The importance of increased levels of oxytocin induced by naloxone to milk removal in dairy cows

V. Tancin[1], J. Macuhova[2], D. Schams[2], R. Jurcik[1], S. Mihina[1], L. Macuhova[1] & R. M. Bruckmaier[2]

[1]*Research Institute for Animal Production, Hlohovska 2, 949 92 Nitra, Slovak Republic*
E-mail: tancin@vuzv.sk

[2]*Institute of Physiology, FML, Technical University Munich, Freising, Germany*

Fast and complete milk removal is related to the release of oxytocin and milk ejection occurrence during whole milking process (Bruckmaier *et al.*, 1994). Milk ejection occurs n response to tactile teat stimulation when oxytocin blood levels reach concentrations above threshold levels of 3-5 ng/l (Schams *et al.*, 1984). However, several studies showed that oxytocin concentrations during milking could be related to the conditions of milk removal and production in cows (Tancin and Bruckmaier, 2001) or ewes (Marnet and McKusick, 2001). Thus more oxytocin in blood during milking could be a result of better welfare of cows (Hopster *et al.*, 2000; Tancin *et al.*, 2000b). On the contrary, stress or discomfort during milking can reduce oxytocin release and milk yield (Rushen *et al.*, 2001; Macuhova *et al.*, 2002, Tancin *et al.*, 2001).

Under normal milking conditions naloxone (opioid antagonist) can stimulate the release of oxytocin during milking (Tancin *et al.*, 2000a). Thus administration of naloxone under the normal milking conditions could be a good approach to see the effect of increased endogenous oxytocin on milking performance. The aim of this study was to test whether higher oxytocin release during milking under the normal milking conditions results in higher efficiency of milk removal.

Eight pregnant multiparous Holstein cows from second to fifth lactations were used for this experiment. The experiment was carried out during three consecutive days, i.e. six milkings (three morning and three evening milkings). During first and third evening milkings in cross over design (four and four animals) 250 mg of naloxone or 10 ml saline was injected 5 min before the start of udder preparation. During these milkings after stripping 2 IU of oxytocin was injected i.v. to cows and the amount of milk after oxytocin injection was measured. Pre-milking naloxone treatment stimulated the release of oxytocin in response to milking

procedure, however, only in six of eight cows. The stimulatory effect of naloxone on oxytocin release in a group of mentioned six cows was also influenced by individuality and ranged from 4 ng/l to 132 ng/l. Naloxone treatment did not influence milk yield before stripping and stripping milk yield. However, naloxone treatment significantly reduced amount of milk after 2 IU of *i.v.* oxytocin. Peak flow rate tended to be higher after naloxone treatment.

In conclusion, oxytocin release seems to be very important and useful parameter involved in the evaluation the effect of different milking routines and milk removal environment on the welfare of dairy cows. Any small disturbance of milking routine seems to reduce or block the ability of naloxone to potentionate oxytocin release.

Table 1. The effect of saline and naloxone treatment on oxytocin and milking removal during evening milking.

	Treatment			
	saline		naloxone	
n=6 cows	Mean	SEM	Mean	SEM
milk yield before stripping, kg	8.32	0.74	8.66	0.78
stripping milk yield, kg	0.62	0.15	0.65	0.21
milk yield after 2 IU of i.v. oxytocin	0.56[a]	0.15	0.47[b]	0.12
% of milk yield after 2 IU of i.v. oxytocin	5.81[c]	1.21	4.86[d]	1.11
peak flow rate, kg/min	3.47	0.55	3.61	0.63
oxytocin during entire milking, Δ AUC/min, ng/l	11.42[a]	3.34	64.45[b]	25.34
oxytocin of last 2 min, Δ AUC/min, ng/l	11.34[a]	3.48	48.17[b]	17.73

a,b - P<0.05; c,d - P<0.1;

References

Bruckmaier, R., Schams, D., Blum, J. W., 1994: Continuously elevated concentrations of oxytocin during milking are necessary for complete milk removal in dairy cows. J. Dairy Res. 61, 449-456

Hopster, H., Bruckmaier, R. M., Van der Werf, J.T.N., Korte, S. M., Macuhova, J., Korte-Bouws, G., van Reenen, C. G., 2002: Stress responses during milking, comparing conventional and automatic milking in primiparous dairy cows. J. Dairy Sci., 85, 3206-3216

Macuhová. J., Tancin, V., Kraetzl, W. D., Meyer, H.H.D., Bruckmaier, R. M., 2002: Inhibition of oxytocin release during repeated milking in unfamiliar surroundings: importance of opioids and adrenal cortex sensitivity. J. Dairy Res., 69, 63-73

Marnet, P. G., McKusick, B. C., 2001: Regulation of milk ejection and milkability in small ruminants. Livest. Prod. Sci., 70, 125-13

Rushen, J., Munksgaard, L., Marnet, P. G., DePasillo, A. M., 2001: Human contact and the effects of acute stress cows at milking. Appl. Anim. Behav. Sci., 73, 1-14

Schams, D., Mayer, H., Prokopp, A., Worstorff, H., 1984: Oxytocin secretion during milking in dairy cows with regard to the variation and importance of a threshold level for milk removal; J. Endocrinol. 102, 337-343

Tancin, V., Bruckmaier, R. M., 2001: Factors affecting milk ejection and removal during milking and suckling of dairy cows. Vet.Med.-Czech, 46, 108-118

Tancin, V., Kraetzl, W.-D., Schams, D., 2000a: The effect of morphine and naloxone on the release of oxytocin and on milk ejection in dairy cows. J. Dairy. Res., 67, 13-20

Tancin, V., Kraetzl, W.D., Schams, D., Bruckmaier, R., 2001: The effect of conditioning to suckling, milking and of calf presence on the release of oxytocin in dairy cows. Appl. Anim. Behav. Sci, 72, 235-246

Tancin, V., Kraetzl, W.-D., Schams, D., Mihina, S., Hetenyi, L., 2000b: The oxytocin secretion and milk letdown during milking immediatelly after the change of milking and housing conditions. Vet. Med.-Czech, 45, s. 1-4