



## SHORT COMMUNICATION

# Growth performance, health and behavioural characteristics of Brown Swiss calves fed a limited amount of acidified whole milk

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### ABSTRACT

The purpose of this study was to compare performances of 27 Brown Swiss calves (13 male, 14 female) fed acidified whole milk (AM) or sweet whole milk (SM) at 8% of birth weight during 35 days. Daily body weight gains of calves that consumed AM were similar to those for calves fed SM. Overall feed efficiency ratio of AM-fed calves was also similar to those of SM-fed calves. Calf faecal consistency score and percent days with scours ( $P<0.01$ ) of calves that consumed AM were significantly lower than those offered SM. Some of the behavioural traits such as frequency of daily meals of milk and total time spent consuming milk of calves consuming AM were significantly ( $P<0.05$ ) higher than those of calves fed SM. On the other hand, number of days that assistance was needed to drink milk from open pail for AM-fed calves was higher ( $P<0.01$ ) than that of calves that consumed SM. The results obtained in this study suggested that feeding AM decreased incidence of scours in young Brown Swiss calves without decreasing growth and feed efficiency.

*Key words:* Brown Swiss calves, Acidified whole milk, Weight gain, Diarrhoea, Behaviour.

### RIASSUNTO

PERFORMANCE PRODUTTIVE, STATO SANITARIO E CARATTERISTICHE COMPORTAMENTALI DI VITELLI DI RAZZA BROWN SWISS ALIMENTATI CON QUANTITÀ LIMITATE DI LATTE INTERO ACIDIFICATO

*Scopo di questo studio è stato quello di confrontare le prestazioni produttive di 27 vitelli (13 maschi e 14 femmine) di razza Brown Swiss, alimentati con latte intero acidificato (AM) o latte intero dolce (SM) in quantità pari all'8% del peso corporeo alla nascita, per un periodo di 35 giorni. L'incremento ponderale giornaliero dei vitelli non si è diversificato tra le due diete. L'efficienza alimentare nell'intero periodo è stata simile nei due gruppi. Il punteggio di consistenza fecale e i giorni con eventi diarroici sono stati significativamente più bassi ( $P<0,01$ ) nei vitelli alimentati con AM rispetto a quelli alimentati con SM. Alcune caratteristiche comportamentali quali la frequenza dei pasti giornalieri di latte e il tempo dedicato alla suzione è stato significativamente più alto nei vitelli alimentati con AM ( $P<0,05$ ). D'altra parte i giorni di assistenza necessari per assumere il latte a secchio scoperto è stata maggiore nei vitelli alimentati con AM ( $P<0,01$ ) rispetto ai vitelli alimentati con SM.*

*I risultati ottenuti in questo studio suggeriscono che l'alimentazione con latte acidificato diminuisce l'insorgenza, nei giovani vitelli di razza Brown Swiss, di eventi diarroici senza diminuire la crescita e l'efficienza alimentare.*

Parole chiave: *Vitelli Brown Swiss, Latte intero acidificato, Incremento ponderale, Diarrea, Comportamento.*

## Introduction

In Turkey as well as in many other countries, milk is an expensive source of feed for calf feeding compared to the calf starter and hay. Milk is also nutritious food for human beings. Therefore, new calf rearing programs that will limit the amount of whole milk offered to calves, and that will promote improved growth performance while being cost effective and simple have to be developed. For this purpose, a calf-rearing program based on limited amounts of acidified whole milk (AM) was developed and tested in this study. AM was used in this calf-rearing program because of its benefits such as lowering incidence of diarrhoea, improvement of the health status of calves, convenience and simplicity of feeding, and the relatively lower labour cost (Jaster *et al.*, 1990; Skrivanova *et al.*, 1990; Toll-Vera and Vera, 1996; Kaya *et al.*, 2000).

The objectives of this study were to compare growth, feed intake and feed efficiency traits, incidence of diarrhoea and behavioural characteristics of Brown Swiss calves fed sweet (regular) whole milk (SM) or AM under the calf feeding scheme.

## Material and methods

Twenty-seven Brown Swiss calves (13 male and 14 female) from cattle herds of the Research Farm of Agricultural College at Atatürk University, Erzurum, Turkey, were allowed to nurse their dams for the first 3 days of life, and were randomly assigned into AM or SM treatment groups. The calves

were housed in the individual hutches that contained feeders and milk-water pails throughout the trial (6 months). The calves received either AM or SM from open pails once a day (8.00 a.m.) at 8% of their birth weights. Amounts of AM and SM were kept constant before weaning at 35 days of age. After cows were milked in the morning, fresh whole milk was immediately brought to the calf building. Then, half of the milk was allocated for use as whole milk (SM), while the other part of the milk was used to produce AM. The AM was prepared by adding formic acid to the whole milk (about pH=6.7), and pH value of the AM dropped to about 4.8.

Two different calf starters were used in this study. Starter I was available from birth to 4 months of age and starter II was offered after 4 months of age. In order to make calves familiar with starter I, it was made available in the feeder from birth. The daily amount of starter offered to calves was limited to 2 kg/head, but the calves were fed hay *ad libitum* during the experiment. Chemical compositions of the feeds used in this study are presented in Table 1.

The body weights were recorded at birth, weaning, 4 and 6 months of ages. Body measurements such as body length, height at withers, heart girth and chest depth were determined at birth and six months of age. Amount of feed consumed by the calves was also measured individually and recorded. Faecal consistency scores for calves were determined daily until weaning as follows: 1=normal (soft-solid consistency, no fluid), 2=soft (semi-solid, mostly solid), 3=runny (semi-solid, mostly fluid),

Table 1. Chemical composition of starter rations and dried hay.

Nutrients		Starter I	Starter II	Hay	Whole Milk	
					Sweet	Acidified
Dry matter (DM)	g/kg	908	890	899	131	128
Crude protein	g/kg DM	183	171	52	35	37
Ether extract	"	28	33	24	38	35
Ash	"	76	75	95	8	7
Crude cellulose	"	93	107	278	-	-
pH		-	-	-	6.7	4.8

4=watery (all fluid) (Larson *et al.*, 1977). Behavioural data were obtained from individual video records of each calf with 5 min. intervals. Number of observation days was 31 days in the pre-weaning period. The behavioural parameters were: 1) total time spent consuming milk, 2) time spent licking the walls of the pen, 3) number of days that assistance was needed to drink milk from open pail, 4) time spent idle and watching surroundings. The behavioural data were collected from days 4 to 35.

Data were analysed statistically as a completely randomised design with treatments in a 2 (diet) x 2 (sex) factorial arrangement. Preliminary statistical analyses demonstrated that the effect of interaction on the traits studied was insignificant ( $P>0.05$ ) for all variables. Therefore, only main effects of the treatment groups were statistically analysed. Since data regarding with average faecal consistency score of the calves were not normally distributed, they were readjusted to normal by using the reciprocal transformation. Then, statistical analysis was performed. Data concerning percent of calf days with scours were processed as categorical data. They were then analysed by Fisher's Exact Test that was one of the chi-square tests. All statistical

tests were carried out by using SPSS statistics package programme (SPSS, 2002).

## Results and discussion

Live weights obtained at various stages of growth of Brown Swiss calves are presented in Table 2. Body weights at birth, weaning, 4 and 6 months of ages of calves assigned to AM and SM groups were not significantly affected by acidification procedure of milk and sex of calves. Similar results were also reported by Kaya *et al.* (2000).

In the pre and post-weaning periods, SM-fed calves gained at a slight faster rate than calves offered AM (Table 2). However, the differences among AM and SM groups were not statistically significant. The finding is in accordance with results of El-Ayouty *et al.* (1991), Frelich *et al.* (1992). Gains in body measurements in a period between birth and 6 months of age are tabulated in Table 2. Calves consuming AM had similar gains in the body measurements as those fed SM.

Feed efficiency values (Table 3) determined at different stages of growth were not significantly influenced by different liquid diets. Sex of the calves also did not have

Table 2. Least squares means with standard deviations for body weights, daily weight gains and gains in body measurements of Brown Swiss calves.

	Whole Milk			Sex	
	Acidified N = 13	Sweet N = 14	S	Male N = 13	Female N = 14
Body weights (kg):					
Birth	35.4 ± 1.4	36.8 ± 1.3	ns	35.6 ± 1.4	36.6 ± 1.3
Weaning	44.1 ± 0.9	45.9 ± 0.8	ns	44.9 ± 0.8	45.1 ± 0.8
4 months of age	82.4 ± 4.0	87.3 ± 3.6	ns	87.3 ± 3.8	82.5 ± 3.7
6 months of age	126.0 ± 6.3	130.8 ± 5.6	ns	133.8 ± 6.0	123.0 ± 5.8
Daily weight gains (kg):					
Birth to weaning	0.224 ± 0.026	0.279 ± 0.023	ns	0.249 ± 0.025	0.255 ± 0.024
Weaning to 4 months of age	0.462 ± 0.044	0.487 ± 0.039	ns	0.510 ± 0.042	0.439 ± 0.41
4 to 6 months of age	0.716 ± 0.055	0.714 ± 0.050	ns	0.763 ± 0.053	0.667 ± 0.052
Birth to 6 months of age	0.501 ± 0.035	0.522 ± 0.031	ns	0.544 ± 0.034	0.479 ± 0.033
Gains in body measurements between birth and 6 months of age (cm):					
Body length	27.8 ± 2.1	29.7 ± 1.9	ns	28.9 ± 2.0	28.7 ± 1.9
Height at withers	21.4 ± 1.4	21.7 ± 1.2	ns	23.1 ± 1.3	20.1 ± 1.3
Heart girth	41.8 ± 2.2	43.0 ± 2.0	ns	45.1 ± 2.1	39.8 ± 2.0
Chest depth	15.4 ± 1.0	14.6 ± 0.91	ns	15.3 ± 0.9	14.7 ± 0.94

S: significance; ns: non-significant.

Table 3. Least squares means with standard deviations for feed efficiency ratio, average faecal consistency score, calf days with scours and behavioural traits of the calves.

	Whole Milk			Sex	
	Acidified N = 13	Sweet N = 14	S	Male N = 13	Female N = 14
Feed efficiency ratio between:					
Birth and weaning	2.79 ± 0.38	2.48 ± 0.34	ns	2.52 ± 0.37	2.75 ± 0.35
Weaning and 4 months of age	4.36 ± 0.41	4.23 ± 0.36	ns	4.43 ± 0.39	4.16 ± 0.37
4 and 6 months of age	5.45 ± 0.33	5.54 ± 0.29	ns	5.08 ± 0.32	5.91 ± 0.31
Birth and 6 months of age	4.62 ± 0.18	4.46 ± 0.17	ns	4.39 ± 0.18	4.69 ± 0.17
Average faecal consistency score <sup>a</sup> :					
4 to 17 d	1.33 ± 0.02	1.77 ± 0.04	**	1.57 ± 0.07	1.53 ± 0.07
18 to 35 d	1.27 ± 0.04	1.53 ± 0.04	*	1.44 ± 0.04	1.36 ± 0.04
4 to 35 d	1.30 ± 0.03	1.66 ± 0.03	**	1.50 ± 0.03	1.46 ± 0.03
Behavioural traits:					
Total time spent consuming milk (min.)	4.55 ± 0.30	3.49 ± 0.29	*	4.46 ± 0.31	3.59 ± 0.29
Time spent licking the walls of the pen (min.)	1.60 ± 0.13	1.38 ± 0.13	ns	1.42 ± 0.13	1.56 ± 0.13
Number of days needed assistance to drink milk from open pail	21.33 ± 2.07	29.79 ± 1.86	**	27.52 ± 2.00	23.61 ± 1.93
Time spent idle and watching surroundings (min.)	2.23 ± 0.18	1.97 ± 0.18	ns	2.31 ± 0.18	1.89 ± 0.18

S: significance; ns: non-significant; \*:  $P < 0.05$ ; \*\*:  $P < 0.01$ .

<sup>a</sup> 1 = normal (soft-solid consistency, no fluid), 2 = soft (semi-solid, mostly solid).

Feed efficiency ratio = dry matter consumed (kg) / weight gain (kg).

Table 4. Percentages of calves suffered from diarrhoea for 3 days or longer than 3 days (%).

	Percent of calves suffered from diarrhoea for	
	3 days or less than 3 days	longer than 3 days
Between 4th and 17th days of life:		
Calves fed AM	100	0
Calves fed SM	57.1	42.9
Between 18th and 35th days of life:		
Calves fed AM	100	0
Calves fed SM	78.6	21.4

significant influence on the feed efficiency ratios. The results were supported by the findings of El-Ayouty *et al.* (1991), Yanar (1999), Kaya *et al.* (2000).

Calves fed AM exhibited significantly ( $P < 0.01$ ) lower faecal consistency scores than did calves offered SM (Table 3). Percentage of calves that suffered from diarrhoea longer than 3 days from fourth to seventh and from eighteenth to thirty fifth days of the calf's life were significantly ( $P < 0.01$ ) influenced by the feeding of AM (Table 4). The result can be explained by the reduction of pH in the lower alimentary tract of young calves fed acidified milk as reported by Woodford *et al.* (1987). The high acidity might control and lower *Escherichia coli* proliferation (Frelich *et al.*, 1992) and promote lactobacilli growth in the digestive tract (Muller, 1986). Relatively higher acidity of the alimentary tract is likely due to exhibited bacteriostatic influence, thereby reducing the incidence of scours among calves. The finding is also in agreement with results of Toll-Vera and Vera (1996), Vajda and Pastorek (1996).

All of the behavioural traits of calves consuming AM and SM were significantly influenced by AM and SM except for time

spent licking the walls of the pen and time spent idle and watching surroundings (Table 3). Calves fed AM did not drink excessive quantities of the liquid feed at one time, and frequency of daily AM intake was greater than those consumed SM as already reported by Stolpman (1983). Sour taste of the AM did not cause adverse influence on the number of days required for the calves to learn drinking liquid feed from open pail.

### Conclusions

The results of this research suggested that growth, feed intake and feed efficiency characteristics of Brown Swiss calves reared under the new calf feeding program with acidified milk in Turkey were similar, however, occurrence of scours was significantly decreased, leading to improvements in the health status of the calves fed acidified milk.

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