Eastern Turkey is very appropriate for livestock production due to its widely spread pasture and climatic conditions. Dairy cattle raised in this region have special significance compared with other farming. In the dairy farms of the region Brown Swiss is one of the European dairy cattle breeds most commonly raised.

Milk production is a major main source of income for dairy farmers. Also, the price of milk in Turkey is higher than that of calf starter and the other types of concentrate feeds.

Studies conducted in this region by Yanar *et al*[14,15] and other studies carried out in other countries by Ugarte,[10] Winter,[11,12] Yun and Chung[17] and Ogundula[5] demonstrated that dairy calves can be weaned in early age without any adverse effect on their growth. The author has found that Brown Swiss calves raised in the east region of Turkey can be weaned successfully as early as five weeks of age.[15] The amount of milk fed to calves was based upon 8% of their birth weight and the amount was kept constant during the milk feeding period. However, the amount of milk suggested might be further lowered. If the level of milk could be reduced more, the feed cost to farmers would drop and milk consumption for calf raising would decrease. Hence, the profit of dairy farmers would increase considerably.

A study was undertaken to investigate the effect of different levels of milk feeding on the growth, feed efficiency and body measurement of calves raised in Eastern Turkey, and is reported on here.

The effect of levels of milk feeding on the performance of Brown Swiss calves raised in Turkey

R. Aydin, H. Emsen, M. Yanar and N. Tüzemen

Atatürk Universitesi, Ziraat Fakültesi, Zootekni Bölümü, 25240, Erzurum, Turkey

In this study, forty new-born calves from the Brown Swiss cattle herd raised in the Research Farm of the Agricultural College at Atatürk University, Erzurum, Turkey were used. The calves were allocated four levels of milk feeding (given the amount of milk 7, 8, 9 and 10% of birth weight) according to sex.

The calves were housed in a building furnished by individual pens, feeders and water-milk buckets. After the calves were born, they received colostrum for the first three days by suckling their dams. Then, the calves were fed milk by using buckets.

In this research, starter I and II were used before and after 4 months of age respectively. The chemical compositions of starters and dry hay utilised in this project are given in Table 1. The calves were fed individually during the 6 months research period. The quantity of starter I, II and dry hay that remained in feeders were weighed daily and the amount consumed was determined and recorded.

The levels of milk fed by calves were calculated as 7, 8, 9 and 10% of their birth weight. These quantities of milk remained constant in all treatment groups during the

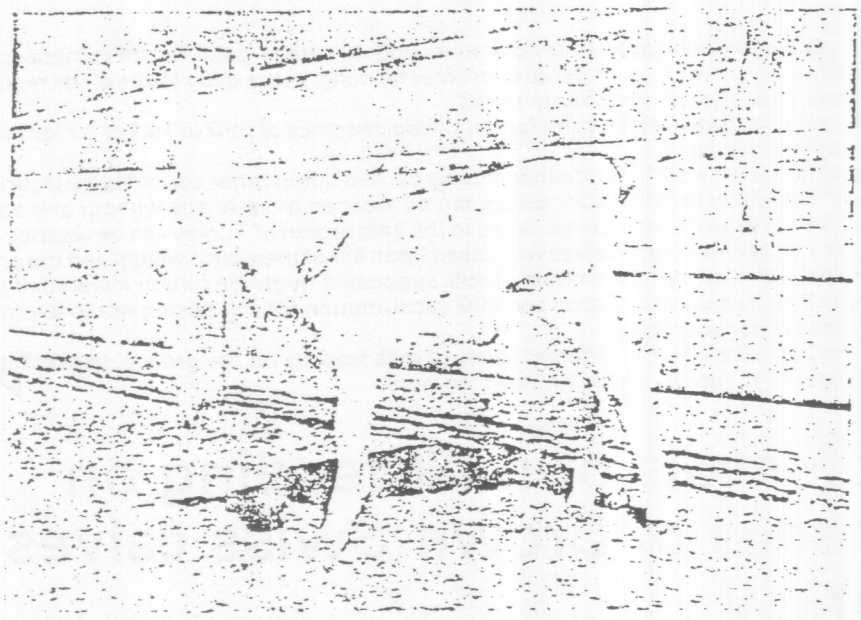
Table 1: Chemical Compsition of Diets

	Milk %	Starter I %	Starter II %	Dry Hay %
Dry Matter	11.5	90.0	90.4	91.0
Crude Protein	3.8	19.6	18.0	6.55
Ether Extract	4.1	5.0	4.46	3.43
Crude Ash	0.8	5.0	9.50	10.37
Crude Cellulose	—	8.6	10.6	28.4
Lactose	2.8	—	—	—
Nitrogen Free Extract	—	51.8	47.84	42.25

Table 2: The Weights, daily gains in weight and feed efficiencies in Calves

	Levels of Milk Feeding					Sex		
	% 7 n = 10 $X \pm S_x$	% 8 n = 10 $X \pm S_x$	% 9 n = 11 $X \pm S_x$	% 10 n = 9 $X \pm S_x$	S	Male n = 23 $X \pm S_x$	Female n = 17 $X \pm S_x$	S
Weights (kg) at								
Birth	38.52 ± 1.58	34.79 ± 1.67	34.45 ± 1.54	45.93 ± 1.73	NS	35.66 ± 1.05	36.18 ± 1.24	NS
Weaning	42.47 ± 1.61	44.38 ± 1.46	43.98 ± 1.37	45.11 ± 1.47	NS	43.75 ± 0.92	44.21 ± 1.07	NS
4 Month	96.75 ± 2.55	98.43 ± 2.54	97.46 ± 2.45	95.87 ± 2.66	NS	97.82 ± 1.65	96.43 ± 1.93	NS
6 Month	122.20 ± 3.96	122.56 ± 3.96	125.36 ± 3.81	122.78 ± 4.14	NS	125.94 ± 2.57	120.51 ± 3.00	NS
Daily Gain in Weight (kg)								
Birth - Weaning	0.155 ± 0.04	0.244 ± 0.03	0.235 ± 0.03	0.268 ± 0.03	NS	0.211 ± 0.02	0.240 ± 0.02	NS
Weaning - 6 Month	0.539 ± 0.02	0.531 ± 0.02	0.562 ± 0.02	0.544 ± 0.02	NS	5.561 ± 0.01	0.527 ± 0.02	NS
Amount of Milk (Kg) Consumed by calves	82.31 ± 1.81[a]	91.36 ± 1.64[b]	102.07 ± 1.54[c]	111.22 ± 1.65[d]	*	97.73 ± 1.03	95.75 ± 1.21	NS
Feed Efficiency[a]								
Before Weaning	6.19 ± 1.12	4.23 ± 1.02	4.91 ± 0.96	4.87 ± 1.02	NS	5.71 ± 0.64	4.39 ± 0.75	NS
After Weaning	6.17 ± 0.30	6.22 ± 0.30	6.08 ± 0.29	6.39 ± 0.32	NS	6.11 ± 0.20	6.31 ± 0.15	NS

S: Significance
NS* Non-Significant
a: Feed Efficiency: Consumed dry mater of feed (kg) / Weight gain (kg)
$X \pm S_x$: Least squares mean ± Standard error of least squares mean
*: ($P<0.05$)



Typical Brown Swiss calf in Turkey

milk feeding period. The calves were weaned at five weeks of age as suggested by Yanar *et al.*[15]

The weights and body measurements were determined at birth, weaning, and 6 months of age of calves. Additionally, the weight of calves were taken at 4 months of age.

The data were analysed statistically by using 4 x 2 compietely randomised factorial experimental design. The ANOVA analysis and Duncan's multiple comparison test was performed by using SAS statistics package programme (SAS[7]).

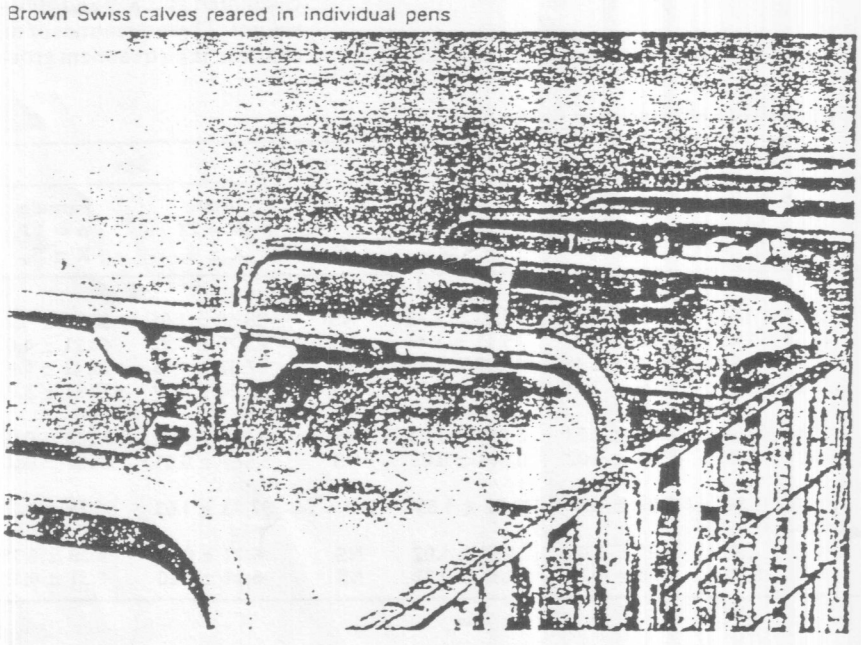
Results and discussion

The least squares mean of weights at birth, weaning, 4 and 6 months of ages are presented in Table 2. The average birth weights of Brown Swiss calves allocated to the levels of milk feeding treatment were not found to be significantly different ($P>0.05$). The data related to average birth weight Brown Swiss calves raised in Turkey are in agreement with results of Sönmez *et al.*[9] Saoaz.[6] Cengiz.[2], Yanar and Ockerman.[13] Yanar *et al.*[16], Cengiz and Ilaslan.[3], Arpacik *et al.*[1] However, sex did not have a statistically significant ($P>0.05$) effect on birth weight.

The weights at weaning, at 4 and 6 months of age, were not influenced significantly ($P>0.05$) by the treatments (Table 2). Similar findings were reported by Sharif and Abu Bakar.[3] who studied the effects of different levels of milk feeding on the growth characteristics of Jersey and LID x Jersey calves raised in Malaysia.

The average daily weight gain before and after weaning was not influenced sig-

Brown Swiss calves reared in individual pens



Mr Aydin

Dr Emsen

Dr Yanar

Dr Tüzemen

Recep Aydin is a research assistant in the department of Animal Science at Atatürk University, Erzurum, Turkey. Dr Halli Emsen has been a full professor at the Atatürk Univesity for five years. Third author, Dr Mete Yanar, was recently appointed as assistant professor in the same university, after he graduated from The Ohio State University, USA. Dr Naci Tüzemen, associated professor, has been working on the cattle breeding area for 14 years.

Table 3: The Body Measurement of Calves

	Levels of Milk Feeding					Sex		
	% 7 n = 10 $X \pm S_x$	% 8 n = 10 $X \pm S_x$	% 9 n = 11 $X \pm S_x$	% 10 n = 9 $X \pm S_x$	S	Male n = 23 $X \pm S_x$	Female n = 17 $X \pm S_x$	S
Body Length (cm) at								
Birth	61.04 ± 0.81	61.52 ± 0.77	62.09 ± 0.75	60.65 ± 0.79	NS	60.75 ± 0.49	61.91 ± 0.58	NS
Weaning	66.67 ± 0.65	66.49 ± 0.66	66.56 ± 0.63	66.60 ± 0.68	NS	66.98 ± 0.43	66.17 ± 0.50	NS
6 Month	89.52 ± 0.73	89.86 ± 0.75	89.52 ± 0.72	89.65 ± 0.77	NS	89.37 ± 0.48	89.90 ± 0.57	NS
Height at withers								
Birth	67.33 ± 0.81	68.97 ± 0.77	68.93 ± 0.76	68.36 ± 0.80	NS	68.19 ± 0.50	68.61 ± 0.58	NS
Weaning	72.22 ± 0.68	72.51 ± 0.68	71.70 ± 0.65	70.68 ± 0.70	NS	71.92 ± 0.44	71.64 ± 0.52	NS
6 Month	87.41 ± 0.67	88.23 ± 0.68	87.85 ± 0.65	87.45 ± 0.70	NS	86.90 ± 0.44	88.57 ± 0.52	*
Chest Depth (cm) at								
Birth	24.31 ± 0.55	24.75 ± 0.52	25.16 ± 0.52	25.14 ± 0.54	NS	24.84 ± 0.34	24.84 ± 0.40	NS
Weaning	27.02 ± 0.53	28.37 ± 0.54	27.25 ± 0.51	27.61 ± 0.55	NS	27.75 ± 0.35	27.37 ± 0.41	NS
6 Month	38.61 ± 0.46	38.33 ± 0.46	37.90 ± 0.44	38.54 ± 0.48	NS	38.29 ± 0.30	38.40 ± 0.35	NS
Hearth Girth								
Birth	71.47 ± 0.54	71.71 ± 0.51	71.64 ± 0.50	71.61 ± 0.53	NS	71.36 ± 0.33	71.85 ± 0.39	NS
Weaning	76.02 ± 0.62	75.52 ± 0.62	75.02 ± 0.59	75.82 ± 0.64	NS	75.39 ± 0.40	75.80 ± 0.47	NS
6 Month	107.96 ± 0.82	107.08 ± 0.83	106.55 ± 0.80	107.62 ± 0.86	NS	107.12 ± 0.54	107.48 ± 0.63	NS

S:Significance
*: P<0.05
NS: Non-Significant
$X \pm S_x$: Least squares mean ± Standard error or least squares mean

nificantly (P>0.05) by the treatments under environmental conditions of Eastern Turkey. Total weight gain in a period between birth to 6 months of age also was not affected by the levels of milk feeding treatment and sexes (Table 2). These results are in agreement with findings of Khouri and Pickering,[4] Sharif and Abu Bakar.[8]

Milk consumed by calves in the different levels of milk feeding (7, 8, 9 and 10%) were 82.31 ± 1.81 kg, 91.36 ± 1.64 kg, 102.07 ± 1.54 kg and 111.22 ± 1.65 kg respectively. The differences among the milk feeding groups were statistically significant (P<p.05) as would be expected (Table 2).

Feed efficiency ratios in the pre and post-weaning periods were not influenced significantly (P>0.05) (Table 2). These findings were supported by results of the reseach carried out by Sharif and Abu Bakar.[8]

Body length, height at withers, heart girth and chest depth were not influenced significantly (P>0.05) by the levels of the milk feeding treatments (Table 3). The results related to body measurements indicate that decreasing the level of milk in a calf raising programme does not affect adversely the skeletal development of Brown Swiss calves.

The overall results of this research suggest that it could be possible to drop the level of the milk feeding from 8, 9 or 10% to 7% of birth weight of Brown Swiss calves raised in Eastern Turkey without causing a detrimental effect on their growth characteristics and feed efficiencies.

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