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THE EFFECT OF AGE, BIRTH WEIGHT AND MILK SUCTION TIME ON SOME CARCASS CHARACTERISTICS AND LOAD DISTRIBUTION RATIO (LDR): EASTERN ANATOLIAN RED CATTLE EXAMPLE IN TURKEY

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Abstract: The aim of this research is to evaluate the current situation and create a model for some countries involved in animal production. Eastern Anatolian Red (EAR) breed that adapts to arid and barren areas has been raised in Turkey. The experimental animals comprised 31 head of EAR cows of different ages, fed on pastures and in the barn. This study determined the effects of age, birth weight and suction time on carcass characteristics of EAR cows. The animals were divided into 6 groups based on birth weight, 4 groups based on age and 6 groups based on milk suction time. They were reared under a conventional system that was based on grazing during summer and a semi-intensive system during winter. Carcass length, fat thickness over longissimus dorsi, marbling score, and LDR were significantly ($P< 0.05$) affected by age group. Significant ($P< 0.05$) differences were noted for carcass length, fat thickness over LD, and marbling score among animals with different birth weights. The milk suction time had a significant ($P< 0.05$) effect on all the parameters measured. In this research, the 4th age group was seen advantageous based on carcass characteristics and LDR and resembled other groups. As indicated in the study, the carcass characteristic output from the 2nd birth weight group shows that carcass length was a far more important output than other carcass portions or carcass quality parameters. Similarly, the 1st group based on milk suction time came to the forefront for some carcass characteristic, although it indicated partial similarity with other groups.

Key words: meat production, carcass characteristics, domestic cow, Eastern Anatolian Red, rearing style.

Introduction

The suitability and low cost of materials such as animals, feeds and labor to procure a profitable and sustainable yield from available sources can be of

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extensive potential contribution to livestock production enterprises. Most mixed production enterprises exploit the multipurpose use of domestic and mixed breeds for low risk, cost and labor (VanRaden and Sanders, 2003). The cows that are not intended to benefit from themselves except for milk and calf have been considered as materials that can be used directly in meat production or as the breeding material in meat production improvement in recent years (Scholtz and Theunissen, 2010). The existence of cows adapted to extensive conditions is a significant revenue source for farms practising mixed rearing as these animals are quickly sold due to the reasonable market prices. Indigenous cattle diversity is the most important resource of life conditions in rural Turkey. Even if there are the indigenous cattle breeds over the country, they are mostly concentrated in high settlements, steep lands, marginal areas, and low-quality pastures. Eastern Anatolian Red (EAR) breed in the eastern region mainly consists of widely medium-small body size, adapted to marginal areas, dark red color, horned, of harsh temperament, abstemious character (Yüksel et al., 2011) and deep-rooted past (Ozdemir and Dogru, 2009). There are considerable exploitable variation and normal fertility in reproductive performance in EAR cattle. Reproductive failure was often reported to be a significant cost (Arnot et al., 2015). Özlütürk et al. (2004) have stated that the EAR cattle also show superior characteristics (e.g. fertility and ease of birth) compared to some exotic cattle. Despite the smaller body size, they have shown phenotypic progress as for the disease and pests (Yüksel et al., 2011). The relationship between birth weight and calf loss was studied by Özlütürk et al. (2007), who stated that it could be high until being the one-year-old in the enterprise. Another issue that needs attention, similarly to the relationship between birth weight and living performance, is productiveness, based on the relationship between living resistance and intake milk amount. An issue that needs attention is based on the relationship between birth weight, milk suction time, cow age and carcass characteristics. The decision about this unique issue is quoted, not to diminish the general importance of intensive rearing and exotic cows in most developing regions, but simply to highlight the need to closely examine how and why farmers use their indigenous animals while deciding on the rearing method or production objectives in any given situation.

The overall objective of this research was to identify the most appropriate evaluation possibilities for indigenous EAR cows. As this breed differs with from other breeds, characteristics may respond differently to environmental factors. The potential use of the EAR breed in meat production was identified under certain rearing conditions in eastern Turkey. The goal was to determine the effect of cow age, birth weight and milk suction time for carcass characteristics and LDR. Thus, creating a model between breeders and EAR breeding, will improve public opinion and environmental sensitivity.

Material and Methods

The experimental animal materials comprised 31 head of EAR cows of different ages, produced by the Eastern Anatolian Agricultural Research Institute (EAARI). These animals were reared in two individual facilities at the EAARI. The calves born in the enterprise were fed milk, hay, and concentrate for six months. Starting from the 6th month of age, all animals were fed in a semi-intensive production system until being one-year-old. Then, animals were fed on meadow hay, alfalfa hay, wheat straw, concentrate (Table 1) in closed barns from November to April, and by grazing (Table 1) in pastures from May to October.

Table 1. The chemical composition of feeds (DM basis).

Feeds	DM %	CP %	EE %	Ash%	ADF %	NDF %
			Winter period			
Alfalfa hay	90.66	19.61	2.13	9.53	31.06	41.10
Meadow hay	92.26	10.13	2.10	8.90	39.55	62.40
Wheat straw	91.23	3.53	1.48	8.43	50.10	67.75
Concentrate	88.25	12.45	3.1	7.00	-	-
			Summer period			
PM	23.6	19.06	3.96	11.13	24.20	37.40

DM: dry matter; CP: crude protein; ME: metabolizable energy; CA: crude ash; ADF: acid detergent fiber NDF: neutral detergent fiber, EE: ether extract, PM: pasture mix (Agropyron cristatum, Trifolium repens, Dactylis glomerata).

According to the traditional rearing model, the animals were fed ad libitum in the winter period and by grazing in summer. The cows were transported over a distance of 4 km to the slaughterhouse, where they were kept in the paddock with free access to water. After four hours of resting, animals were slaughtered by industrial standards. Hot carcass weight was determined, and carcasses were divided into half-carcasses by cutting according to the standard criteria guided by the USDA (1989). The load distribution ratio (LDR) among groups or the general herd was determined according to the load rate of each individual in the group. For this process, our model was used by evaluating the relevant parameters, as follows.

$$LDR = \left(\frac{Xi}{\Sigma\, X1+X2\ldots Xn}\right) x\ 100 \quad (1)$$

Xi: i. individual, n: number of the herd

Twenty-four hours post-slaughter, in between two ribs (12th and 13th), measurements were made from right half-sections. Fat thickness over LD, LD area and the marbling score were measured on the longissimus dorsi (LD) muscle (USDA, 1989). The scale used for the marbling evaluation ranged from 1 to 6 (1 =

slight, 2 = small, 3 = modest, 4 = moderate, 5 = slightly abundant, 6 = abundant). Carcass length, round length, and width of the round were measured on the right half-carcass.

Data were processed statistically using SPSS 20.0 version IBM (SPSS, 2015). Within the first category, animals were divided into four groups based on their age: 30–60 month (m) = 1, 61–90 m =2, 91–120 m = 3, and 121–150 m = 4. Within the second category, animals were divided into six groups based on their birth weight: 12–13 kg = 1, 14–15 kg = 2, 16–17 kg = 3, 18–19 kg = 4, 20 –21 kg = 5 and 22–23 kg = 6. As for the third category, animals were divided into six groups based on their milk suction time: 50–60 days (d) = 1, 61–70 d = 2, 71–80 d = 3, 81–90 d = 4, 91–100 d = 5 and 101–110 d = 6. The effects of all categories on carcass length, round length, the width of the round, fat thickness over LD, LD area, marbling score, and LDR were determined by the least-squares method, using the formula:

$$Yijkl = \mu + A_i + B_j + C_k + (AB)_{ij} + (AC)_{ik} + (BC)_{jk} + e_{ijkl} \quad (2)$$

where Y_{ijkl} is the value of the analyzed parameter, μ is the population mean, A_i = the effect of i cow age groups, B_j = the effect of j birth weight groups, C_k = the effect of k milk suction time, $(AB)_{ij}$, $(AC)_{ik}$, and $(BC)_{jk}$ is the interaction and e_{ijkl} is a random error. Differences between means were estimated by the Tukey's test.

Results and discussion

The indicators belonging to some carcass characteristics of EAR cows as affected by different age groups in this study are presented in Table 2. Carcass lengths, comparing all groups, the 3rd and 4th age group scales were characterized better (Table 2). Significant ($P < 0.01$) differences were noted for the older age group. In all groups, the 4th group with 121–150 m (158.7 cm) had the highest carcass length measure – above the general average (151.5 cm). The interaction values among the age, the birth weight and the milk suction time groups were found not significant ($P > 0.05$) statistically. The width of the round and the round length of the age groups are reported in Table 2. Neither width of the round nor round length was affected ($P > 0.05$) by age group differences. Within the current study, the 4th group had a higher round length value (over grand mean) than others, irrespective of statistical evaluation. Similar results were observed in the width of the round.

Fat thickness over LD determined for different age groups varied between age groups. Fat thickness over LD was higher in the 2nd age group. Significant ($P < 0.05$) differences were observed for the highest fat thickness over LD (Table 2). In the 3rd and the 4th age groups, fat thickness over LD tended to display close resemblance, whereas in the 1st age group the lowest value was noted, well below the grand mean.

The area of LD, determined for different age groups, varied between cow age groups. Significant (P > 0.05) differences were not observed (Table 2) for the highest LD area value (47.1 cm^2, group 2).

In this research, significant good variation (P < 0.05) for the marbling score was found among the cow age groups. The 3rd and the 4th groups had the highest values (5.0 and 4.7 points, respectively).

Table 2. Means and standard errors for the carcass value in terms of age groups.

Dependent variable	Grand mean	Age group scales for cows (month)				Sig
		1	2	3	4	
CL (cm)	151.5±1.7	143.1^{b}±3.0	149.1^{ab}±3.74	155.0^{a}±4.1	158.7^{a}±2.7	**
RL (cm)	74.4±1.4	71.0±2.6	72.8±3.1	74.0±3.5	75.9±2.3	ns
WR (cm)	35.8±0.5	35.0±0.8	36.1±1.1	35.6±1.1	36.8±0.8	ns
FTLD (cm)	0.80±0.1	0.49^{c}±0.16	1.05^{a}±0.20	0.84^{b}±0.22	0.83^{b}±0.14	*
LDA (cm^2)	44.7±1.7	41.9±3.1	47.1±3.8	45.3±4.2	44.5±2.87	ns
MS	3.8±0.4	2.6^{c}±0.7	3.0^{b}±0.8	5.0^{a}±0.9	4.7^{a}±0.6	*
LDR (%)	3.2±0.1	2.7^{b}±0.2	3.2^{ab}±0.2	3.3^{ab}±0.2	3.6^{a}±0.2	*

1: cows aged 30–60 months; 2: cows aged 61–90 months; 3: cows aged 91–120 months; 4: cows aged 121–150 months; LD: longissimus dorsi; Sig: significant; **: P < 0.01; *: P < 0.05: ns: not significant; a–c: different letters represent values on the same line that are statistically different; CL: carcass length, RL: round length, WR: width of the round, FTLD: fat thickness over longissimus dorsi, LDA: longissimus dorsi area, MS: marbling score; LDR: load distribution ratio, load distribution rate among cow age groups in terms of hot carcass weight.

The effect of cow age groups on LDR is reported in Table 2. The grand mean in the present study amounted to 3.2%, and cow age groups ratios ranged between 2.7% and 3.6% (P > 0.05).

Based on birth weight and milk suction time (Tables 3 and 4), highly significant differences (P<0.01) were observed among the groups. The lowest carcass lengths were determined for birth weight groups and milk suction time groups, 143 cm, and 132 cm, respectively. The highest values for both groups were determined 157 cm and 156.5 cm, respectively. The differences in round length values among groups based on birth weight were not significant. A statistical difference at a level of importance P < 0.05 was found among values of the round length of EAR cows among groups according to milk suction time. The highest average round length (80 cm) was reached by the group with the milk suction time between 50 and 60 d (1st group). The lowest average round length (70.5) was found in the 2nd group with 61–70 d.

It showed an influence of the birth weight and the milk suction time of treatment cows on fat thickness over LD (Tables 3 and 4, respectively). In both

sources of variation, differences in fat thickness over LD among groups were found statistically significant ($P < 0.05$). The highest representation according to birth weight was achieved by the 3rd group, the lowest value was observed in the 6th group. On the other hand, LD area among treatment groups for the milk suction time groups varied significantly ($P < 0.05$). The highest average LD area value (56.5 cm^2) was reached by the 5th group. On the contrary, the lowest average LD area was reached in the 2nd group. The grand mean in the milk suction time group for the LD area was 43.9 cm^2.

Marbling scores differed due to birth weight, and milk suction time (Table 3) and these changes were found to be significant ($P < 0.05$). The highest marbling score in terms of birth weight was reached by the 2nd and 4th groups (5 points each). On the other hand, the 1st and 5th groups had the highest marbling score value in the milk suction time, and the 2nd and 4th groups had the lowest value.

Table 3. Means and standard errors for the carcass value in terms of birth weight.

Dependent variable	Grand mean	Birth weight group scales for cows (kg)						Sig
		1	2	3	4	5	6	
CL (cm)	149.4±2.4	150.6^{b}±5.8	157.0^{a}±7.2	153.5^{ab}±3.0	148.7^{b}±5.0	143.5^{c}±7.2	143.0^{c}±5.8	**
RL (cm)	75.5±2.0	70.3±5.0	78.5±6.1	73.4±2.6	75.5±4.3	70.0±6.1	72.3±5.0	ns
WR (cm)	36.3±0.6	35.6±1.4	38.5±1.7	36.3±0.7	34.5±1.2	36.5±1.7	36.3±1.4	ns
FTLD (cm)	0.7±0.1	0.60^{c}±0.30	0.80^{b}±0.37	1.05^{a}±0.16	0.62^{c}±0.37	0.60^{c}±0.31	0.46^{c}±0.30	*
LDA (cm^2)	44.3±2.4	39.1±5.8	49.2±7.2	44.5±3.0	44.5±5.0	44.7±7.2	44.0±5.8	ns
MS	3.5±0.5	2.0^{d}±1.3	5.0^{a}±1.6	4.1^{b}±0.6	5.0^{a}±1.1	2.0^{d}±1.6	3.0^{c}±1.3	**

1: a birth weight of 12–13 kg; 2: a birth weight of 14–15 kg; 3: a birth weight of 16–17 kg; 4: a birth weight of 18–19 kg; 5: a birth weight of 20–21 kg; 6: a birth weight of 22–23 kg; Sig: significant; **: $P < 0.01$; *: $P < 0.05$: ns: not significant; a–d: different letters represent values on the same line that are statistically different, CL: carcass length, RL: round length, WR: width of the round, FTLD: fat thickness over longissimus dorsi, LDA: longissimus dorsi area, MS: marbling score.

Drennan et al. (2008) reported that correlations of carcass length with carcass meat proportion and carcass value were either not significant or low and negative. In accordance with this finding, the same researchers also reported the same result for live-animal length scores and carcass length. EAR cattle have not been considered to have a body length that would adversely affect meat production, contrary to the statements of Piedrafita et al. (2003). In our study, the interaction of the round length and the width of the round was not observed, most probably, due to breed characteristics and the diet style of treatment cows. Our results are not in agreement with those of Alberti et al. (2008), who found a significant variation between age and breed. On the other hand, Jenkins et al. (1981) have found that variations in the yield of carcass components are related to body size differences, unlike our findings.

Table 4. Means and standard errors for the carcass value in terms of milk suction time.

Dependent variable	Grand mean	Milk suction time group scale for cows						Sig
		1	2	3	4	5	6	
CL (cm)	148.6^{a}±1.8	156.5^{a}±5.3	132.5^{b}±5.3	153.2^{a}±3.7	146.3^{ab}±4.3	156.0^{a}±5.3	147.6^{a}±3.3	**
RL (cm)	74.1±1.7	80.0^{a}±4.9	70.5^{b}±4.9	72.5^{b}±3.4	76.0^{ab}±4.0	74.0^{b}±4.9	72.0^{b}±3.1	*
WR (cm)	35.8±0.6	36.5±1.8	38.0±1.8	36.7±1.3	35.6±1.5	33.0±1.8	35.4±1.1	ns
FTLD (cm)	0.8±0.1	1.6^{a}±0.2	0.7^{b}±0.2	0.9^{b}±0.2	0.4^{c}±0.2	0.8^{b}±0.2	0.6^{c}±0.1	**
LDA (cm^2)	43.9±2.3	49.7^{ab}±6.5	35.0^{b}±6.5	39.6^{ab}±4.6	42.3^{ab}±5.3	56.5^{a}±6.5	40.2^{ab}±4.1	*
MS	3.7±0.6	5.0^{a}±1.6	2.0^{c}±1.6	4.2^{b}±1.1	2.0^{c}±1.3	5.0^{a}±1.6	4.4^{b}±1.0	*

1: the drinking milk for 50–60 days; 2: drinking milk for 61–70 days; 3: drinking milk for 71–80 days; 4: drinking milk for 81–90 days; 5: drinking milk for 91–100 days; 6: drinking milk for 101 – 110 days; LD: longissimus dorsi; Sig: significant; **: $P < 0.01$; *: $P < 0.05$: ns: not significant; a–c: different letters represent values on the same line that are statistically different, CL: carcass length, RL: round length, WR: width of the round, FTLD: fat thickness over longissimus dorsi, LDA: longissimus dorsi area, MS: marbling score.

The fat thickness over LD of the EAR cows in this study was lower than the Serrana de Teruel breed in different physiological periods (Ripoll et al., 2016). A study reported back fat thickness for concentrate with roughage separately (CON) and total mixed ration (TMR) models in Hanwoo steers, 11.95 and 13.95 mm, respectively (Chung et al., 2017). The fat thickness over LD in the study was different from a study of Yüksel et al. (2009), who reported that fat thickness over LD did not differ among control, 4% SBP, 8% sugar beet pulp (SBP). On the other hand, the study was similar to Yüksel et al. (2019), who indicated that the fat thickness over LD differed among treatment groups. Although some researchers (Piedrafita et al., 2003) report that local and hard animals are not suitable for meat production because they make more fat, different results have been obtained in this research. The fat thickness over LD, which is an important indicator of the animal degree of fattening (Drennan et al., 2008), has come close to world standards (Anonymous 1) in this research.

Longissimus dorsi muscle is a high-value section of the beef carcass associated with lean meat content (Nogalski et al., 2013). It is always desirable that the area of this muscle is wide. Yüksel et al. (2019) reported significant differences among treatment groups in the LD area belonging to EAR bulls. However, Yüksel et al. (2012) failed to find a difference between groups including eighteen-month-old EAR bulls considering different feeding styles. The studies of Hanwoo Steers at different yield grades revealed no significant effect of live BW at slaughter on carcass leanness and fatness (Jung et al., 2013). However, according to some studies, the findings in this study were found to be low (Yüksel et al., 2009; Shin et al., 2011).

The marbling score is the strongest sign in many countries (Hocquette et al., 2005), and is also the major factor in the USA quality grade for beef quality attributes (Indurain et al., 2009). In the research carried out by Pacheco et al. (2011), when comparing 2.5-year-old Charolais steers and cull cows, the degree of the marbling score was similar to the 1st age group in our study. Thus, they could be classified as light. Young bulls of lower ages and different styles (Yüksel et al., 2012; Yüksel et al., 2009; Ünlü et al., 2008) had lower values of the marbling score than our results when compared with older cows.

It was observed that the 4th group had the highest load distribution (LDR). Some authors conclude that local animals will not be used for the production of meat (Piedrafita et al., 2003). However, this research indicated the opposite result of this claim. This type of a rearing model has increased profitability in regions with large bumpy areas not suitable for the market place, integrating plants and the intensive system. Animal buying-selling process in such areas requires the live and herd form, not individual. Thus, the weeding of smaller and poor condition animals in the herd will be prevented. Therefore, the high general performance of the herd has great importance in terms of trade. The share of individuals in the total carcass weight of the herd shows the carried load and is of great importance in increasing the general performance of the herd.

The conclusive statistical difference at a level of importance was not found among values of the width of the round among groups according to birth weight and milk suction time. There are some studies specifically intended for some farm animals (Sladek and Mikule, 2017; Mioc et al., 2011). Unfortunately, there is less information on the long-term consequences of carcass measurements related to birth weight for cattle. For this reason, this research is expected to be an infrastructure for researches to be conducted. Greenwood et al. (2006) reported that hot standard carcasses were 30 kg (7.6%) lighter in low compared with high birth weight cattle. Khattak et al. (2018), Koçyiğit et al. (2015) and Kisac et al. (2011) reported that there was linearity between the milk absorption time and the weight gain. Enriquez et al. (2011) stated concerning Reinhardt and Reinhardt (1981) that there was a great individual variation in describing natural weaning in domestic cattle.

Geenwood et al. (2006) stated that fat depth at the P8 (rump) site and dressing percentage did not differ due to birth weight; however, it was 0.4% of live weight greater among low than high birth weight cattle at an equivalent carcass weight. The fat thickness over LD, which is closely related to the different ration content and fattening style (Yüksel et al., 2012), is also related to the physiological period of the animal. This parameter, which is used in determining yield grade, is especially of great importance in carcass quality (Anonymous 1). The fat thickness over LD values of the subgroups (birth weight, milk suction time) within the main factors followed a generally stable course among the groups. In this study, it was

observed that the fat thickness over LD values of the groups were close to world standards (Anonymous 1). The LD area values of the groups determined by birth weight showed differences among the groups. However, it was determined that these differences were not statistically significant.

Salient results of the milk suction time group correspond to the important LD area, i.e., cows with milk suction time between 91 and 100 d reached the highest LD area value (56.5 cm^2) in comparison with cows with other milk suction times. It has been observed that the LD area changes depending on some factors such as fattening time and age (Unlu et al. 2008), but it does not change regarding some factors such as ration content and fattening style (Yüksel et al., 2012; Yüksel et al., 2009). However, there is a need for new researches that will show the direct effect of milk absorption time.

It has been observed that the marbling score values of both birth weight and milk suction time exceeded the grand mean values. A marbling score is the most used element in determining meat quality (Troxel and Gadberry, 2009). Therefore, it is important to know the factors affecting this element in the short term or long term. Greenwood et al. (2006) reported that marble scores did not differ due to birth weight or pre-weaning growth, but differed due to genotypes and ages. It was reported that despite fat content differences, no marbling differences were observed by Guzek et al. (2013). The statistical difference at a level of importance $P < 0.05$ was found in terms of values of the marbling score among different treatment groups according to feeding styles (Yüksel et al., 2012).

Conclusion

Effective production planning entails a comprehensive considering of human need for profitable rearing, a thorough analysis of the feed, animal and labor potential of methods, and an assessment of social life impact (long- and short-term) that may influence local and regional conditions. In many different subzones found in the livestock regions, the sustainable development of EAR breeding may supply many advantages; labor to the essential users of livestock, to local and regional development authorities, government policy makers, and to consumer of meat. The 4^{th} group of cow age groups has several advantageous consequences, both the carcass characteristics and the LDR ratio. In addition, this group will also have the chance of giving at least one calf until the slaughter period. The 2^{nd} group needs to be taken into account as breeders develop policies based on birth weight in the EAR breed. Such policies will also affect the ratio of valuable muscles such as longissimus dorsi, depending on the BL advantage. Based on milk suction time, selection objectives must identify animals that perform well for carcass characteristics at different liquid feeding times and can cope with variation in the feeding program including lower milk. In ongoing and future breeding, greater

emphasis needs to be focused on the utilization of the 3rd group for carcass characteristics and meat production, coupled with lower exploitation of produced milk. The necessity of creating active local rearing models in the world with EAR and similar breeds is felt significantly.

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References

Alberti, P., Panea, B., Sanudo, C., Olleta, J.L., Ripoll, G., Ertbjerg, P., Christensen, M., Gigli, S., Failla, S., Concetti, S., Hocquette, J.F., Jailler, R., Rudel, S., Renand, G., Nute, G.R., Richardson, R.I., & Williams, J.L. (2008). Live weight, body size and carcass characteristics of young bulls of fifteen European breeds. *Livestock Science, 114* (1), 19-30.

Arnot, G., Ferris, C., & O'connell, N. (2015). Developments in dairy cow fertility research. https://pureadmin.qub.ac.uk/ws/portalfiles/portal/127810671/Arnott_et_al._2015b.pdf

Chung, C.S., Cho, W.K., Jang, I.S., Lee, S.S., & Moon, Y.H. (2017). Effects of feeding system on growth performance, plasma biochemical components and hormones, and carcass characteristics in Hanwoo steers. *Asian-Australasian Journal of Animal Science, 30* (8), 1117-1123.

Drennan, M.J., Mcgee, M., & Keane, M.G. (2008). The value of muscular and skeletal scores in the live animal and carcass classification scores as indicators of carcass composition in cattle. *Animal, 2* (5), 752-760.

Enriquez, D., Hötzel, M.J., & Ungerfeld, G. (2011). Minimising the stress of weaning of beef calves: a review. *Acta Veterinaria Scandinavica, 53* (1), 28-31.

Greenwood, P.L., Cafe, L.M., Hearnshaw, H., Hennessy, D.W., Thompson, J.M., & Morris, S.G. (2006). Long-term consequences of birth weight and growth to weaningon carcass, yield and beef quality characteristics of Piedmontese - and Wagyu-sired cattle. *Australian Journal of Experimental Agriculture, 46* (2), 257-269.

Guzek, D.D., Głąbska, G., Pogorzelski, K., Kozan, J., Pietras, M., Konarska, A., Sakowska, K., Glabski, E., Pogorzelska, J., Barszczewski, J., & Wierzbicka, A. (2013). Variation of Meat Quality Parameters Due to Conformation and Fat Class in Limousin Bulls Slaughtered at 25 to 27 Months of Age. *Asian Australasian Journal of Animal Science, 26* (5), 716-722.

Hocquette, J.F., Richardson, R.I., Prache, S., Medale, F., Duffy, G., & Scollan, N.D. (2005). The future trends for research on quality and safety of animal products. *Italian Journal of Animal Science, 4* (3), 49-72.

Indurain, G.T., Carr, R., Goni, M.V., Insausti, K., & Beriain, M.J. (2009). The relationship of carcass measurements to carcass composition and intramuscular fat in Spanish beef. *Meat Science, 82* (2), 155-161.

Jenkins, T.G., Long, C.R., Cartwright, T.C., & Smith, G.C. (1981). Characterization of cattle of five-breed diallel: IV. Slaughter and carcass characteristics of serially slaughtered bulls. *Journal of Animal Science, 53* (1), 62-79.

Jung, S., Nam, K.C., Lee, K.H., Kim, J.J., & Jo, C. (2013). Meat Quality Traits of Longissimus dorsi muscle from carcasses of Hanwoo Steers at different yield grades Korean. *Korean Journal for Food Science of Animal Resources, 33* (3), 305-316.

Khattak, A.H.K., Wasay, A., Ali, T., Iqbal, M., Kalim, K., Hassan, M.F., Mobashar, M., Ahmad, N., Iqbal, A., & Islam, M.N. (2018). Influence of Different Weaning Ages on Growth Performance of Achai Crossed Jersey Calves. *Pakistan Journal* of *Zoology, 50* (6), 2159-2163.

Kisac, P., Broucek, J., & Uhrincat, A.M. (2011). Effect of weaning calves from mother at different ages on their growth and milk yield of mothers Hanus. *Czech Journal of Animal Science, 56* (6), 261-268.

Koçyiğit, R., Aydın, R., Yanar, M., Güler, O., Diler, A., Avcı, M., Özyürek, S., Kabakçı D., & Hirik, E.N. (2015). Effects of Weaning Ages on the Growth, Feed Conversion Efficiency and Some Behavioral Traits of Brown Swiss x Eastern Anatolian Red F1 Calves. *Journal of Agricultural Sciences, 21* (4), 492-499.

Mioc, B., Susi, V., Susic, V., Antunovic, Z.A.Z., Prpic, Z.P.Z., Vnucec, I.V., & Kasap, A. (2011). Study on birth weight and pre-weaning growth of Croatian tudy on birth weight and pre-weaning growth of Croatian multicolored goat kids ulticolored goat kids. *Veterinarski Arhiv, 81* (3), 339-347.

Nogalski, Z., Wronski, M., Wielgosz-Groth, Z., Purwin, P., Sobczuk-Szul, M., & Mochol, M. (2013). The effect of carcass conformation class (EUROP system) on the slaughter quality of young crossbred beef bulls and Holstein-Friesians. *Annals of Animal Science, 13* (1), 23-28.

Ozdemir, M., & Dogru, U. (2009). Determination of Phylogenetic Relationships of Turkish Native Cattle Breeds with Other Cattle Breeds Using Mitochondrial DNA D loop Sequence Polymorphism. *Asian-Australasian Journal of Animal Sciences, 22* (7), 955-961.

Özlütürk, A., Güler, O., Yanar, M., Akbulut, Ö., Tüzemen, N., Kopuzlu, S., Küçüközdemir, A., & Yüksel, S. (2007). Some Environmental Factors Effective on Growth and Development Properties of Eastern Anatolian Red Cattle. *Journal of Tekirdag Agricultural Faculty, 4* (1), 17-26.

Özlütürk, A., Tüzemen, N., Yanar, M., Esenbuga, N., & Dursun, E. (2004). Fattening performance, carcass traits and meat quality characteristics of calves sired by Charolais, Simmental and Eastern Anatolian Red sires mated to Eastern Anatolian Red dams. *Meat Science, 67* (3), 463-470.

Pacheco, P.S., Restle, J., Filho, D.C.A., Brondani, I.L., Pascoal, L.L., Kuss, F., Glasenapp de Menezes, L.F., & Neiva, J.N.M. (2011). Carcass physical composition and meat quality of Charolais cattle of different categories. *Revista Brasileira de Zootecnia*, *40* (11), 2597-2605.

Piedrafita, J., Quintanilla, R., Sanudo, C., Olleta, J.L., Campo, M.M., Panea, B., Renand, G., Turin, G., Jabet, S., & Osoro, K. (2003). Carcass quality of 10 beef cattle breeds of the Southwest of Europe in their typical production systems. *Livestock Production Science, 82* (1), 1-13.

Reinhardt, V., & Reinhardt, A. (1981). Natural sucking performance and age of weaning in zebu cattle (*Bos indicus*). *Journal of Agricultural Science, 96* (2), 309-312.

Ripoll, G., Alberti, P., Alvarez-Rodriguez, J., Blasco, I., & Sanz, A. (2016). Body size, carcass and meat quality of three commercial beef categories of 'Serrana de Teruel' breed. *Spanish Journal of Agricultural Research, 14* (3), 13-17.

Scholtz, M.M., & Theunissen, A. (2010). The use of indigenous cattle in terminal cross-breeding to improve beef cattle production in Sub-Saharan Africa. *Animal Genetic Resources, 46* (4), 33-39.

Shin, S., Heo, J., Yeo, J., Lee, C., & Chung., E. (2011). Genetic association of Phosphodiesterase 1B (PDE1B) with carcass. *Molecular Biology Reports*, *39* (4), 4869-4874.

Sladek, L., & Mikule, V. (2017). An influence of birth weight of piglets on feeding quality and carcass value. *Research In Pig Breeding, 11* (2), 16-21.

SPSS (2015). SPSS for windows. Released 20.0 SPSS Inc., Chicago, IL., USA.

Troxel, T., & Gadberry, S. (2009). Understanding Beef Carcass Information, Agriculture and Natural Resources, FSA3089, University of Arkansas System, https://www.uaex.edu/publications/PDF/FSA-3089.pdf

Unlu, N., Yanar, M., Esenbuga, N., Ozluturk, A., Yüksel, S., & Macit, M. (2008). Effect of days on feed on the performance and carcass characteristics of Eastern Anatolian Red young bulls. *Journal of Applied Animal Research, 34* (2), 163-168.

USDA (1989). Official United States standards for grades of carcass beef. Agricultural Marketing Service (USDA, Washington DC).

VanRaden, P.M., & Sanders, A.H. (2003). Economic merit of crossbred and purebred US dairy cattle. *Journal of Dairy Science, 86* (3), 1036-1044.

Yüksel, S., Yanar, M., Turgut, L., Özlütürk, A., Kopuzlu, S., & Sezgin, E. (2009). Feed efficiency and carcass and meat quality characteristics of bulls finished on diets containing varied proportions of wheat straw and wet sugar beet pulp. *South African Journal of Animal Science, 39* (4), 313-320.

Yüksel, S., Sezgin, E., & Kopuzlu, S. (2011). Some of common features of Eastern Anatolian Red Cattle, its local position and importance as genetic resources. *8 th Global Conference On The Conservation Of Animal Genetic Resources*, (pp. 175-178), Tekirdag, Turkey.

Yüksel, S., Yanar, M., Aksu, M.I., Kopuzlu, S., Kaban, G., Sezgin, E., & Oz, F. (2012). Effects of different finishing systems on carcass traits, fatty acid composition, and beef quality characteristics of young Eastern Anatolian Red bulls. *Tropical Animal Health and Production, 44* (7), 1521-1528.

Yüksel, S., Karaçuhalılar, A., Yüksel, F., & Balta, B. (2019). Effects of Housing Condition, Feeding Style and Age on Meat Colour, and Some Carcass Characteristics in Eastern Anatolian Red Bulls. *Turkish Journal of Agriculture - Food Science and Technology, 7* (5), 750-756.

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UTICAJ STAROSTI, TELESNE MASE NA TELENJU I DUŽINE PERIODA SISANJA MLEKA NA NEKE ODLIKE TRUPA I PREKRIVENOSTI TRUPA LOJEM (PTL): PRIMER ISTOČNOANADOLSKOG CRVENOG GOVEČETA U TURSKOJ

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R e z i m e

Cilj ovog istraživanja je da se proceni trenutna situacija i da se napravi model za neke zemlje koje se bave stočarskom proizvodnjom. Istočnoanadolska crvena (IAC) rasa goveda koja je prilagođena sušnim i neplodnim područjima, uzgaja se u Turskoj. Eksperimentom je obuhvaćeno 31 grlo IAC krava različite starosti, koje su se hranile na pašnjacima i u štali. Ovom studijom su utvrđeni efekti starosti, telesne mase na rođenju i dužine perioda sisanja na karakteristike trupa IAC krava. Životinje su bile podeljene u 6 grupa na osnovu telesne mase na telenju, 4 grupe na osnovu starosti i 6 grupa na osnovu dužine sisanja mleka. Uzgajane su u okviru konvencionalnog sistema, koji se zasniva na ispaši tokom leta i u poluintenzivnom sistemu ishrane tokom zime. Dužina trupa, debljina masnog tkiva preko mišića *longissimus dorsi*, ocena mramoriranosti i PTL bili su značajno uslovljeni starosnom grupom ($P < 0,05$). Značajne ($P < 0,05$) razlike zabeležene su u dužini trupa, debljini masnog tkiva preko mišića LD i oceni mramoriranosti kod životinja sa različitim telesnim masama na telenju. Dužina perioda sisanja mleka pokazala je značajan ($P < 0,05$) uticaj na sve izmerene parametre. U ovom istraživanju videlo se da je četvrta starosna grupa najpovoljnija na osnovu karakteristika trupa i PTL, u odnosu na druge grupe. Ispitivane karakteristike trupa su bile najpovoljnije u okviru druge grupe na osnovu telesne mase na telenju i pokazuje da je dužina trupa daleko važnija od ostalih delova trupa ili parametara kvaliteta trupa. Slično tome, prva grupa zasnovana na dužini perioda sisanja mleka najpovoljnije je uticala na ispitivane osobine kvaliteta trupa, iako je ukazivala na delimičnu sličnost sa drugim grupama.

Ključne reči: proizvodnja mesa, karakteristike trupa, goveda, istočnoanadolsko crveno goveče, sistem gajenja.

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