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EXAMINATION OF SUCKLING FREQUENCY IN BEEF CATTLE POPULATIONS

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Abstract

This paper was carried out to study the connection between the mother cows (sucklers) and their calves during the lactation period, by examining suckling as a form of maternal behaviour. The daily suckling frequency was observed in two beef populations. We constructed suckling curves from some measured variables. The dam's genotype, the age of cows, the sex of calves, and some environmental agents (e.g. temperature) were tested as factors influencing the suckling frequency of calves. The number of suckling (NSM) increased after the animals woke up, and their (daily) peak was reached in the morning hours. Genotype of the dam significantly affected ($P<0.01$) the suckling frequency, but the age of the dam did not affect it significantly ($P>0.05$). NSM was not affected by the sex of calves and there was a low correlation between the NSM and the weaning weight of calves. The difference between the experimental days was analyzed only in relation to the year or month in both cases ($P<0.01$).

Keywords: animal behaviour, suckling frequency, beef cows and calves, Hereford, Red Angus.

A szopási gyakoriság vizsgálata húsmarha populációkban

Összefoglalás

Jelen közlemény a húshasznú anyatehén, illetve a borjú közötti kapcsolatot vizsgálja a laktáció alatt, a szopás tényén keresztül, amely az anyai magatartásformák egyik fő formája. A szerzők a szopási gyakoriság napszakos változását két húsmarha-állományban vizsgálták. A szopási gyakoriságra ható tényezők közül számos vizsgálatra került. Ilyenek - többek között - a tehén genotípusa és kora, a borjú ivara, valamint további környezeti tényezők (pl. hőmérséklet). A szopások száma rohamosan növekedett miután az állatok felkeltek és a napi csúcsot még a reggeli órákban elérte. A tehén genotípusa szignifikáns mértékben ($P<0,01$) befolyásolta a szopási gyakoriság értékét, a tehén kora ugyanakkor nem volt szignifikáns hatású a mért változóra nézve ($P>0,05$). A szopások napi számát nem befolyásolta a borjú ivara és csekély összefüggés mutatkozott a napi szopásszám, illetve a választási súly között. A kísérleti napok között csak éves, illetve havi viszonylatban mutatkozott szignifikáns különbség ($P<0,01$).

Kulcsszavak: állatok viselkedése, szopási gyakoriság, hústehén és borjú, hereford, red angus.

Introduction

It is reasonable to assume that knowledge of suckling behaviour contributes to optimal management of beef cattle. However there is little information about suckling behaviour of beef cattle breeds and about those effects which are related to the suckling frequency. The differences in suckling behaviour seem to be produced by a complex combination of genetic and environmental factors, which result in a particular behavioural relationship between mother and offspring pairs. The aim of this study is to analyze the daily pattern of suckling according to various parameters of the animals (e.g. breed, age, gender, etc.) and their environment (e.g. date, temperature, etc.). This study was conducted at two locations.

Review of relevant literature

In beef cattle production there is great importance attached to calf-rearing ability, this ability affects the benefit of these branches. The index of this ability is the weaning weight corrected to 205 days, and its heritability is moderate (h^2=0.30-0.35). The genetic influence can be divided into two parts: the additive genetic effect, and the maternal genetic effect. The second one means the influence of mother's genotype on the maternal traits. This affects the vitality and growth of calves (e.g.: easy calving, milking ability) (*Cameron*, 1997). Consequently, environmental factors comprise a total of 60-70 % of the phenotypic variance. The environmental effects were also separated into two parts. Maternal effect origins from environment and other environmental effects. It is well known that we understand the maternal (permanent) effect origins from environment, which inherit from year to year, and from calving to calving by beef cows (*Lengyel*, 2005). Some traits to be ranked here by the authors are nursing of newborn calves, the possibility of suckling to own calf, protection of calf, and the part of cows' milking ability as influenced by the environment. *Kovács* (2005) published that those complex forms of behaviour, which are in relation to suckling comprise 2-7 % of the phenotypic variance of weaning weight.

According to the references the grazing period depends on the yield of the grass. If the pasture stays in good state the cows graze periods are 4-5 per a day. In the late summer and autumn the number of periods decrease but the grazing time is longer inside each period. The grazing activity is strong in the early morning and during the evening hours. This grazing habit is very important in respect of calves, because they have only a chance to suckle their mother during the break in grazing (*Márton*, 2003).

Other authors published, that the suckling frequencies of calves rise after driving, during the midday rest and evening hours (*Czakó*, 1978).

Usually, the newborn calves suckle 5-7 times per day (*Hafez* and *Lineweaver*, 1968). The number of suckling decreased in relation with age, but beef calves suckled more because the milkmass of cows

decreased during lactation (*Hafez*, 1975). According to *Houpt* and *Wolski* (1982) the beef calves suckled 3-5 occasions per day till weaning.

The most frequent suckling period is at dawn, but following periods separated between 9.00-11.00; 15.00-18.00 and 22.30-01.00 (*Walker*, 1962). Others described that the number of suckling take place during daylight to a large extent (*Shake* and *Riggs*, 1969). *Enyedi* and *Szuromi* (1991) separated 5 suckling periods during day-time and one more typical period during night from each other in summer. The suckling frequencies were in the highest proportion at midnight and after 5.00 a.m. in the morning, when more of the 50 percent of calves suckled.

Vandenheede et al. (2001) examined the relationship between the calf and cow after the Caesarean section and they established that the maternal behaviour was influenced by the parity of cows. The first calvers seem to be poor at nursing, compared to the oldest ones. In the first experiment we found the first calvers suckling more, but allosuckling was also observed in that group. Alien calves should suck to first calvers, that these cows not sure the best for nursing. According to *Stookey* (1997) if the cows allow all of the calves to suckle them, only the oldest calves would survive the lactation period.

According to *Lidfors* and *Jensen* (2003) calf-cow pairs spent more time together if the calf was female and if the weaning weight was smaller.

M. José et al. (2006) three behavioural traits were considered: number of suckling (NSM), duration of each suckling (DSM) and total suckling duration (TSD). Allosuckling was not observed. The calves suckled at any time during the daylight, and the overall means were NSM=2.57±0.05 meals/12 h; DSM=9.25±0.11 min., and TSD=23.76±0.47 min/12 h. There was an effect of dam's breed on NSM and DSM. The age of calf had a significant effect on all traits. Males averaged higher NSM and TSD (2.60±0.03 and 25.05±1.37 min/12 h) respectively.

Materials and methods

Our investigations were done in different parts of the country, at *Balatonfenyves* (Hubertus Ltd.) and at *Mezőfalva* (Agricultural Cooperative) in the years 2002-2003 and 2005.

In *Balatonfenyves* the results of the substitution crossing different genotype (Hereford; Hereford x Red Angus F_1 and R_1) were observed. The experimental groups represent pure blood Hereford cows (n = 12; 11) crossing Hereford x Red Angus F_1 cows (n=12; 11) and crossing Hereford x Red Angus R_1 cows (n=10; 10) with their calves, in 2002 and 2003, respectively. The pure Hereford cows were 5 or more years old, the F_1 cows were 3-5 years old and the R_1 cows were 2-3 years old at the start of experiment (2002). Ethological investigations were done for both years, 5-5 occasions (experimental day) in August. We observed the same cows in 2002 and 2003.

In *Mezőfalva* the researching population contained three different aged dam's group, but the genotype of these cows were similar to each other (Hereford x H. Simental F_1). First calvers were taken to the first group, second calvers were put in to the second group, and the oldest cows were taken to the third group (n=10; 10; 10), respectively. The researching period contained 10 experimental days in two terms (July and August).

On the experimental days, 24 hours long (manual) observation was applied (00.00-24.00.) During this time we observed the realization of suckling in every hour.

The animals were kept in the pasture in both cases. A 2-3 hectares stage to be at their disposal. After the cows grazed the stage completely, they got a new section. For two days before and for two days after changing pasture, the experiment was paused. Usual drinking water and licking-salt were provided for safety, but other nutritional supplements were not given.

The influence of the two main factors (genotype and age) was tested by a nonparametric (Chi-square) test in every interval. Further genetic and environmental effects to the suckling frequency were examined by One and Two Way Analysis of Variance. To clear up the relationship between measured variables linear regression was used. The statistical analysis was done using *Microsoft Excel*, and *SPSS* 11.5 under the *Windows*.

Meteorological data were collected (temperature; air pressure and rainfall) from the Countryside Meteorological Service of *Siófok*.

Results and discussion

The *first figure* shows the suckling frequency in *Balatonfenyves* during a day without treatment. The average of number of suckling (NSM) was 3.06/day.

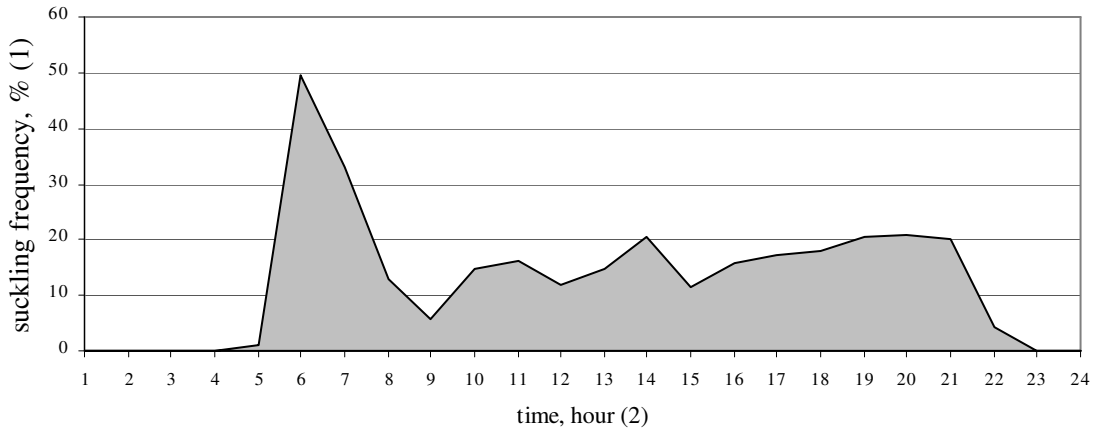

Figure 1: **Change of suckling frequency during a day (n=330/hour), Balatonfenyves**

1. ábra: A szopási gyakoriság napszakos változása Balatonfenyvesen
szopási gyakoriság, %(1); idő, óra(2)

The suckling frequency rose after the animals woke up (5.00), and their (daily) peak was reached between 5.30-6.30 a.m.. After 8.00 a.m. the number of suckling decreased sharply. About at 9.00 a.m. the calves and the cows grazed, uniformly. We registered another two high density suckling between 10.00-11.00 a.m., and 13.00-14.30 p.m. Between 14.30-15.30 we observed a second grazing period with the respect to the cows. After the nadir (around 15.00 p.m.) the suckling frequency increased slowly from 15.30 till at late evening hours (21.00). The ratio of suckling was about 20 % during this duration. The suckling and the grazing were done simultaneously.

We agree with *Walker* (1962), who said that the most frequent suckling period is at dawn, and *Czakó* (1978), who described that the suckling frequency rise after driving, during the midday rest and evening hours. At night no suckling was detected - corresponding to *Shake and Riggs* (1969).

Investigating the suckling frequency with regards to genotype, we got a significant difference ($P<0.01$) (See also the *Table 4*). The Hereford x Red Angus R_1 cows suckled their calves much more (NSM=3.24/day), than the F_1 genotype or pure Hereford (NSM=2.98/day). The shape of suckling curve showed four peaks (R_1), opposite the other two genotypes (three peaks) (*Figure 2*).

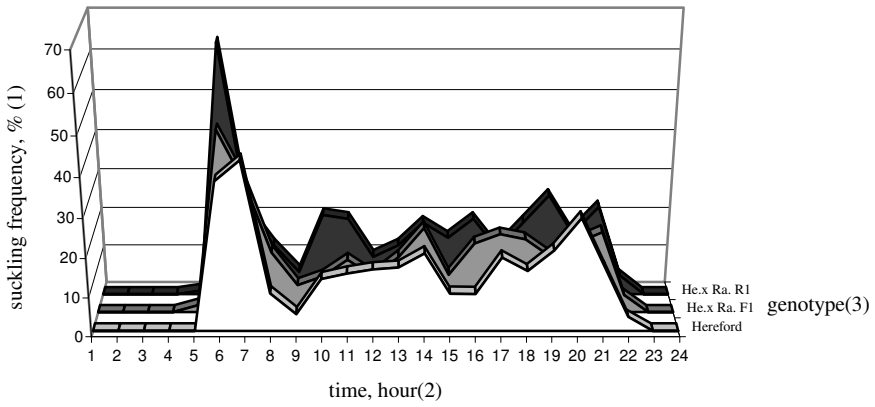

***Figure 2*: Suckling frequency according to genotype, Balatonfenyves -**

2. ábra: A szopási gyakoriság napszakos változása a tehén genotípusa szerint (Balatonfenyves) szopási gyakoriság, %(1), idő, óra(2), genotípus(3)

M. José et al. (2006) also published that dam's breed has an effect on NSM. Because the R_1 genotype were also first calvers, it was difficult to separate the two effects (genotype and age) from each other. Thus we decided that the effect of dam's age should be examine independent from genotype. This purpose was appointed in the second research (*Mezőfalva*). *Table 1* shows that there is no significant difference in NSM due to the different age of the dams.

Table 1: **Influence of dam's age to the daily number of suckling (NSM)**

age of dam(1)	n	$\bar{x} \pm s$	source(5)	sum of squares(9)	df	mean square (10)	F
1st calvers(2)	100	3.72 ± 0,73	age(6)	0.26	2	0.13	0.238
2nd calvers(3)	100	3.74 ± 0,70	error(7)	161.99	297	0.545	P
3rd calvers ≤(4)	100	3.79 ± 0,78	total(8)	162.25	299		0.788

1. táblázat: A tehén korának hatása a szopások napi számára
anya életkora(1), első ellés(2), második ellés(3), 3 vagy többedik ellés(4), forrás(5), életkor(6), hiba(7), összesen(8), négyzetösszeg(9), átlagos négyzet(10)

Respecting the number of suckling we got results similar to the *Houpt* and *Wolski* (1982) who described that the NSM was 3-5/day.

We examined if there is any relationship between the sex of the calves and the suckling frequency. Our results are shown in the *Table 2.*

Table 2**: Influence of the sex of calves to the daily number of suckling (NSM)**

Place(1)	Source(2)	sum of squares(6)	df	mean square(7)	F	P
Balaton-fenyves	sex of calves(3)	0.0097	1	0.0097	0.084	0.773
	error(4)	7.428	64	0.116		
	total(5)	7.438	65			
Mezőfalva	sex of calves(3)	3.333	1	3.333	0.935	0.342
	error(4)	99.867	28	3.567		
	total(5)	103.200	29			

2. táblázat: A borjú ivarának hatása a szopások napi számára
hely(1), forrás(2), borjú ivara(3), hiba(4), összesen(5), négyzetösszeg(6), átlagos négyzet(7)

There wasn't got significant difference between the variables independent from the experimental place. According to *M. José et al.* (2006) bull calves averaged higher NSM. On the other hand, in the *Lidfors* and *Jensen* (2003) study calf-cow pairs spent more time together if the calf was female and if the weaning weight was smaller.

We examined the connection between the suckling number of calves and their weaning weight. The results of linear regressions are shown on the *Table 3*.

Table 3: **Relationship between the weaning weight and the number of suckling (NSM)**

Place(1)	Source(2)	sum of squares(6)	df	mean square(7)	F	P
Balaton-fenyves	Regression(3)	0.315	1	0.315	2.816	0.098
	Error(4)	7.053	63	0.112	R=0.207	
	Total(5)	7.369	64		R^2=0.043	
Mezőfalva	Regression(3)	1.104	1	1.104	0.303	0.587
	Error(4)	102.096	28	3.646	R=0.103	
	Total(5)	103.200	29		R^2=0.011	

3. táblázat: Összefüggés a választási súly és a napi szopásszám között
hely(1), forrás(2), regresszió(3), hiba(4), összesen(5), négyzetösszeg(6), átlagos négyzet(7)

We got a weak and an obscure relationship between the two measured variables independent of the experimental place.

Relationship between meteorological data (mainly the temperature) and suckling frequency also were investigated. We got a significant difference (P<0.01) between the years (2002 and 2003) in *Balatonfenyves* (*Figure 3*) and the months (July and August) in *Mezőfalva* (*Figure 4*).

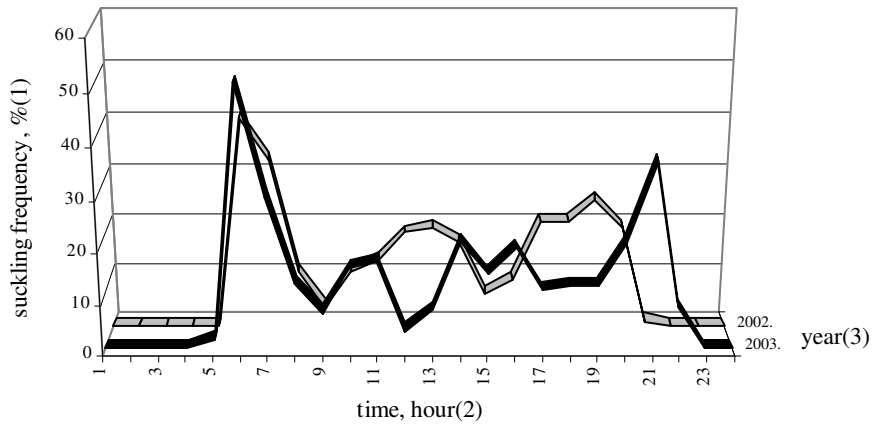

Figure 3: **Change of the suckling frequency according to years, Balatonfenyves**

3. ábra: A szopási gyakoriság napszakos változása kísérleti évek szerint (Balatonfenyves)
szopási gyakoriság(1), idő, óra(2), év(3)

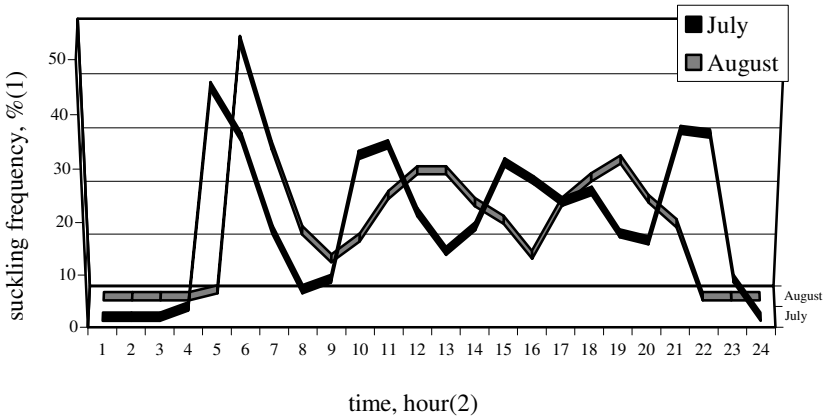

Figure 4: **Change of suckling frequency according to months, Mezőfalva**

4. ábra: A szopási gyakoriság napszakos változása kísérleti hónapok szerint (Mezőfalva)
szopási gyakoriság, %(1), idő, óra(2)

For duration of the experiment the average daily temperature was 20.91ºC in 2002., and 25.17ºC in 2003. The high temperature separated into two parts at the second suckling period about noon, and the number of suckling increased (NSM were 2002=2.91; 2003=3.22).

We made a two-way ANOVA to clear-up is if there was any interaction between the experimental years and the genotype of cows. The result of this analysis is shown on the *Table 4*.

Table 4: **Variance of dam's genotype and the experimental years and their interactions in the NSM**

source(1)	sum of squares(10)	df	mean square(11)	F	P
corrected model(2)	14.772	5	2.954	6.381	0.001
intercept(3)	3097.920	1	3097.920	6690.805	0.001
genotype(4)	4.404	2	2.202	4.756	0.009
year(5)	8.306	1	8.306	17.939	0.001
genotype*year(6)	2.005	2	1.002	2.165	0.116
error(7)	150.016	324	0.463		
total(8)	3256.000	330			
corrected total(9)	164.788	329			

4. táblázat: A tehén genotípus, illetve a kísérleti évek hatása (interakciója) a szopásszámra nézve
*forrás(1), korrigált modell(2), állandó(3), genotípus(4), év(5), genotípus*év(6), hiba(7), összesen(8), korrigált, összesen(9), négyzetösszeg(10), átlagos négyzet(11)*

There wasn't got significant interaction between experimental years and the genotype of cows (P>0.1). Differences between the experimental days were analyzed only in relation to year (*Balatonfenyves*) or month (*Mezőfalva*) in both cases (interaction). But while in *Balatonfenyves* the temperature stayed in the background of differences, in *Mezőfalva* may be the age of the calves was responsible for the significant difference (NSM were July=4.33; August=3.16). The tendency of NSM in relation to the months (*Mezőfalva*) was similar to *Hafez* (1975), who published, that the number of suckling decreased in the respect with age. According to *M. José et al*. (2006) all measured traits (e.g. NSM) were affected by the age of calf. There was not any connection between the change in the daily temperature and the suckling frequency. That means that when we progress to smaller intervals (year/month→day→hour) the decrease in temperature has little direct influence on the suckling frequency. It is strongly probable, that the temperature variable stays in the background. Besides of actual (air) temperature, the intensity of sunshine also plays a role in hot sensation. It is no coincidence that the resting of animals were observed in the early afternoon, but the peak in daily temperature was at 18.00 p.m. (2003=30.5 ºC).

Conclusions

The daily suckling frequency was observed in two beef populations. Number of suckling (NSM) increased after the animals woke up, and their (daily) peak was reached in the morning hours. Smaller peaks were registered about noon and during the evening hours. At night no suckling was detected. In *Balatonfenyves* genotype of the dam significantly affected (P<0.01) the suckling frequency. The background of this phenomenon showed that the more milk - more suckling in respect to the Hereford and Angus. Because of the small interaction between the dam's genotype and their age, we examined the influence of the cows' age, in a separate trial (*Mezőfalva*). According to our results the age of the dam did not affect the suckling frequency significantly (P>0.05). NSM was not affected by the sex of calves and there was a low correlation between the NSM and the weaning weight of the calves. Besides, differences between the experimental days were analyzed only in relation with year (*Balatonfenyves*) or month (*Mezőfalva*) in both cases (P<0.01) (interaction).

It is well known that there are better and worse breeds in the calf rearing, which means not only more or less milk (e.g. Angus - Hereford), but stronger or weaker defenses (e.g. Limousin - Belgian Blue). We should be examining the difference of NSM in the next future.

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