



## RESEARCH ARTICLE

### Comparison of fattening performance of Limousine, Charolais, Angus and Hereford breed bulls

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Received:18.03.2019, Accepted: 03.05.2019

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### Limuzin, Şarole, Angus ve Hereford ırkı boğaların besi performanslarının karşılaştırılması

Eurasian J Vet Sci, 2019, 35, 2, 104-108

DOI: 10.15312/EurasianJVetSci.2019.231

#### Öz

**Amaç:** Bu araştırma, Türkiye'ye ithal edilen Limuzin, Şarole, Angus ve Hereford ırkı danalarının besi performanslarını karşılaştırmak amacıyla yapılmıştır.

**Gereç ve Yöntem:** Hayvan materyali olarak 10-12 aylık yaştaki; Limuzin, Şarole, Angus ve Hereford ırkı olmak üzere toplam 200 erkek besi danası kullanılmıştır. Danalar 24 haftalık besi süresince ad libitum olarak beslenmişlerdir. Besinin ilk 12 haftasında hayvanlara %14.26 Ham proteinli (HP) ve 2637 kcal/kg Metabolik Enerjili (ME) besi geliştirme yemi ve yaklaşık son 12 haftasında ise %14.11 HP ve 2744 kcal/kg ME'li besi bitirme yemi verilmiştir. Besi periyodu çalışmanın 168. gününde (24 hafta) tamamlanmıştır.

**Bulgular:** Canlı ağırlık, büyüme hızı ve yem tüketimi açısından gruplar arasında önemli farklılıklar gözlenmiştir. Besi başlangıcında Şarole'ler en düşük ağırlıkta olmalarına rağmen en yüksek günlük canlı ağırlık artışıyla besi sonunda en yüksek ağırlığa ulaşan ırk olmuştur. Büyüme performansı açısından Şarole ve Hereford' lar arasında benzer bir ilişki gözlenmiştir.

**Öneri:** Bu çalışmayla, Şarole ve Hereford ırkı danaların Türkiye'ye besi için ithal edilmesinin diğerlerinden daha karlı olacağı sonucuna varılabilir. Diğer taraftan, daha doğru sonuçlar almak için, Türkiye'ye ithal edilen sığır ırkları hakkında daha fazla araştırma yapılması gerekmektedir.

**Anahtar kelimeler:** Besi performansı, Limuzin, Şarole, Angus, Hereford

#### Abstract

**Aim:** This research was conducted to compare the fattening performances of Limousine, Charolais, Angus and Hereford breed calves imported to Turkey.

**Materials and Methods:** A total of 200 male fattening calves, aged 10-12 months were used as animal material. The calves were fed ad libitum for 24 weeks of fattening. During the first 12 weeks of fattening, the animals were given fattening development feed with 14.26% crude protein (CP) and 2637 kcal / kg metabolic energy (ME) and in the last 12 weeks, they were given fattening completion feed with 14.11% CP and 2744 kcal / kg ME. The fattening period was completed on the 168th day of the study (24 weeks).

**Results:** Significant differences were observed among groups in terms of live weight, growth rate and feed consumption. Although the Charolais had the lowest weight at the beginning of the fattening, they reached the highest weight gain with the highest daily live weight at the end. A similar relationship was observed between the Charolais and Herefords in terms of growth performance.

**Conclusion:** In this study, it can be concluded that Charolais and Hereford breed calves would be more profitable than others to be imported to Turkey for fattening. On the other hand, to get more accurate results, more research needs to be done about cattle breeds imported to Turkey.

**Keywords:** Fattening performance, Limousine, Charolais, Angus, Hereford.





## Introduction

With the increase of the world population and the development of socio-economic conditions, the need for animal protein, that is the amount of meat consumed per person, has increased. In order to meet the needs of the increasing world population, increasing animal production is among the main targets of the states (Sakarya and Aydın 2011).

According to data from the Statistics Institute of Turkey, the total number of cattle increasing by 13.2% compared to the previous year was 16 million 105 thousand, while the total number of small ruminant increasing by 7.2% was 44 million 312 thousand in 2017 (Anonymous 2018).

Producing the needed animal products in Turkey and creating added value to the economy are among the important and vital issues of recent times. Previously, it was aimed to increase the breeding number of both beef and dairy cattle through the import of pregnant heifer. However, it is seen that sufficient benefit are not provided from these breeding brought to Turkey and the required breeding production is not at an adequate level. Millions of dollars of currency are spent through imports of live animals in Turkey every year. It was decided to import empty heifer and fattening male calf in order to reduce these expenditures, or even if they are not reduced, to import more live animals with the same amount of foreign currency. Especially in recent times, many imports have been carried out for this purpose. 35% of these imports are from Uruguay, 19% are from Brazil and 9% are from the Czech Republic and the majority of them consist of fattening calves (Anonymous 2017). It was observed that the required yield records of imported livestock were not kept and therefore the analyzes were not performed at sufficient levels. Studies on fattening and crossbreeding with culture cattle breeds in Turkey were found to be limited and inadequate.

In order to increase the productivity in animal production, besides the high genetic capacity of the animals, having the environment which will enable the transformation of this genetic potential to yield is required. That is, it is necessary that high-yielding animals are housed under suitable environmental conditions in order to increase the efficiency in livestock (Tilki et al 2013). The aim of this study is to determine the breed appropriate for conditions in Turkey in terms of fattening performance of Limousine, Charolais, Angus and Hereford breed male calves. In the study it is aimed to guide the breeders about which animal breed will provide more profitability.

## Materials and Methods

A total of 200 male fattening calves imported to a private enterprise in Konya in 2017, including 50 Limousine (LI), 50 Charolais (CH), 50 Angus (AN) and 50 Hereford (HE) aged

between 10 and 12 months, with initial fattening weight of 300-350 kg were used in the study. The calves were placed in the paddocks in the open-shed system stables with an area of 8.5 m<sup>2</sup> and 50 cm feed length per animal as 50 heads each. The animals were given protective and anti-parasitic medicine before the study and they were vaccinated against infectious and viral diseases at various periods throughout the study. The fattening calves in each breeding group were fattened with the same ration under the same climate and environmental conditions. Considering the commercial targets, decisions and ongoing practices of the enterprise, the fattening of calves were terminated on the 24th week.

All animals were given Total Mixed Ration (TMR) ad libitum consisting of concentrated feed and roughage. TMR was also composed of corn silage, clover, beet pulp, soybean meal, potatoes, biscuits, straw, corn flakes, cottonseed, sodium bicarbonate and vitamin-mineral mixture. The ration given to the animals was formulated according to NRC (2001). The fattening development feed used in the rations had 14.26% HP and 2637 kcal / kg ME, the fattening completion feed had 14.11% HP and 2744 kcal / kg ME content, and MEs were calculated according to MAFF (1976). Analysis results of the concentrate feed used in the ration were presented (Table 1). TMR application was carried out in 2 meals, morning and evening. The animals were given fattening development ration during the first 12 weeks of fattening and they were given the fattening completion ration in the following 12 weeks. In the study, during the ten-day adaptation period, animals were not given any food overnight and weighed in the morning and the initial fattening weights were determined. Live weights of the animals were determined every 4 weeks and average daily gain (ADG) was calculated. In the first 5 days of each month, the feeds given to the groups and the feeds left in front of the animals in the morning were collected and weighed and thus the daily feed consumption was determined. In addition, feed conversion rates were calculated by using dry matter (DM) consumption and live weight gain values.

Statistical Analysis: The covariance analysis was used to eliminate the weight differences. The statistical method:

$$Y_{ijk} = \mu + IW_j + B_k + E_{ijk}$$

in which  $Y_{ijk}$  = dependent variables;  $\mu$  = average of all observations;  $IW_j$  = effect of the  $j$ -th initial live weight;  $B_k$  = effect of the  $k$ -th cattle breed; and  $E_{ijk}$  = residual random error was used to determine the differences between the groups by eliminating the effects on end-of-fattening weights. Data were analyzed with SPSS 24.0 for Windows. One-way ANOVA (One-Way ANOVA) method was used to evaluate the significance of intergroup differences in terms of analyzed characteristics. Covariance analysis was used where the differences between the experimental groups were significant. The significance of the differences between the groups was accepted as  $p < 0.05$  significant with Duncan's Multiple Range test.



Table 1. Fattening development and fattening completion feed analysis

Ingredients	Growing Ration (g kg <sup>-1</sup> as fed)	Fattening Ration (g kg <sup>-1</sup> as fed)
Dry matter <sup>1</sup>	891.7	887.4
Ash <sup>2</sup>	69.0	65.7
Ether extract <sup>2</sup>	35.9	42.8
Crude protein <sup>2</sup>	142.6	14.11
Crude fiber <sup>2</sup>	90.7	57.9
Starch <sup>2</sup>	293.5	293.5
Acid detergent fiber <sup>2</sup>	135.7	73.1
Neutral detergent fiber <sup>2</sup>	265.0	246.9

<sup>1</sup>g kg<sup>-1</sup> as fed.

<sup>2</sup>g kg<sup>-1</sup> dry matter.

## Results

In the study, monthly live weight averages, ADG, daily feed consumption averages and feed conversion rates of the fattening animals were determined until the end of fattening (Table 2).

### Live weight averages

The differences between live weight averages at the beginning of fattening were statistically significant and the initial weight averages of CH breed fattening calves were lowest with 329.2 kg. At the beginning of fattening, LIs were 349.4, ANs were 340.3 and HEs were 341.5 kg ( $P < 0.05$ ). When the final weight averages were examined, although the initial weight of CHs was the lowest, they came first with 590.7 kg at the end of fattening. CHs were followed by HEs with 588.2 kg. Final weights of ANs were 570.5 and of LIs were 561.5 kg. HEs had the same final weight as CH and AN. Final weights of

LIs were the lowest and were similar to ANs ( $P < 0.05$ ).

### Average daily gains

Statistically significant differences were found in terms of ADG calculated for breed groups during fattening ( $P < 0.05$ ). The statistical order of ADG was the same as the final weights. At the end of fattening, the highest ADG was found in CH breed with 1.492 kg. In addition, HEs were listed with 1.477, ANs 1.371 and LI are 1.318 kg / day live weight gain. LIs were found to have the lowest ADG although they showed statistically similar results with ANs.

### Feed consumption and feed conversion rates

Daily feed consumption of LI, CH, AN and HEs were 15.29, 15.39, 15.73 and 16.49 kg, respectively. The highest feed consumption among the groups was seen in HEs. Feed consumption in ANs was found to be statistically similar to the other breeds. Feed consumption of LI and CHs was found to be significantly lower than HEs ( $P < 0.05$ ). There were no significant differences ( $P > 0.05$ ) between the groups in terms of feed conversion rates calculated as 7.93 in LIs, 6.90 in CHs, 7.78 in ANs, and 7.42 kg / kg in HEs.

## Discussion

The study was conducted to compare the fattening performances of four cattle breeds imported to Turkey.

### Live weight averages

Initial weight averages of 10-12 month old calves used in the study were determined. After 24 weeks from the beginning of fattening, cattles were weighed to determine the final weights of fattening.

Table 2. Fattening performances and feed conversion rates of fattening animals

Traits	LI (n=50) X ± Sx	CH (n=50) X̄ ± Sx̄	AN (n=50) X̄ ± Sx̄	HE (n=50) X̄ ± Sx̄	Significance
IW* (kg)	349.4 ± 5.5 <sup>a</sup>	329.2 ± 2.9 <sup>b</sup>	340.3 ± 4.3 <sup>a</sup>	341.5 ± 3.7 <sup>a</sup>	0.01
FW* (kg)	561.5 ± 5.1 <sup>c</sup>	590.7 ± 5.3 <sup>a</sup>	570.5 ± 5.0 <sup>bc</sup>	588.2 ± 5.1 <sup>ab</sup>	0.00
ADG* (kg/day)	1.318 ± 0.031 <sup>c</sup>	1.492 ± 0.031 <sup>a</sup>	1.371 ± 0.030 <sup>bc</sup>	1.477 ± 0.030 <sup>ab</sup>	0.00
DFC (kg/day)	15.29 ± 0.23 <sup>b</sup>	15.39 ± 0.26 <sup>b</sup>	15.73 ± 0.28 <sup>ab</sup>	16.49 ± 0.40 <sup>a</sup>	0.02
DDMC (kg/day)	9.94 ± 0.15 <sup>b</sup>	10.01 ± 0.17 <sup>b</sup>	10.22 ± 0.18 <sup>ab</sup>	10.72 ± 0.24 <sup>a</sup>	0.02
FCR* (kg/kg)	7.93 ± 0.43	6.90 ± 0.26	7.78 ± 0.31	7.42 ± 0.32	0.14

a, b, c : The differences between the means of groups carrying various letters in the same row are significant ( $P < 0.05$ ).

\* : Corrected averages by applying covariance analysis,

IW : Initial weight, FW: Final weight, ADG: Average daily live weight gain, DFC: Daily feed consumption, DDMC: Daily dry matter consumption, FCR: Feed conversion rates (based on dry matter intake)

LI: Limousine, CH: Charolais, AN: Angus and HE: Hereford





When the initial weight averages and final weight averages of the livestock were examined, initial weights were 349.4 in the LIs, 340.3 in the ANs and 341.5 kg in the HEs. The CH breed started with a lower weight of 329.2 kg than others. In spite of this, CHs were found to be the breed with the maximum weight of 590.7 kg. HEs reached 588.2 and ANs reached 570.5 kg live weight. The breed having the lowest final weight was LI with 561.5 kg. In a study on the comparison of cattle breeds conducted by Chambaz et al (2001), the initial weights for LI, AN and CHs were determined as 321, 342 and 391 kg, respectively. At the end of the fattening period, LI and CHs had high (698 and 744 kg), while ANs had lower final weights (524 kg). Similar to this study, CHs were reported to have the highest final weight compared to LI and ANs. However, contrary to this study, the fattening duration was kept longer to control the intramuscular fat content in *M. longissimus dorsi*. In the study conducted with AN, CH, HE ve SIMs (Simental) in 2006, Bartoň et al (2006) reported that the initial weight was low in CH and HEs (298 and 286 kg) and higher (391 kg) in ANs. In another study carried out with CHs by Bartoň et al (2007), the initial and final weights can be said to be similar to the values in this study (336 and 599 kg). Retallick et al (2013) reported low initial weights (173 kg) and high final weights (615 kg) in ANs.

#### *Average daily gains*

In the study, the average daily weight gain of the breeds was calculated using routinely kept monthly weight records. CHs and HEs gained more weight than ANs and LIs. No significant difference was found between the calculated values for ANs and LIs. When the ADG of the breeds used in this study are examined, ADG of 1.318 kg obtained for LI breed is higher than the values (0.514, 1.069) reported by Aydoğan et al (1997) and Chambaz et al (2001), and the value (1.290) reported by Arıkan and Gökhan (2018) but lower than the values (1.460 and 1.450 kg) reported by Schoeaman (1996).

In the study, 1.492 kg of ADG obtained for CH breed were higher than the values reported by Chambaz et al (2001), and Bartoň et al (2006, 2007), and were similar to the values reported by Chewning et al (1990) in period 1 and the values (1.51 and 1.53 kg) reported by Albertí et al (2008), and lower than the values (1.66 kg) reported by Chewning et al (1990) in period 2 and the values (1.815 kg) reported by Schoeaman (1996). In addition, Bonsembiante et al (1982) reported that CH and SIM hybrids had a higher 200-day live weight and showed more ADG. Dhuyvetter et al (1985) found that the CH crossbreeds showed 60 g more ADG than the LI crossbreeds in the crossbreeding by using CH and LI breed bulls.

ADG obtained for AN breed (1.371 kg) was found to be higher than the value (1.013 kg) reported by Butler et al (1962), the value (1.27 kg) reported by Chewning et al (1990) in period 1, the value (1.360 kg) reported by Chambaz et al (2001),

the value (1.170 kg) reported by Bartoň et al (2006) and the value (1.240 kg) reported by Holló et al (2012) and to be lower than the value (1.480 kg) reported by Chewning et al (1990) in period 2, the value (1.629 kg) reported by Schoeaman (1996), the value (1.970 kg) calculated by Albertí et al (2008) and the value (1.860 kg) reported by Retallick et al (2013) in their studies.

The ADG obtained for HE breed (1.477 kg) was higher than the value (1.067 kg) reported by Butler et al (1962), the values (1.310-1.430 kg) reported by Chewning et al (1990) in period 1 and period 2 and the value (1.315 kg) reported by Bartoň et al (2006) and lower than the value (1.554 kg) reported by Schoeaman (1996).

#### *Feed consumption and feed conversion rates*

Average daily feed consumption (DFC) was calculated in the first 5 days of the months. Feed consumption in HEs was significantly higher than CHs and LIs. It was determined that ANs consumed a similar amount of feed with other breeds. The feed conversion rates (FCR) were examined by taking the dry matter intake into account. All groups showed very similar results in terms of FCR.

The feed conversion rates calculated for the LI breed (7.93 kg / kg) were higher than the values (7.32) reported by Chambaz et al (2001) and the values of the fattening studies on Limousine x Jersey crossbreeds (7.24) reported by Sakarya and Günlü (1996) and the value (6.45) reported by Arıkan and Gökhan (2018).

In the study, the 6.90 kg / kg feed conversion rate calculated for CH breed was found to be lower than the value (7.30) found by Chewning et al (1990) in period 1, the value (7.11) reported by Chambaz et al (2001) and the value (7.32) reported by Bartoň et al (2007), while it was found to be similar to the value reported by Chewning et al (1990) in period 2 and the value of the study on Sharole x Dark crossbreeds (6.70) reported by Sağsöz et al (2005).

The feed conversion rate calculated for the AN breed (7.78 kg / kg) was close to the values (7.81, 7.46) reported by Chewning et al (1990) in period 1 and period 2, and higher than the value (6.16) reported by Chambaz et al (2001) for ANs.

The feed conversion rates (7.42 kg / kg) found in HEs were slightly higher than the values (7.13 - 7.10) reported by Chewning et al (1990) in period 1 and period 2. In the study with castrated HEs and ANs, Butler et al (1962) reported that the feed conversion rates of HEs were slightly better than those of ANs. The fattening performance obtained in the research, live weight averages, ADG, feed consumption and feed conversion rates and the values of the findings during fattening were similar to the values reported in some studi-





es, but were different from some of them. These differences can be caused by different environmental conditions, mainly genotypes, and different care and feeding practices.

### Conclusions

As a result of the analyzes, it was observed that the effect of the breed factor on most of the fattening performance characteristics was significant. The most important cost factors in red meat production in Turkey constitutes fattening material and feed costs. The comparison of fattening calves according to their performance characteristics may increase the ability of the producer to make economic decisions. According to the results of this study, although CH breed calves started fattening with lower weights than the others, they reached the highest live weight with the highest ADG at the end of fattening. Despite non-significant differences, the feed conversion rates were found to be better in CHs. Although CHs obtained the highest results in terms of both final weight and ADG, the fattening performances of HEs showed statistically similar results with CHs. Therefore, if fattening calves is to be imported to Turkey, CH and HE breed male calves may be advisable to consider as a priority. However, to get more accurate results, more research needs to be done about cattle breeds imported to Turkey.

### Acknowledgements

The study was performed in Konya, Turkey and approved by Selcuk University Faculty of Veterinary Medicine Ethics Committee (Protocol No. 2017/55).

This study was summarized from a PhD thesis titled "The Comparison of Fattening Performances and Carcass Features of Limousin, Charolais, Angus and Hereford Male Cattle" by Tamer KAYAR. 1.International Erciyes Agriculture Animal and Food Sciences Conference (AGANFOS-2019) was presented at the international congress and the abstract section was published.

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