

THE EFFECT OF SYNTHETIC OXYTOCIN ON THE MYOEPITHELIAL CELLS
OF THE UDDER IN THE THREE BREEDS COWS

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The pressure measurements in the mammary gland of animals belonging to various species indicated that their reaction to oxytocin administration varies, depending on the size of the dose, the method of the hormone introduction and the animal species /van Dyke et al. 1955; Martinet, Denamur 1960; Tindal, Yokoyama 1962; Cleverley, Folley 1970; Barowicz 1972 /. It is interesting to note, that in spite of uniform chemical structure of oxytocin in all the mammalian species the reaction of the myoepithelium to this hormone is different. These differences are explained as being due to the changes "reactivity" of the myoepithelium cell receptors, occurring in the phylogenetic development of animals /Gaitan et al. 1967/.

The aim of the present work was to determine the reaction of the mammary gland to intravenous injections of synthetic oxytocin in cows belonging to three breeds of cattle most popular in Poland.

The investigations were carried out on 44 cows - 16 Black-and-White, 10 Red-and-White and 18 Polish Red. The measurements were always made between the 100th and 120th day after calving, 5 hours after the morning milking. One hour before the experiment a polyethylene canulae was placed into the right jugular vein. Besides, the hind right quarter of the udder was emptied by inserting a metal catheter in the teat. 2 ml of synthetic oxytocin in 0,9% NaCl were administered in a single injection through the canulae. During 9 consecutive days the following doses were given: 0,05 , 0,10 and 0,20 I.U. pre cow. The reaction of the cows udder to the synthetic

oxytocin was estimated on the basis of the following measurements: /1/ time /in sec/ from the moment of the hormone injection to the appearance of the first drop of milk out of the catheter /"a latent period"/, /2/ the period of milk flow /in sec/, and /3/ the quantity of milk obtained /in ml/. Moreover, during the experiment, at the evening milking the quantity of milk obtained /in kg/ and the volume of hand stripping /in %/ were measured.

The results obtained indicate that the reaction of the myoepithelium cells of the cows mammary gland to the intravenous injected synthetic oxytocin depends, in a high degree, on the dose used. Within the range of doses from 0,05 to 0,20 I.U. per cow a negative correlation between the dose and the "latent period" length was found / $P \leq 0,05$ /. In turn a positive correlation was ascertained between the dose and the milk flow period / $P \leq 0,01$ / as well as milk quantity / $P \leq 0,01$ /. A similar tendency in the bovine mammary gland reaction to the synthetic oxytocin injected i.v. was described by Donker /1958/, Morag /1968/ and Graf /1970/. All these authors agreed that a higher dose of the hormone causes a shortening of the "latent period", while the period of milk flow prolongs and the milk yield increases.

The results obtained in the present work indicated that the breed of cows exerts a significant influence on the mammary gland reaction to the synthetic oxytocin. The "latent period" was significantly longer in the Black-and-White cows as compared with that in the Polish Red / $P \leq 0,05$ /. No differences were found in the length of this period between the Red-and-White and Black-and-White cows, or between the Red-and-White and Polish Red cows. The lowest mean value, 31.2 sec, was recorded for the Polish Red cows, 33.2 sec, for the Red-and-White cows, and 36.0 sec, for the Black-and-White breed. The milk flow had a reverse tendency. The lowest value /89.7 sec/ was recorded for the Black-and-White cows, while for the Red-and-White and the Polish Red cows the values were 120.8 and 122.8 sec, respectively. Significant differen-

es were found between the Black-and-White and Red-and-White breeds and highly significant between the Black-and-White and Polish Red reed.No differences in the time of milk flow between the Polish Red and Red-and-White cows were observed.Similarly,the lowest mean milk quantity - 193.8 ml - was obtained in the Black-and-White cows,next 95.8 ml in the Red-and-White cows and 319,0 ml in the Polish Red cows.

able 1. The reaction of the mammary gland to the intravenous injections of synthetic oxytocin in cows of three breeds/mean[±]SE/

Breed	n	Doses of oxytocin I.U./cow	Latent period /sec./	Duration of milk flow /sec/	Milk yield /ml/
Black-and-White	16	0.05	43.5 [±] 3.7 ^a	63.1 [±] 6.5 ^a	107.2 [±] 24.2 ^a
		0.10	35.2 [±] 2.5 ^b	95.9 [±] 8.7 ^b	204.7 [±] 34.6
		0.20	29.4 [±] 1.4 ^b	110.0 [±] 11.5 ^b	269.6 [±] 46.8 ^b
Red-and-White	10	0.05	39.7 [±] 2.1 ^a	88.8 [±] 15.6 ^a	176.4 [±] 50.6 ^a
		0.10	31.8 [±] 0.6 ^b	125.0 [±] 20.0 ^a	310.1 [±] 65.4
		0.20	28.1 [±] 0.8 ^b	148.5 [±] 21.2 ^a	400.8 [±] 66.5 ^b
Polish Red	18	0.05	37.5 [±] 4.1 ^a	92.5 [±] 12.6 ^a	215.8 [±] 43.5 ^a
		0.10	29.6 [±] 1.2 ^b	137.5 [±] 19.0 ^a	350.0 [±] 52.3
		0.20	26.6 [±] 0.9 ^b	138.5 [±] 16.7 ^a	390.6 [±] 55.3 ^b
Total	44	0.05	40.2 [±] 2.2 ^a	81.0 [±] 6.8 ^a	167.4 [±] 23.6 ^a
		0.10	32.1 [±] 1.1 ^b	119.5 [±] 9.7 ^b	288.1 [±] 29.9 ^b
		0.20	28.0 [±] 0.7 ^c	130.4 [±] 9.4 ^b	349.0 [±] 32.7 ^c

^{a, b, c}Significant differences between means /P ≤ 0.05/.

The significance of differences was identical as in the case of milk flow.A detailed analysis concerning the influence of the doses administered on the examined parametres of the mammary gland within the individual breeds is presented in Table 1.In the present experiment the number of animals in particular grups was similar,and they did not differ in respect to the milk yield or age.The respective results are presented in Table 2.Significant differences between the breeds examined occurred in the volume of hand stripping.Highly significant differences were found between the Black-and-White and the Red-and-White and Polish Red breeds.There was no difference between the Red-and-White and Polish Red breeds.The results obtained indicate that

A study was made, using 44 cows from three breeds Black-and-White, Red-and-White and Polish Red. Synthetic oxytocin in doses varying from 0,05 to 0,20 I.U. was administered intravenously. The effects of exogenous oxytocin on milk-ejection were measured by changes in the time from injection to the beginning of milk flow /latent period/, the duration of milk flow, and milk yield. The hormone doses applied proved to have a highly significant influence on the parameters mentioned. With increasing oxytocin to 0,20 I.U. the length of the latent period decreased. The duration of milk flow and milk yields increased with increasing oxytocin dose. The reaction of the mammary gland to the synthetic oxytocin depends on the breed of cows. The lowest reaction was demonstrated in the Black-and-White cows, next in Red-and-White, while the strongest in the Polish Red cows. A relationship between the "reactivity" of the cows mammary gland to the administered oxytocin and the quantity of milk received from hand stripping has been suggested, while the productivity and age of the animals examined did not have any significant effects.

R E S U M E N

Se ha realizado un estudio con 44 vacas de tres razas, Frisona Berrenda en Negro, Berrenda en Colorado y Roja Polaca. Se administró intravenosamente oxitocina sintética en dosis de 0,95 a 0,20 U.I. Los efectos de la oxitocina exógena sobre la secreción láctea se midieron a través de los cambios existentes desde la inyección al comienzo de la lactación (periodo de latencia), la duración de la lactación y la producción de leche. Las dosis hormonales aplicadas demostraron tener una significativa influencia sobre los parámetros mencionados. Aumentando la oxitocina a 0,20 U.I., la longitud del periodo latente disminuyó. La duración del periodo de lactación y de la producción láctea aumentó cuando se incrementó la dosis de toxitocina. La reacción de la glándula mamaria a la oxitocina sintética depende de la raza de la vaca. La menor reacción fue demostrada en el Berrendo y Negro, la siguiente en Berrendo y Colorado mientras que fue más fuerte en las vacas Rojas Polacas. Se ha sugerido una gran relación entre la "reactividad" de la glándula mamaria de las vacas a la oxitocina administrada y la cantidad de leche obtenida mediante ordeño manual, mientras que la productividad y la edad de los animales examinados no tuvieron efectos significativos.

the volume of hand stripping is connected with the differences in the "reactivity" of the mammary gland occurring between the breeds examined. The Black-and-White cows, which a large volume of hand

Table 2. Productivity of the examined cows

Breed of cows	n	Milk yield /kg/	Hand stripping /%/	Lactation ^x
Black-and-White	16 ^a	4.64±0.35 ^a	2.72±0.68 ^a	5.19±0.89 ^a
Red-and-White	10 ^a	5.12±0.27 ^a	1.18±0.36 ^b	3.30±0.51 ^a
Polish Red	18 ^a	4.34±0.25 ^a	0.84±0.12 ^b	3.88±0.79 ^a
Total	44	4.62±0.17	1.60±0.29	4.22±0.47

^x Mean ±SE.

^{a, b} Significant differences between means / $P \leq 0.01$ /.

stripping, were characterized by a considerably smaller "reactivity" of the mammary gland to the intravenously injected synthetic oxytocin. The lowered "reactivity" of the mammary gland to the synthetic oxytocin in these cows indicates that during milking the myoepithelium transfer the milk from the follicles and smaller channels to the larger ones and to the sinus in a small degree, which made it impossible to obtain the whole milk mechanically. On the contrary, the cows with the lowest hand stripping /Polish Red/ demonstrated a considerably higher reactivity of the myoepithelium to the hormone examined / $P \leq 0.01$ /. In the Red-and-White cows, intermediate values in relation to the other two breeds were demonstrated. The results obtained are difficult to interpret since no data concerning this problem could be found in the available literature. It could be assumed that the highly productive dairy breeds cattle /e.g. Black-and-White/ ought to be characterized by a greater reactivity of the myoepithelium cells to injected oxytocin than the cows of dual purpose breeds /e.g. Red-and-White/.

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