A comparison of Holstein Friesian, Brown Swiss and Eastern Anatolian Red cattle slaughtered in Turkey for carcass conformation and fatness in SEUROP system

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ABSTRACT: The study was conducted to compare the carcass conformation and fatness of common slaughter cattle breeds in Turkey. A total of 878 carcasses from pure Holstein Friesian (HF, *n* = 381), pure Brown Swiss (BS, *n* = 314) and pure and crosses of Eastern Anatolian Red (EAR, *n* = 183) males that had been slaughtered in a commercial abattoir between 1 October 2000 and 1 October 2001 were evaluated. Carcass conformation and fatness classes were evaluated subjectively using photographic patterns according to the SEUROP classification system. According to the data of this study, HF and BS carcasses were heavier and had a better class in fleshiness than EAR. As carcass weight increased, the conformation and fatness class increased. The BS carcasses (–U) had more than one subclass higher fleshiness than HF (+R) carcasses. Conformation of EAR carcasses (–R) was lower than in HF and BS carcasses. However, the fatness scores of HF and EAR carcasses (9.38 = +3) were 0.25 unit higher than in BS (9.63 = –2). The carcass quality was better in HF and BS than in EAR.

Keywords: SEUROP classification; conformation; fleshiness; fatness; carcass grade

Beef carcasses are classified by visual inspection according to the SEUROP scheme regulated by the European Union in the European Union member and member-candidate countries. The SEUROP scheme defines conformation (shape) and fatness on a scale. There are officially six conformation and five fatness classes in the SEUROP classification system, in addition to which the class can be further divided into three subclasses if needed (EEC, 1991).

This system guarantees independent nationally uniform and objective classification. Conformation is indicated by the letters S,E,U,R,O,P. In order to determine the degree of fleshiness, the carcasses are grouped into 18 different subclasses. The degree of fattening is the second classification criterion applied and is also indicated by a number (1–5). In order to determine the degree of fatness, the carcasses are grouped into 15 different subclasses. The combination of these two criteria produces the final classification. However, in European countries, the base price per kg of carcass is defined for a reference carcass type with regard to fatness and conformation class. The final price per kg of carcass is formed by either giving premiums for better conformation classification or by deductions from the base price for poorer fatness or conformation classification. Some slaughter companies also give an extra premium for crossbred or pure beef breed carcasses. The final price that a farmer gets for a carcass is formed by multiplying the final price per kg of carcass by the carcass weight of the animal (Liinamo, 2000). The classification is carried out by the meat plant's "classifier" – a person trained to grade according to the SEUROP scheme or by a classifier from an independent institution. To maintain and control the common classification system through the Union, a hierarchy of control agents has been set up: An "inspector" from the national classification board visits the slaughterhouse regularly to verify the classifier's grading. In each European member country, the inspectors are controlled by the national chief inspector who in turn meets with chief inspectors from other countries to standardise the common European system (Borggaard *et al*., 1996).

In Turkey, over 96 individual slaughter companies slaughter cattle (OIK, 2001). These companies decide on their own pricing policies for beef carcasses, but in practice, pricing is very similar for all companies. The base price of beef is different for bulls, heifers and cows. But in this pricing system slaughtered animals are not classified by the EEC common system and strict rules are not applied. Neither was any study conducted to determine the conformation and fatness class of common slaughter cattle in Turkey. There is a lack of information on the conformation and fatness class of these cattle. The aim of this study was to determine the conformation and fatness class of Holstein Friesian, Brown Swiss and Eastern Anatolian Red cattle slaughtered at a commercial abattoir in Izmir according to the SEUROP classification system.

MATERIAL AND METHODS

The study was conducted at TANSAS abattoir (which has the largest slaughter capacity of Turkey) in Izmir between 1 October 2000 and 1 October 2001. A total of 878 males from 381 head of pure Holstein Friesian (HF), 314 head of pure Brown Swiss (BS) and 183 head of pure and crosses of Eastern Anatolian Red (EAR) were used. Animals were selected randomly from each herd in abattoir lots. Selected male cattle were fed concentrate supplemented forage diets (straw, beet pulp and maize silage) during the fattening period. After slaughter the skin, head and body organs and non-carcass parts were removed from carcass. The eviscerated carcasses were then halved, carcass weights were measured. The official carcass weight is the measured weight of the warm carcass minus a 2% warm carcass deduction. After 24 h *post mortem*, the left half-carcasses were classified for conformation (scale SEUROP, from S = superior, E = excellent, U = very good, R = good, O = fair to P = poor) and fatness (scale 1–5, from 1 = none or low fat cover, 2 = slight, 3 = average, 4 = high to 5 = entire carcass covered with fat) subjectively using photographic patterns according to the routinely used European Union SEUROP classification system (EEC, 1991). The six classes for conformation and five classes for fatness were divided each into three subclasses +, o, or –. Conformation classes were transformed into numbers so that numbers from 1 to 18 replaced classes from –P to +S. Fatness classes were transformed into numbers so that numbers from 1 to 15 replaced classes from –5 to +1.

Statistical analyses

Data were analysed using the linear model (GLM) procedure of SAS (1985) mixed model least squares and maximum likelihood computer package. The following statistical model was used for the analyses of each parameter.

$$Y_{ij} = \mu + a_i + e_{ij}$$

where: Y_{ij} = individual observation
μ = general mean
a_i = effect of ith breed (i = 1, 2, 3)
e_{ij} = residual error normally distributed with mean 0 and variance σ_e^2

The model was designed to determine the effect of breed on carcass weight, conformation and fatness. Least squares means were calculated for all variables in the study and LSD test was used to determine significance of differences. Pairwise linear correlations were determined within breeds to describe the linear relationships between parameters. Proportional values of conformation and fatness subclasses were also calculated for each breed.

RESULTS

Descriptive statistics for warm carcass weight, carcass conformation and fatness according to breeds are shown in Table 1. The sampled carcasses were highly variable for all traits. The carcass weight ranged from 125.75 kg to 575.35 kg. The average warm carcass weight was 276.80 kg. Warm carcass weight was significantly different between breeds ($P < 0.001$). HF and BS had significantly higher weight carcasses than EAR (297.05 kg and 292.14 vs. 208.32 kg). The average fleshiness of all carcasses was 8.81 between classes R and R+. Thus an average carcass had profiles on the whole straight and good muscle development. BS had one subclass better conformation than HF whereas BS had three subclasses better conformation than EAR. HF, BS and EAR carcasses were classified +R (higher than good; profiles on the whole straight, good muscle development), –U (lower than very good; profiles on the whole convex, very good muscle development), –R (lower than good; profiles on the whole straight, good muscle development) for conformation, respectively. The average fatness of all carcasses was 9.47 (class 2). In class 2, carcasses are slightly fat covered with flesh visible almost everywhere. The

Table 1. Number of observations (*n*), means, standard deviations (SD), minimum (Min) and maximum (Max) values of warm carcass weight, carcass conformation and fatness

Variable		HF	BS	EAR	General
		n = 381	*n* = 314	*n* = 183	*n* = 878
Warm carcass	Mean	297.05[a]	292.14[a]	208.32[b]	276.80
Weight	SD	56.83	50.50	49.24	63.67
	Min	125.75	160.45	126.90	125.75
	Max	575.35	521.20	331.25	575.35
Conformation	Mean	8.96[b]	9.50[a]	7.30[c]	8.81
		(R+)	(R+)	(R–)	(R+)
	SD	1.15	1.07	1.81	1.52
	Min	4.00	5.00	4.00	4.00
		(O–)	(O)	(O–)	(O–)
	Max	12.00	12.00	11.00	12.00
		(U+)	(U–)	(U)	(U+)
Fatness	Mean	9.38[a]	9.63[b]	9.38[a]	9.47
		(3+)	(2–)	(3+)	(2–)
	SD	0.77	1.03	0.79	0.88
	Min	7.00	7.00	7.00	7.00
		(3–)	(3–)	(3–)	(3–)
	Max	12.00	12.00	11.00	12.00
		(2+)	(2+)	(2)	(2+)

[abc]within rows means with different superscripts differ significantly ($P < 0.001$)

fatness scores of HF and EAR carcasses (9.38 = +3) were 0.25 units higher than BS (9.63 = –2).

The frequency distribution of HF, BS and EAR carcasses for warm carcass weight, carcass conformation and fatness class is given in Figure 1 and 2. The majority of the carcasses for HF, BS and EAR fell within the range of 240 to 320 kg, 260 to 320 kg and 140 to 230 kg, respectively (Figure 1). Carcasses

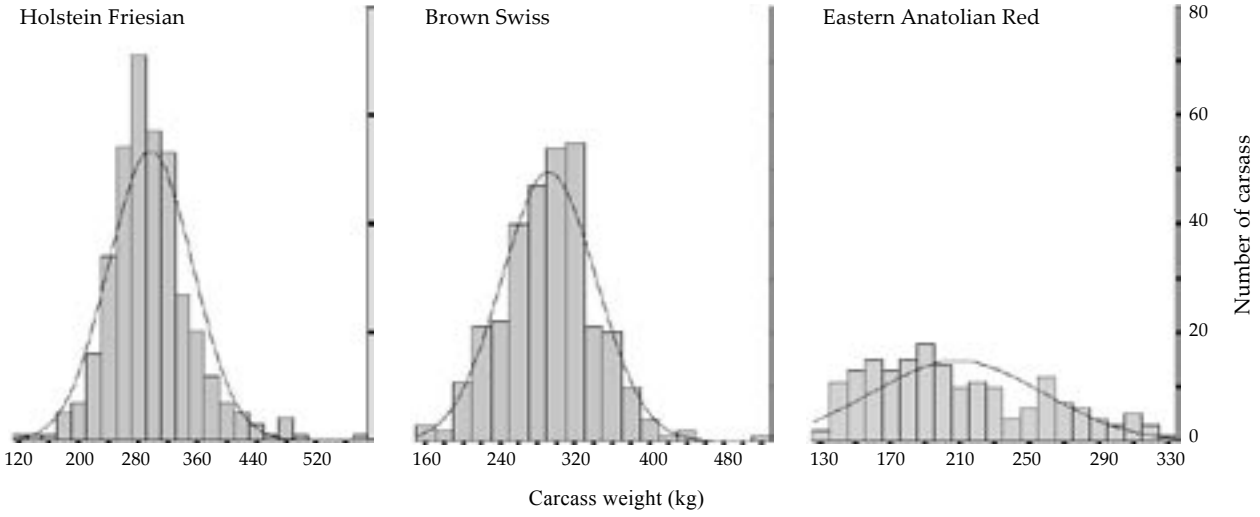

Figure 1. Frequency distribution of warm carcass weight in HF, BS and EAR males

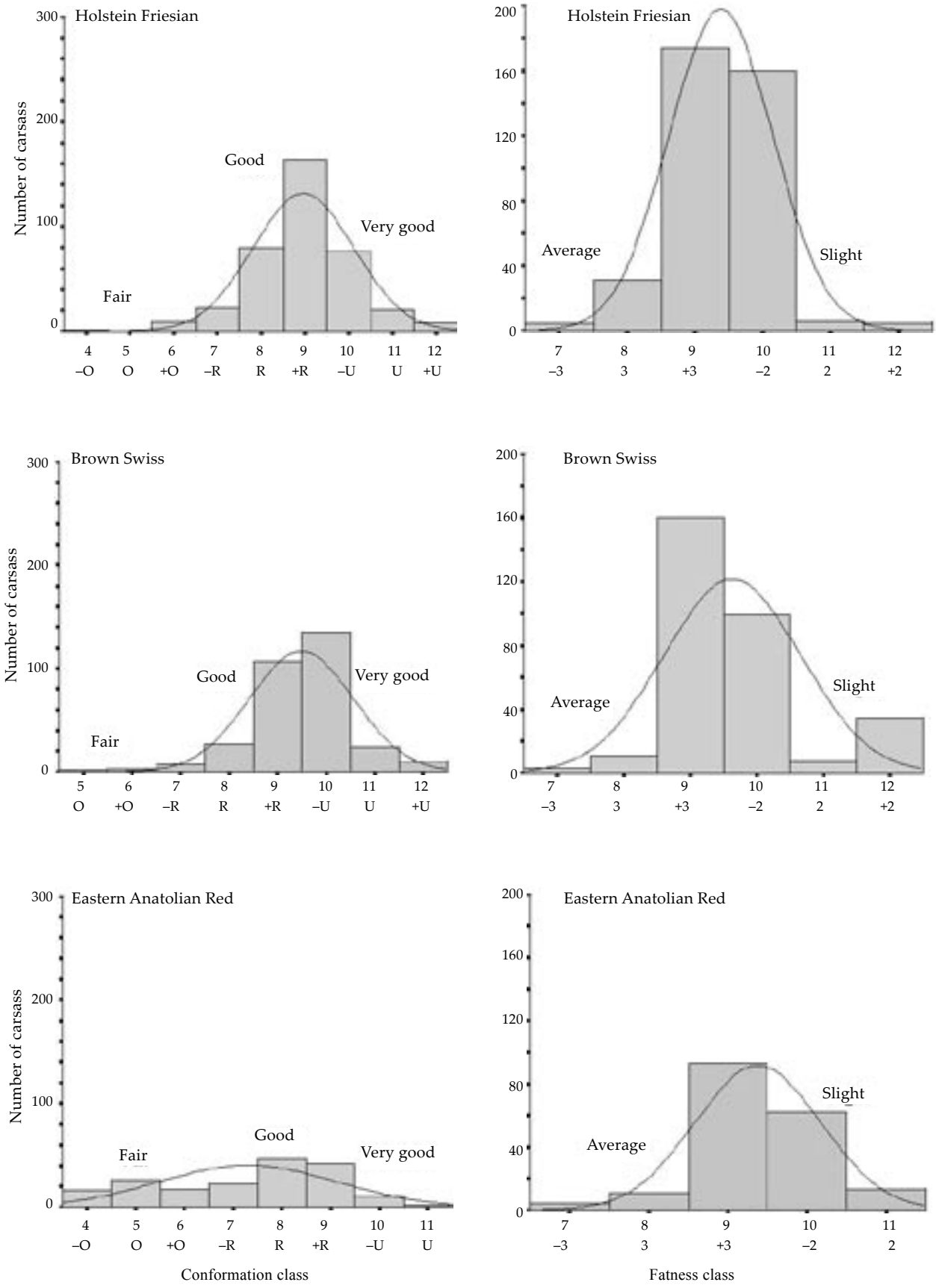

Figure 2. Frequency distribution of SEUROP conformation and fatness classes in HF, BS and EAR males

Table 2. Simple correlations between warm carcass weight, carcass conformation and fatness class

	Warm carcass weight	Conformation	Fatness
HF			
Warm carcass weight		0.61***	0.04
Conformation			0.09
Fatness			
BS			
Warm carcass weight		0.62***	0.22*
Conformation			0.37**
Fatness			
EAR			
Warm carcass weight		0.72***	0.05
Conformation			0.22*
Fatness			

*$P < 0.05$, **$P < 0.01$, ***$P < 0.001$

of HF, BS and EAR were approximately distributed between conformation class of R to –U; +R to –U and O to +R, respectively. Fatness classes for all breeds fell in a very narrow range of 3+ to 2– (Figure 2).

Simple correlations for breeds are presented in Table 2. Warm carcass weight was correlated with conformation (r = 0.61, 0.62, 0.72 for HF, BS and EAR, respectively) and fatness (r = 0.04, 0.22, 0.05 for HF, BS and EAR, respectively), most highly with conformation. Conformation and fatness were also intercorrelated (r = 0.09, 0.37, 0.22 for HF, BS and EAR, respectively). In the present study, conformation and fatness were positively correlated to warm carcass weight, showing that as warm carcass weight increased, conformation and fatness increased.

Proportional values of conformation and fatness classes for each breed are shown in Tables 3 and 4. Carcasses in the –O, O, +O category accounted for 8.4% of the total, whereas carcasses of class –R, R, +R and –U, U, +U accounted for 59% and 32.6% of the total, respectively. The number of carcasses of class –O, O+O was higher in EAR. The highest percentage of carcasses of class –R, R+R occurred in HF (69.8%); the percentage of this class in HF was 9.1% percentage units higher than in EAR

Table 3. Carcass conformation class according to breeds

Breed	% within breed								
	–O	O	+O	–R	R	+R	–U	U	+U
HF	0.3	–	2.4	5.8	21.0	43.0	19.9	5.5	2.1
BS	–	0.6	1.0	2.2	8.6	34.1	42.7	7.6	3.2
EAR	8.7	14.2	9.3	12.0	25.7	23.0	6.0	1.1	–
Total	1.9	3.2	3.3	5.8	17.5	3.56	25.2	5.4	2.1
	–O, O, +O			–R, R, +R			–U, U, +U		
HF	2.6			69.8			27.6		
BS	1.6			44.9			53.5		
EAR	32.2			60.7			7.1		
Total	8.4			59.0			32.6		

Table 4. Carcass fatness class according to breeds

Breed	% within breed					
	–3	3	+3	–2	2	+2
HF	1.3	8.1	45.7	42.0	1.6	1.3
BS	1.0	3.5	51.0	31.5	2.2	10.8
EAR	2.2	6.0	50.8	33.9	7.1	–
Total	1.4	6.0	48.6	36.6	3.0	4.4
	–3, 3, +3			–2, 2, +2		
HF	55.1			44.9		
BS	55.4			44.6		
EAR	59.0			41.0		
Total	56.0			44.0		

and 24.9% percentage units higher than in BS. The highest percentage of carcasses in the class –U, U, +U was in BS (53.5%) and the smallest percentage occurred in EAR (7.1%). A majority of the carcasses had an average fatness class (–3, 3, +3). Carcasses in the fatness class –3, 3+3 accounted for 56% of the total whereas carcasses of fatness class –2, 2, +2 accounted for 44% of the total. 59% of the carcasses in those categories in EAR showed fatness class –3, 3+3, followed by 55.4% in BS and 55.1% in HF. Fatness class –2, 2+2 was determined in 44.9% of the carcasses in those categories in HF, followed by 44.6% in BS and 41.0% in EAR.

DISCUSSION

In this study, about 26% of the evaluated male carcasses had the weight lower than 240 kg, 74% of those had the weight higher than 240 kg. The majority of the carcasses belonged to conformation class R (good) and fatness class 3 (average). The number of R and U conformation classes was higher in HF and BS. Average carcass weight in this study was lower than the average in the European countries. Fleshiness of carcasses corresponds with the results reported by several researchers (Bozó *et al*., 2000; Parkkonen *et al*., 2000; Allen *et al*., 2001; Bohuslávek, 2002; Florek and Litwińczuk, 2002). However, the fleshiness of carcasses in this study was poorer than the average in other studies (Silva, 1996; Van de Werf *et al*., 1998; Simoes and Mira, 2002; Bjelka *et al*., 2002). No major differences in fatness were found between European countries and Turkey. In Portugal, male carcasses between 265 and 300 kg represent 45% of all slaughters. The breed represented in the study was Portuguese large sized breed and about 80% of these carcasses fell into class 2 (U) of the EU carcass classification scheme EUROP (Silva, 1996). In another study realised in Portugal, Simoes and Mira (2002) found that the carcass weight for small and large breeds ranged from 112 kg to 350 kg and from 155 kg to 508 kg, respectively. Male cattle slaughtered (n = 17 389) between January 1995 and April 1996 in the Netherlands had carcass weight of 343 kg, conformation and fatness scores (1–15) were 5.60 (–U) and 7.34 (+3), respectively (Van de Werf *et al*., 1998). An experiment carried out at an abattoir line with an output of 800 carcasses in Pfarrkirchen (Germany) showed that mean carcass weight was 367.2 kg, conformation and fatness scores (1–15) were 9 (+R) and 7 (+3), respectively (Bohuslávek, 2002). This researcher reported that carcass weight ranged from 190.6 kg to 497.4 kg, conformation score ranged from 5 (O) to 14 (E), fatness score ranged from 2 (1) to 12 (–4). In Hungary, 168 head of male cattle belonging to 15 breeds and genotypes were evaluated according to the SEUROP system. Average carcass weight was 303.1 kg. Distributions of conformation classes for E,U,R,O were 13%, 29%, 37% and 21%, respectively (Bozó *et al*., 2000). In Ireland, Allen *et al*. (2001) classified 7 247 beef carcasses. According to the distribution of carcasses within the national slaughter (1999), carcasses of E conformation accounted for 0.05%, percentage of U conformation carcasses in the trial was 4.5%. A majority of the carcasses belonged to R (32%) and O (48.4%) conformation. P conformation was 15.2%. The researcher reported that a majority of the carcasses fell into 3 (17.1) and

4 (57.1%). Florek and Litwińczuk (2002) conducted a study in the years 1995–1996 in the Central-eastern part of Poland that covered young Black and White cattle and their crosses with beef breeds. The majority of bull carcasses was classified as class R (66%) carcasses. The fewest carcasses were in class P (3.8%) in males. 49.1% were classified as class 2, 29.2% as class 3, 12.3 as class 1 and 9.4% as class 4. None of the male carcasses was classified as class 5. In Finland, between 1996 and 1997, the average fleshiness of all carcasses was 4.3 between classes –O and O. The average fatness of all carcasses was 2.27 (class 2). The average slaughter weight for HF (n = 8 711) and Ayrshire (n = 22 231) bulls was 280 kg and 270 kg, respectively. Fleshiness (1–11) for HF and Ayrshire (Ayr) bulls was 4.75 (O) and 4.43 (–O), respectively. HF was classified 0.3 grades better than Ayr. Fatness (1–5) for HF and Ayrshire bulls was 2.19 (2) and 2.15 (2), respectively (Parkkonen *et al*., 2000). In Spain, male carcass weights of Spanish local breeds ranged from 255.9 to 291.8 kg. Fatness and conformation class of these breeds were –2 and 3; –R and U, respectively (Alberti *et al*., 1997). As reported by Drennan (1998), differences in conformation and fatness mainly reflect the carcass weight difference between countries. In the light of the literature, this study confirmed that slaughtered male cattle in Turkey have the lower carcass weight and conformation score compared to slaughtered male cattle in European countries. However, beef carcasses in Turkey have lower fat than beef carcasses in EU countries. Our results are in agreement with the results of Aass (1996), Fiems *et al*. (2000), Liinamo (2000), Page (2001), Bjelka *et al*. (2002), Bohuslavek (2002), who indicate a close relationship between conformation, weight and fatness. However, our findings are in disagreement with the results of Van der Werf *et al*. (1998), who found that correlations of fleshiness and weight with fat covering were lower in male carcasses. On the other hand, the carcass fatness score in this study meets market requirements. Drennan (1998) suggested that the market requires lean carcass of good conformation and breed is a major factor influencing these traits.

CONCLUSION

In countries leading in the production of market beef only carcasses classified as at least conformation class R and fatness class 2 or 3 are accepted. The majority of the common slaughter cattle in this study was of conformation R (good) and fatness 3 (average). HF and BS carcasses were heavier than those of EAR with the largest weight difference (88.73 kg and 83.82 kg, respectively). The EAR carcasses were fatter than the HF and BS carcasses. Carcass conformation and fatness class revealed that the carcasses in this study were of moderate quality.

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ABSTRAKT

Srovnání zmasilosti a protučnělosti jatečně upraveného těla podle sytému SEUROP u holštýnsko-fríského skotu, švýcarského hnědého skotu a východoanatolského červeného skotu poráženého v Turecku

Provedli jsme srovnání zmasilosti a protučnělosti jatečně upraveného těla (JUT) u běžných plemen jatečného skotu v Turecku. Celkem jsme zhodnotili 878 JUT býků holštýnsko-fríského plemene (HF, *n* = 381), čistokrevného švýcarského hnědého skotu (BS, *n* = 314) a čistokrevného východoanatolského červeného skotu i jeho kříženců (EAR, *n* = 183), kteří byli poraženi na komerčních jatkách v období mezi 1. říjnem 2000 a 1. říjnem 2001. Třídy zmasilosti a protučnělosti JUT jsme hodnotili subjektivně s použitím fotografických modelů podle klasifikačního systému SEUROP. Podle výsledků této studie byla JUT plemen HF a BS těžší a dosahovala lepší třídu osvalení než EAR. S rostoucí hmotností JUT se zvyšovala třída zmasilosti a protučnělosti. JUT plemene BS (–U) měla o více než jednu podtřídu vyšší osvalení než JUT plemene HF (+R). Zmasilost jatečně upraveného těla EAR (–R) byla nižší než u JUT HF a BS. Bodové hodnocení protučnělosti JUT HF a EAR (9,38 = +3) bylo však o 0,25 jednotek vyšší než u BS (9,63 = –2). Jatečná kvalita byla ve srovnání s EAR vyšší u plemen HF a BS.

Klíčová slova: klasifikace podle systému SEUROP; zmasilost; osvalení; protučnělost; stupeň hodnocení jatečně upraveného těla

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