animals are stressed, scared or in pain, the hormone adrenaline is secreted. This hormone causes constriction of the blood vessels, thereby hindering the supply of sufficient amount of oxytocin to the udder. Adrenaline also directly acts on the myoepithelial cells in the alveoli by blocking the oxytocin receptors. The inhibition if milk let-down will result in the leaving of milk in the secretory parts of the udder. Continuous exposure of stress to the buffaloes will affect the milk production negatively. Change of milker or milking routine, application of wrong milking technique or milking machines in bad conditions are some reasons for the buffaloes to with hold the milk.

BENEFIT OF RESTRICTED SUCKLING BY CALVES

Cows and their calves interact in a variety of ways according to management, influencing saleable and consumed milk fractions, milk fat content:

- ❖ The absence of calf stimulation at milking reduces saleable milk yield and fat content.
- ❖ Calf presence increases saleable milk yield and fat content when it occurs during milking, but not before. This stimulus is not sufficient to allow the complete removal of milk from the udder.
- ❖ Suckling before milking until let down is observed increases saleable milk yield and fat content, but this stimulus does not continue during milking and milk is not completely removed.
- ❖ Milk suckled before milking has a low fat content. So the procedure should slightly increase saleable milk fat, but at levels not detected in these studies. The effect is reduced if the period since the previous suckling is short.
- ❖ In cows milked twice daily at different intervals, response to calf stimulation increases as the period from the previous suckling is reduced.