

EFFECTS OF TWO DIFFERENT ENVIRONMENTAL CONDITIONS ON THE FATTENING PERFORMANCE OF BROWN SWISS BULLS

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SUMMARY: In this study, Brown Swiss Bulls with the initial ages of fattening of either <6-9 months or ≥9-12 months were maintained at two different barn conditions called as adequate (average air temperature of 11.9 ± 2.6 °C and relative humidity of 77.0 ± 2.0 %) or inadequate (average air temperature of 16.0 ± 3.3 °C and relative humidity of 85.5 ± 2.8 %). The bulls were fed a ration made up from 70 % of concentrate and 30 % of roughage (dry hay and wet sugar beet pulp) for 150 days. The results of the research showed that there was a significant ($P < 0.05$) depression in rate of weight gain for the bulls housed under inadequate conditions of the barn compared to adequate conditions. It was also determined that feed conversion ratio was in favour of cattle kept under suitable barn conditions. In addition, negative relationships between average relative humidity values and total weight gains obtained during 14 day periods for unsuitable ($r = -0.50$) and suitable ($r = -0.38$) housing conditions were determined. The findings of the research work confirmed that fattening performance of the Brown Swiss bulls could be significantly improved by providing appropriate atmospheric conditions for barns.

Key words: Cattle, Brown Swiss, Fattening, Environmental conditions, Relative humidity

ESMER TOSUNLARIN BESİ PERFORMANSI ÜZERINE İKİ FARKLI ORTAM ŞARTLARININ ETKİLERİ

ÖZET: Bu çalışmada, besi başı yaşı <6-9, veya ≥ 9-12 ay olan Esmer ırkı tosunlar uygun (11.9 ± 2.6 °C ortalama sıcaklık ve % 77.0 ± 2.0 nisbi nemli) ve uygun olmayan (16.0 ± 3.3 °C sıcaklık ve % 85.5 ± 2.8 nisbi nemli) diye nitelendirilen iki ayrı ahır ortamında tutulmuşlardır. Tosunlara, 150 gün süreyle % 70 oranında kesif yem ve % 30 oranında da kaba yemden (kuru çayır otu ve yaş pancar posası) oluşan bir rasyon yedirilmiştir. Bu çalışmanın sonuçları, uygun olmayan koşullarda besiyeye alınan tosunların canlı ağırlık artışlarında uygun koşullara oranla önemli bir düşme olduğunu göstermiştir. Yemden yararlanma oranının da uygun ahır koşullarında barındırılan sığırların lehine olduğu tesbit edilmiştir. Ayrıca, uygun olmayan ve uygun ortam koşulları için, 14 günlük periyotlarda tesbit edilen ortalama canlı ağırlık artışları ve nisbi nem değerleri arasında sırasıyla ($r = -0.50$) ve ($r = -0.38$) olmak üzere negatif ilişkiler saptanmıştır. Araştırma sonuçları, Esmer tosunların besi performansının uygun ahır içi atmosferik koşulların sağlanması ile önemli derecede artırılabilirliğini göstermiştir.

Anahtar kelimeler: Sığır, Esmer sığır, Besi, Çevre koşulları, Nisbi nem

INTRODUCTION

Climatic conditions of the Eastern Region of Anatolia during winter season are usually too harsh, and the temperature sometimes drops under -20 to -30 °C. It snows heavily, and the cold winter season may prolong by the middle of April. Because of the severe weather conditions, cattle breeders in this region have misconception that the animals must be housed under hot environmental conditions to receive maximum yield. Therefore, all air-inlets and air-outlets are closed tightly in order to keep the temperature high in the barn. This practice results in considerable an increase of the relative humidity and temperature in the barn's air.

The influences of different temperature, relative humidity on the growth and fattening characteristics of cattle were investigated in different countries by several workers (Paine, et al. 1977; Morrison and Lofgreen, 1979; Beer and Sachse, 1980; Kamal et al. 1989). For example, Nelson (1959) noted that growth rates of Shorthorn were relatively poor at 26.7 °C. In another

study, beef cattle whose average final weights were 134 and 256 kg showed respectively a 50 to 20 percent more daily weight gain at 10 °C than 26.7 °C (Anonymous, 1992). This information agrees with the work performed by Morrison and Lofgreen (1979) who found a significant ($P < 0.05$) depression in rate of weight gain and feed intake of Hereford and Hereford x Angus steers at 29.3 °C compared to 20.3 °C. Daily weight gain and daily feed intake values were 1.30 kg and 8.18 kg at 20.3 °C, 1.08 kg and 7.34 kg at 29.3 °C respectively.

Morrison and Prokop (1983) compared beef cattle performance at 21 °C with constant temperatures of 13 and 29°C. Their results indicated that significantly lower daily weight gain (1.08 vs. 1.31 kg) and feed conversion ratio (7.17 vs. 6.57) occurred at the temperature of 29 °C compared to 21 °C. However, there were no significant differences in the rate of weight gain and feed conversion ratio at 13 or 21 °C.

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In Brazil, Lucci et al. (1979) compared growth performance of calves at 5 months of age housed in two different climatic conditions. First group of calves were kept in a chamber with average air temperature of 30 °C at relative humidity of 62.3 to 70.2 %, and other half were housed at a temperature ranging 26.0 to 29.4 °C and 52.3 to 68.3 % of relative humidity for 64 days. The results of the research revealed that there were no significant differences between treatment groups in daily gains and food intake.

Seventeen Friesian calves, aged 3-5 months, were maintained in two selected environmental conditions at 18 °C or 36 °C temperatures with 65 % relative humidity. The high temperature of barn's air had significant adverse effect on the average daily weight gains (0.752 kg vs. 0.500 kg) (Kamal et al., 1989).

There is scarce information about effects of air temperature and relative humidity on daily weight gain and feed conversion ratio of cattle fattened in Eastern Region of Anatolia. In a study carried out in this region, Okuroğlu (1994) noted that relative humidity values in the 94.1 % of the barns in this area was higher than 80 % indicating a common high humidity problem in the closed barns.

This study was undertaken to investigate the effects of the two different housing conditions (adequate and inadequate) on the fattening characteristics of Brown Swiss bulls which were < 6-9 months or ≥9-12 months old.

MATERIAL and METHODS

A total of 32 Brown Swiss young bulls raised in the Research Farm of Agricultural College at Atatürk University were used in the study. The bulls were weighed for three consequent days before fattening. Then, they were kept in two stall barns whose average temperatures and relative humidities were 11.9 ± 2.6 °C, 77.0 ± 2.0 % and 16.0 ± 3.3 °C, 85.5 ± 2.8 % respectively. Animals in the barn were also classified as two age groups according to initial fattening ages. These cattle were fed a ration containing 70 % concentrate and 30 % roughage (dry hay and wet sugar beet pulp). The chemical composition of the concentrate was 88.4 % dry matter, 13.8 % crude protein, 2.5 % ether extract, 4.3 % crude ash, 8.5 % crude cellulose, 59.2 % nitrogen free extract. Dry hay had 91.55 % dry matter, 6.4 % crude protein, 2.6 % ether extract, 8.9 % crude ash, 28.8 % crude cellulose, 44.6 % nitrogen free extract. The wet sugar beet pulp

contained 12.6 % dry matter, 0.12 % crude protein, 1.8 % ether extract, 0.55 % crude ash, 5.3% crude cellulose, 4.8 % nitrogen free extract.

Group-feeding was applied and water was supplied by automatic waterer. Amount of the feed consumed by each groups were determined daily. Bulls were weighed individually at 14 days intervals and the fattening lasted for 150 days. Temperature and relative humidity of the barns were also recorded continuously by using a thermohygrograph.

The differences due to environmental conditions and age treatments were statistically analysed by using 2x2 completely randomised factorial experimental design using the GLM procedures of SAS (1985). Initial fattening weight was also included in the statistical model as a covariate, when final weight, daily and total weight gain were analysed. Since group feeding method was applied in this study, feed conversion ratios were not possible to be compared statistically. In addition, simple correlations were calculated in order to reveal relationships between variables.

RESULTS and DISCUSSION

Data with regard to fattening performance of Brown Swiss cattle housed in different environmental conditions are presented in Table 1. Initial weights of the bulls allocated to the different barns were not statistically different. Average daily and total weight gain of the cattle housed under inadequate environmental conditions (high relative humidity and temperature) were significantly ($P < 0.05$) lower. The bulls kept in the barn with suitable housing conditions possessed 12.1 kg more weight gain than bulls housed in unsuitable environment during the fattening period (Table 1). The results are in agreement with findings of Borodulin and Kadzhrishvili (1975) who stated that daily weight gain of cattle raised under 77.8 % relative humidity was lower compared with animals housed under 71.4 % relative humidity.

Age of bulls at the beginning of the fattening had significant influence ($P < 0.01$) on the initial fattening weight as expected. However, the initial fattening age did not significantly affect on the daily weight gains. The results were in accordance with findings of Yanar et al. (1990) and Tüzemen (1991). The average daily weight gain obtained in the present study was also in agreement with results of Mason (1971), Arpacık et al. (1984) and Ptacek and Suchanek (1986) who reported

a range in daily weight gains of 0.956-1.046 kg, 0.958-1.117 kg, 0.994-1.070 kg respectively.

The correlation coefficients between average relative humidity values and total weight gains obtained 14 days intervals for unsuitable housing conditions revealed that there was negative ($r = -0.50$) but statistically insignificant relationship (Fig. 1). Also, a negative relationship ($r = -0.38$) between these parameters was obtained for bulls housed in satisfactory conditions (Fig.

2). Similar relationship between temperature values and total weight gains were also studied, but correlation values were smaller compared to relative humidity findings. They were $r = -0.11$ and $r = -0.21$ for inadequate and adequate conditions respectively. On the other hand, Paine et al. (1977) indicated that temperature, precipitation and wind were significantly correlated with average daily weight gain of beef cattle fed under feedlot management.

Table 1. Fattening Performance of Brown Swiss Bulls

	Housing Conditions		S	Initial Age of Fattening		S
	Adequate ¹ (N=14)	Inadequate ² (N=18)		< 6-9 Months (N=16)	≥9-12 Months (N=16)	
Initial Weight, (kg)	193.8±8.1	202.1±9.2	NS	163.9±8.6	232.0±8.6	**
Final Weight, (kg)	364.6±10.6 (369.1±4.3) ³	360.8±12.0 (355.1±4.9)	*	324.3±11.3 (365.5±5.7)	401.3±11.3 (358.7±5.7)	NS
Total Weight Gain, (kg)	170.8±4.5 (171.7±4.3)	158.7±5.1 (157.6±4.9)	*	160.3±4.8 (168.1±5.7)	169.3±4.8 (161.2±5.7)	NS
Daily Weight Gain, (kg)	1.11±0.03	1.03±0.03	*	1.04±0.03	1.12±0.03	NS
Feed Conversion Ratio ⁴	8.89	8.26		7.88	9.27	

¹: 11.9±2.6 °C temperature with 77.0±2.0 % relative humidity.

²: 16.0±3.3 °C temperature with 85.5±2.8 % relative humidity.

³: The mean values within the parentheses are adjusted for covariate (initial weight).

⁴: Feed conversion ratio = Dry matter of feed consumed (kg) / Weight gain (kg)

S: Significance, NS: Non-significant, *: P<0.05, **: P<0.01.

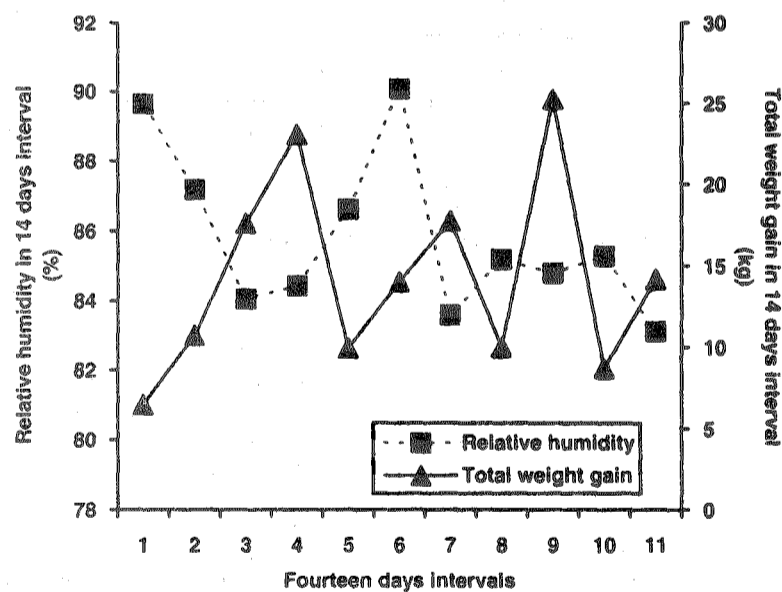


Figure 1. Relative humidity and total weight gains of young bulls housed in the inadequate housing condition at 14 days intervals

Effects of Two Different Environmental Conditions On The Fattening Performance of Brown Swiss Bulls

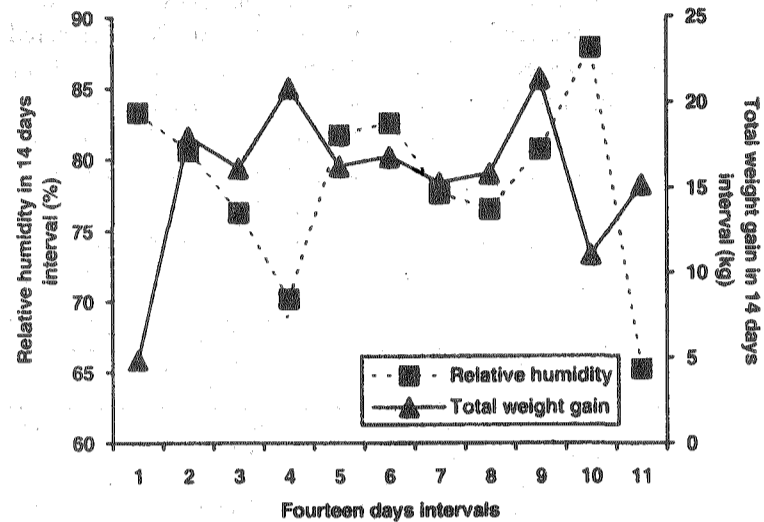


Figure 2. Relative humidity and total weight gains of animals kept in the adequate housing condition at 14 days intervals

The average overall feed consumption (as dry matter) per kg weight gain for the bulls kept in the inappropriate housing conditions were 0.630 kg higher than that of cattle housed under better environmental conditions. The feed conversion ratios of cattle kept under inadequate and adequate barn conditions were 8.89 and 8.26 respectively. Again, the same values for the < 6-9 and \geq 9-12 months age groups were 7.88 and 9.27 respectively. The results concerning the feed conversion values of bulls were in agreement with findings of Kendir et al. (1970) and Mason (1971).

In conclusion, the results of the study revealed that if relative humidity of the barns was lowered by natural ventilation, young Brown Swiss bulls could show considerably better fattening performance.

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