Ann. Anim. Sci., Vol. 10, No. 4 (2010) 467–476

QUALITY OF BEEF FROM POLISH HOLSTEIN-FRIESIAN BULLS AS RELATED TO WEIGHT AT SLAUGHTER

Andrzej Węglarz

Department of Cattle Breeding, University of Agriculture in Krakow, Al. Mickiewicza 24/28, 30-059 Kraków, Poland

Abstract

The aim of the study was to determine the effect of slaughter weight in Black-and-White Polish Holstein-Friesian bulls on slaughter value and beef quality traits. Subjects were 24 bulls fattened semi-intensively to two different body weights (12 animals per group). The results obtained showed that designation of heavier bulls for slaughter improves slaughter value parameters (dressing percentage, carcass weight and degree of conformation). Meanwhile, analysis of meat quality showed no significant effect of weight at slaughter on meat pH, colour parameters, texture, histological characteristics and tenderness. The meat from bulls slaughtered at higher body weights was characterized by changes in chemical composition, decreased protein content and increased fat content, as well as less favourable *n-3* PUFA levels and *n-6/n-3* PUFA ratio.

Key words: bulls, slaughter weight, slaughter value, beef quality

Improvements in fattening value, slaughter traits and meat quality characteristics are the main targets of most beef production research. Meeting consumer demand through manufacture of repeatable products of satisfactory quality is the primary focus of beef producers. Quality of beef is an important criterion that influences consumers' buying decisions (Sami et al., 2004; Resurreccion, 2004).

Although breeding of beef cattle in Poland has developed in recent years, its proportion in live animal production will remain very low (less than 1% of the cattle population). In view of the cattle breed structure in Poland, the most suitable method for improving beef cattle quality is commercial crossing of dairy cows with beef breed bulls (Grodzki et al., 2006). However, this method finds little use in the cattle population. As a result, Black-and-White Holstein-Friesians are the basic breed of animals (over 90%) used for beef cattle production in Poland. The carcasses of this cattle, however, are characterized by poorer slaughter and quality parameters (lower carcass dressing percentage and degree of conformation) compared to single-purpose beef cattle or crossbred cattle. Bulls make up a considerable proportion (47%)

of the beef market. Another problem is the low pre-slaughter weight of animals, which translates into lower carcass and meat value.

The optimum weight before slaughter and the associated age at slaughter are important factors affecting the quantity and quality of beef produced (Bruns et al., 2004; Keane, 2003; Maher et al., 2004; Węglarz, 1997; Wroński and Cichocki, 2003).

Oprządek et al. (2007) found that Polish Holstein-Friesian bulls achieve best parameters of carcass quality when slaughtered at higher weights. Likewise, Litwińczuk et al. (2006) and Młynek et al. (2006) confirmed that increased body weight of slaughtered bulls is paralleled by higher dressing percentage and improved carcass conformation class. However, there is a shortage of research on the influence of different slaughter weights on slaughter value and quality of beef from Black-and-White Polish Holstein-Friesian bulls.

The aim of this study was to determine the effect of different pre-slaughter weights of Black-and-White Polish Holstein-Friesian bulls fattened semi-intensively on carcass value and meat quality traits.

Material and methods

Subjects were 24 bulls of the Black-and-White Polish Holstein-Friesian breed, fattened semi-intensively to two different slaughter weights (550 and 650 kg), with 12 animals per group. During fattening, animals were kept in tie stalls. The assumed daily weight gain was 1000 g. The basic bulky feed was maize silage fed *ad libitum*. It was supplemented with meadow hay (1 kg/day) and concentrate containing 45% ground barley, 15% ground maize, 14% rapeseed meal, 12% soybean meal, 10% wheat bran and 4% mineral-vitamin mixture. Bulls were fed individually and concentrate rations were modified at about 50-day intervals, after weighing of animals. Daily feed intake was recorded by weighing feeds and feed refusals on 3 consecutive days. The energy and protein content of feeds was formulated according to IZ-INRA feeding standards (2001), using PrevAlim 3.23 (2006) and INRAtion 3.33 computer programs (2004).

After slaughter and post-slaughter treatment, carcasses were graded for quality (conformation and degree of fat cover according to the EUROP system) and weighed. Forty-eight hours postmortem, pH of *m. longissimus thoracis* (LT) was measured using a pH-STAR CPU device (Matthäus, Germany) with spearhead pH electrode. The pH meter was calibrated in buffers of pH 4.6 and 7.0. Meat colour was determined 48 h after slaughter on a fresh cross-sectional area of LT using a CR-310 chroma meter (Minolta Co., Ltd., Japan) equipped with a 50 mm measuring head, and quantified in the CIE L*a*b* colour space.

Samples weighing about 400 g were taken from LT muscle between the 11th and 13th vertebrae and packed into separate plastic bags, which were transported to a laboratory in an ice thermoinsulated container. Basic chemical composition of the meat was determined using standard procedures (AOAC, 1995). In addition, fatty acid content was determined on a TRACE GC ULTRA gas chromatograph (Chroma-Card) using the analytical procedures of lipid extraction from meat according to Folch (1957) and esterification according to AOAC (1995). Methyl esters of fatty acids were separated by gas chromatography with flame ionization detection (FID), column SUPELCOWAX 10 (30 m × 0.53 mm × 1.0 um). Separation conditions were: helium as carrier gas, 2.5 ml/min, injector temperature 220°C, column temperature 200°C, detector temperature 250°C.

Samples of LT for histological examination were frozen in liquid nitrogen (–80°C) and cut into serial sections 10 μm thick on a cryostat (Slee MEV, Germany) at –25°C. To identify three types of muscle fibres (I – red fibres of high enzymatic activity, IIA – intermediate fibres of medium enzymatic activity, and IIB – white fibres of low enzymatic activity), the reaction of myosin ATPase activity was carried out at pH = 4.37 and pH = 10.4 (Brooke and Kaiser, 1970). The percentage and diameter of different muscle fibre types was calculated using MultiScan v. 14.02 software.

After 7- and 14-day maturation periods, muscle samples were thermally treated at 180°C and at an internal temperature of 78°C. After cooling at room temperature, cylinder-shaped samples (16 mm in diameter and 15 mm in height) were cut along muscle fibres. Shear force was measured using a TA-XT2 Texture Analyser (Stable Micro Systems, Godalming, UK) with a Warner-Bratzler attachment equipped with a blade with a triangular notch. The blade speed during the test was 1.5 mm/s. The result was presented as force per cross-section area (kG/cm^2). Texture profile analysis (TPA) was performed using the same texture analyser with an attachment in the form of a cylinder 50 mm in diameter. A double compression test was performed on the samples to 70% of their height. The cylinder speed was 2 mm/s, the interval between compressions was 3 s, and the detection threshold was 10 g. TPA analysis included main texture parameters such as hardness, cohesiveness, springiness, resilience and adhesiveness. The secondary texture parameter determined was chewiness, which is associated with hardness, cohesiveness and springiness (Breene, 1975).

The numerical values were analysed statistically with one-way analysis of variance using SAS statistical package. Significant differences between the means for the analysed groups were determined using the F test.

Results

In Table 1 the chemical composition and nutritive value of feeds are presented. Mean daily feed and nutrient intake by fattening bulls, shown in Table 2, was similar to the requirements formulated according to INRA feeding standards (2001).

Table 3 presents the results of carcass analysis for bulls slaughtered at different weights. For the analysed groups, pre-slaughter weight of the bulls aged 571 and 691 days averaged 552 and 661 kg, respectively. Pre-slaughter weight had no significant effect on dressing percentage and carcass conformation, but higher values of these parameters were obtained in the group of heavier bulls. The degree of carcass fatness was slightly higher in the group of bulls slaughtered at higher weights ($P<0.05$).

Table 1. Chemical composition (%) and nutritive value of feeds

Component	Maize silage	Hay	Concentrate
Dry matter	30.31	85.6	87.56
Crude protein	2.53	8.33	17.24
Crude ash	1.37	7.16	6.33
Crude fat	1.18	1.57	2.63
Crude fibre	5.83	28.62	5.58
Per kg feed:			
UFV	0.24	0.63	0.90
PDIN (g)	16.2	52.4	119.1
PDIE (g)	21.1	67.5	107.7

Table 2. Mean daily feed and nutrient intake by fattening bulls

Feed	Weight at slaughter (kg)	
	550	650
Maize silage (kg)	12.8	15.1
Meadow hay (kg)	1.0	1.0
Concentrate (kg)	2.20	2.18
Nutrient intake:		
dry matter (kg)	6.66	7.34
UFV	5.68	6.22
crude protein (g)	786.42	841.16
PDIN (g)	521.78	556.66
PDIE (g)	574.52	620.90

Table 3. The results of carcass analysis

Item	Weight at slaughter (kg)				Significance
	550		650		
	mean	SD	mean	SD	
Initial body weight (kg)	183.5	2.97	182.3	3.72	ns
Initial age (days)	197.2	4.12	195.1	3.63	ns
Weight at slaughter (kg)	552.00	12.14	661.29	12.38	**
Age at slaughter (days)	571.52	12.30	691.19	13.55	**
Daily weight gain (kg)	0.984	0.019	0.978	0.017	ns
Weight of carcass (kg)	294.50	10.20	357.63	7.03	**
Dressing percentage, cold (%)	53.36	1.78	54.09	1.05	ns
Carcass conformation (1–15)	4.71	0.76	5.43	0.53	ns
Carcass fat cover (1–15)	5.57	1.62	7.43	1.27	*

ns – not significant; * $P<0.05$; ** $P<0.01$.
Carcass conformation was 15 for class E+ and 1 for class P^-.
Carcass fat cover was 15 for class 5+ and 1 for class 1^-.

Table 4 shows that the mean values of pH and LT colour characteristics for the analysed groups of bulls did not differ significantly. The pH values of meat obtained for both groups 48 h postmortem were within the normal range. Higher L* (slightly lighter colour) and b* (yellowness) values were obtained for the meat from bulls slaughtered at lower weights compared to heavier animals, but the differences were not significant.

Table 4. pH and colour parameters of *longissimus thoracis* muscle

Item	Weight at slaughter (kg)				Significance
	550		650		
	mean	SD	mean	SD	
pH	5.42	0.09	5.50	0.17	ns
L*	37.33	3.41	35.91	3.16	ns
a*	23.24	1.98	23.79	1.53	ns
b*	9.08	2.36	7.74	1.43	ns
C*	25.01	2.45	25.03	1.81	ns
h*	1.20	0.08	1.26	0.04	ns

Table 5. Percentage, diameter of muscle fibres and relative area in *longissimus thoracis* muscle

Item	Weight at slaughter (kg)				Significance
	550		650		
	mean	SD	mean	SD	
Percentage of fibres (%)					
red fibres (I)	24.49	4.97	24.77	6.13	ns
intermediate (IIA)	21.13	5.19	18.29	3.55	ns
white fibres (IIB)	54.37	7.07	56.95	8.30	ns
Diameter of muscle fibres (μm)					
red fibres (I)	61.68	5.26	61.88	14.92	ns
intermediate (IIA)	55.96	5.08	58.22	19.91	ns
white fibres (IIB)	56.80	4.73	60.82	15.81	ns

Table 5 gives the results of histological examination of LT, expressed as percentage and diameter of different fibres. The LT of animals slaughtered at higher weights had a lower percentage of IIA fibres and a higher percentage of white IIB fibres. Diameter of muscle fibres (especially IIA and IIB) was greater in heavier bulls, but the differences proved non-significant.

Table 6 shows basic chemical composition of meat and fatty acid profile. Higher protein content was found in the LT of bulls slaughtered at lower weights, with statistically significant differences ($P<0.01$). The meat of heavier bulls had an about 1% higher fat content ($P<0.05$). No differences were found between the groups for water and ash content. The fat of bulls slaughtered at higher weights was characterized by lower SFA and higher UFA levels compared to lighter bulls, with significant differences. Among the fatty acids determined in the current study, mention should be made of the level of biologically active acids. Higher levels of EPA, DPA and DHA were characteristic of the fat from bulls slaughtered at lower weights, but no statistically significant differences were confirmed for DPA. This group also had more beneficial levels of *n-3* PUFA and *n-6* PUFA and the resulting *n-6/n-3* PUFA ratio.

Table 6. Chemical analysis and fatty acid composition of *longissimus thoracis* muscle (%)

Item	Weight at slaughter (kg)				Significance
	550		650		
	mean	SD	mean	SD	
Water	72.74	0.27	72.61	0.71	ns
Crude protein	22.47	0.29	21.58	0.58	**
Ether extract	3.55	0.41	4.51	1.08	*
Ash	1.05	0.03	1.06	0.05	ns
SFA	49.79	1.89	47.77	3.81	*
UFA	49.41	1.92	51.45	4.11	*
PUFA	4.90	1.20	4.82	1.18	ns
$C_{18:1}$ *n-9*	37.78	2.45	39.92	4.09	*
$C_{18:2}$ *n-6*	3.00	0.82	3.15	0.68	ns
$C_{18:3}$ *n-6*	0.086	0.016	0.078	0.039	ns
$C_{20:5}$ *n-3* (EPA)	0.093	0.05	0.060	0.04	*
$C_{22:5}$ *n-3* (DPA)	0.20	0.06	0.15	0.10	ns
$C_{22:6}$ *n-3* (DHA)	0.06	0.01	0.04	0.01	*
CLA	0.19	0.05	0.17	0.03	ns
PUFA *n-3*	0.91	0.33	0.66	0.27	*
PUFA *n-6*	3.81	0.99	3.99	0.96	ns
PUFA *n-6/n-3*	4.53	1.66	6.52	1.83	*
PUFA/SFA	0.10	0.02	0.10	0.03	ns

SFA – saturated fatty acids, MUFA – monounsaturated fatty acids, PUFA – polyunsaturated fatty acids, UFA – unsaturated fatty acids.

Table 7. Texture profile analysis (TPA) parameters and shear force of bull LT muscle

Item	Weight at slaughter (kg)				Significance
	550		650		
	mean	SD	mean	SD	
7 days of aging					
hardness (N)	23.86	8.79	19.13	7.07	*
springiness (-)	0.57	0.09	0.63	0.11	*
cohesiveness (-)	0.41	0.05	0.44	0.06	ns
chewiness (N)	5.79	3.06	5.65	3.21	ns
resilience (-)	0.22	0.05	0.25	0.05	*
shear force (kG/cm^2)	6.64	2.33	6.67	1.10	ns
14 days of aging					
hardness (N)	22.93	7.30	19.71	7.33	ns
springiness (-)	0.55	0.08	0.49	0.06	*
cohesiveness (-)	0.41	0.04	0.41	0.06	ns
chewiness (N)	6.74	3.48	5.30	2.69	ns
resilience (-)	0.22	0.03	0.24	0.05	ns
shear force (kG/cm^2)	3.77	1.08	3.88	1.07	ns

Table 7 lists mean values of the analysed texture and shear force parameters after 7 and 14 days of aging. After 7-day aging, significant differences ($P<0.05$) emerged between the groups in hardness, springiness and resilience, but after 14 days of aging the differences were only significant for meat springiness. Regardless of the slaughter weight of bulls, shear force values were similar (6.64 and 6.67 after 7 days; 3.77 and 3.88 after 14 days of aging).

Discussion

Slaughter value of cattle is determined mainly by carcass weight, degree of conformation, degree of fat cover, as well as meat quality. These parameters are influenced by a number of different factors such as productive type, breed, sex, nutrition, slaughter weight, and pre-slaughter handling. The fact that pre-slaughter weight affects the slaughter value of bulls was reported by Młynek et al. (2006), who obtained similar relationships between these traits to those observed in the present study. The findings of Bruns et al. (2004) indicate that fattening to higher weights significantly improves dressing percentage and muscling while increasing intramuscular fat content. Meanwhile, Maher et al. (2004) found that slaughtering Holstein-Friesian bulls at higher weights (720 in relation to 620 kg) has a slight effect on decreasing carcass conformation and increasing carcass fatness, although they point to relatively large variation in these traits, especially carcass conformation.

Clausen et al. (2007) found a significant ($P<0.05$) effect of pre-slaughter weight on colour lightness (L*) and yellowness (b*) of meat, with higher values noted for the meat from Holstein-Friesian bulls slaughtered at lower weights regardless of feeding intensity.

The proportion of different muscle fibre types obtained in the present study is comparable with the results of other authors (Młynek et al., 2006; Hunt and Hedrick, 1977; Vestergaard et al., 2000). Higher pre-slaughter weight is paralleled by a higher proportion of type IIB (white) fibres at the cost of type IIA and type I (red) fibres. Młynek and Guliński (2007) found that increased slaughter age of bulls was accompanied by improved carcass quality and increased muscle fibre area.

Maher et al. (2004) observed improvements in tenderness quality of beef from Holstein-Friesian bulls slaughtered at higher weights compared to lighter bulls. The results presented by Solomon et al. (1986) indicate that the meat from young bulls (slaughtered at low weights) is generally harder than the meat from animals fattened to higher weights unless the carcasses are electrically stimulated. According to the same authors, shear force values below 5.2 kg are considered satisfactory in terms of tenderness. Likewise, Młynek et al. (2006) noted better tenderness in the meat from heavy bulls.

Similar results to those presented in the current study concerning the effect of aging time on texture parameters were obtained by Palka (2003), who reported that shear force decreased considerably after 12 days of aging in relation to 5 days of aging (4.60 vs. 6.30 kG/cm^2) at an internal temperature of 80°C.

The results obtained in the present experiment for basic chemical composition of beef are comparable to the findings of Bilik et al. (2009), Maher et al. (2004) and Młynek et al. (2005).

One of the major factors contributing to cardiovascular diseases in humans is the excess dietary intake of *n-6* PUFA and very low intake of *n-3* PUFA, resulting in excessive *n-6/n-3* ratios (Breslow, 2006). The results obtained in the present study did show differences in fat composition between the analysed groups but they were rather low. A more beneficial composition and ratio of fatty acids was obtained for the meat from lighter bulls. De Smet et al. (2000) demonstrated that increased fat content of bovine meat was paralleled by increased proportions of SFA and MUFA and a decreased proportion of PUFA. Meanwhile, Bilik et al. (2009) showed that fatty acid composition of the meat from bulls was more favourable when they were fattened semi-intensively with a higher proportion of bulky feeds in the diet compared to intensive fattening. This concerned, in particular, *n-3* PUFA content and the sum of CLA isomers, but also the *n-6/n-3* PUFA ratio.

It is concluded from the results obtained that Polish Black-and-White Holstein-Friesian bulls can be fattened to higher weights than the 500–550 kg values, which are considered optimal. This is supported by the improved carcass parameters of the bulls slaughtered at higher body weights. Therefore, to make full use of the fattening capacity and slaughter value of this breed of cattle, it is recommended that breeders fatten bulls semi-intensively to about 650 kg of body weight up to 2 years of age. It was found that the increase of slaughter weight did not result in a distinct deterioration of beef quality. The present analysis revealed no significant effect of weight at slaughter on pH, parameters of colour and texture, histological characteristics and tenderness of meat. Meanwhile, the meat from bulls slaughtered at higher weights was characterized by changes in chemical composition, decreased protein content and increased fat content. The same group also had less favourable *n-3* PUFA levels and the *n-6/n-3* PUFA ratio.

References

AOAC (1995). Official Methods of Analysis of the Association of Official Analytical Chemists.

Bilik K., Węglarzy K., Choroszy Z. (2009). Effect of feeding intensity of Limousin bulls on production parameters and dietetic properties of meat (in Polish). Rocz. Nauk. Zoot., 36, 1: 63–73.

Breene W.M. (1975). Application of texture profile analysis to instrumental food texture evaluation. J. Texture Stud., 6: 53–82.

Breslow J.L. (2006). *n-3* fatty acids and cardiovascular disease. Am. J. Clin. Nutr., 83 (6): 1477–1482.

Brooke M.H., Kaiser K. (1970). Muscle fibre type: how many and what kind? Arch. Neurol., 23: 369–370.

Bruns K.W., Pritchard R.H., Boggs D.L. (2004). The relationship among body weight, body composition, and intramuscular fat content in steers. J. Anim. Sci., 82: 1315–1322.

Clausen I., Vestergaard M., Børsting C.F. (2007). Eating quality of meat from young bulls of different ages and fed in three different feeding systems. Proc. 53th ICoMST, p. 2.

De Smet S., Webb E.C., Claeys E., Uytterhaegen L., Demeyer D.I. (2000). Effect of dietary energy and protein levels on fatty acid composition of intramuscular fat in double-muscled Belgian Blue bulls. Meat Sci., 56: 73–79.

Folch J., Les M., Sloane-Stanley G.H. (1957). A simple method for the isolation and purification of total lipids from animal tissues. J. Biol. Chem., 226: 497–509.

Grodzki H., Orłowska O., Przysucha T., Slósarz J. (2006). The influence of crossing Black and White cows with Charolaise and Limousine bulls on carcass conformation and fatness of their crossbred offspring. Anim. Sci. Pap. Rep., 24, Suppl. 2: 93–98.

Hunt M.C., Hedrick H.B. (1977). Profile of fibre types and related properties of five bovine muscles. J. Food Sci., 42 (2): 513–517.

IZ-INRA (2001). Standards of cattle, sheep and goat nutrition (in Polish). National Research Institute of Animal Production, Kraków (Poland).

Keane M.G. (2003). Beef production from Holstein–Friesian bulls and steers of New Zealand and European/American descent, and Belgian Blue × Holstein-Friesians, slaughtered at two weights. Livest. Prod. Sci., 84: 207–218.

Litwińczuk Z., Barłowska J., Florek M., Tabała K. (2006). Slaughter value of heifers, cows and young bulls from commercial beef production in the central-eastern region of Poland. Anim. Sci. Pap. Rep., 24, Suppl. 2: 187–194.

Maher S.C., Mullen A.M., Keane M.G., Buckley D.J., Kerry J.P., Moloney A.P. (2004). Decreasing variation in the eating quality of beef through homogenous pre- and post-slaughter management. Meat Sci., 67: 33–43.

Młynek K., Elminowska-Wenda G., Guliński P. (2006). The relationship between microstructure of *Longissimus lumborum* muscle and carcass quality of bulls slaughtered at three ages. Anim. Sci. Pap. Rep., 24 (1): 57–63.

Młynek K., Guliński P. (2007). The effect of growth rate and age at slaughter on dressing percentage and colour, pH_{48} and microstructure of *longissimus dorsi* muscle in Black-and-White (BW) bulls vs commercial crossbreds of BW with beef breeds. Anim. Sci. Pap. Rep., 25, 2: 65–71.

Młynek K., Guliński P., Litwińczuk Z., Smalec E., Andraszek K. (2005). Histological and physico-chemical traits of meat of Black-and-White bulls and F_1 Charolaise, Limousine and Simmental crossbreds, slaughtered at two levels of body weight. Anim. Sci. Pap Rep., 23, 3: 199–206.

Oprządek J., Dymnicki E., Reklewski Z. (2007). Growth rates and carcass composition of young cattle of different breeds (in Polish). Rocz. Nauk. PTZ, 3: 25–31.

Palka K. (2003). The influence of post–mortem ageing and roasting on the microstructure, texture and collagen solubility of bovine *semitendinosus* muscle. Meat Sci., 64, 2: 191–198.

Resurreccion A.V.A. (2004). Sensory aspects of consumer choices for meat products. Meat Sci., 66: 11–20.

Sami A.S., Augustini C., Schwarz F. J. (2004). Effects of feeding intensity and time on feed on performance, carcass characteristics and meat quality of Simmental bulls. Meat Sci., 67: 195–201.

Solomon M.B., West R.L., Hentges J.F. (1986). Effects of slaughter weight and carcass electrical stimulation on the quality and palatability of beef from young purebred bulls. J. Anim. Sci., 63: 1838–1844.

Vestergaard M., Oksbjerg N., Henckel P. (2000). Influence of feeding intensity, grazing and finishing feeding on muscle fibre characteristics and meat colour of *semitendinosus*, *longissimus dorsi* and *supraspinatus* muscles of young bulls. Meat Sci., 54: 177–185.

Węglarz A. (1997). Estimate of commercial crossing results between Black-and-White cattle and White beef breeds from Italy. Part III. Physico-chemical and organoleptic evaluation of meat (in Polish). Acta Agr. Silv., ser. 35, pp. 90–103.

Wroński M., Cichocki M. (2003). Effect of body weight before slaughter on after slaughter performance traits of crosses with beef breed cattle fattened a semi-intensive system. Acta Univ. Agric. Silvic. Mendel. Brun., 5: 99–106.

Accepted for printing 5 X 2010

ANDRZEJ WĘGLARZ

Jakość wołowiny pochodzącej od buhajków rasy polskiej holsztyńsko-fryzyjskiej w zależności od ubojowej masy ciała

STRESZCZENIE

Celem badań było określenie wpływu masy ubojowej buhajków holsztyńsko-fryzyjskich odmiany czarno-białej na wartość rzeźną i cechy jakości wołowiny. Badania przeprowadzono na 24 buhajkach, które opasano systemem półintensywnym do dwóch różnych mas ciała (po 12 w każdej grupie). Na podstawie uzyskanych wyników można stwierdzić, że przeznaczanie do uboju buhajków przy wyższej masie ciała powoduje poprawę wskaźników wartości rzeźnej (wydajność rzeźną, masę tuszy i stopień jej uformowania). Przeprowadzone analizy określające jakość mięsa nie wykazały natomiast istotnego wpływu masy ubojowej na jego pH, parametry barwy, tekstury, ocenę histologiczną i kruchość. W mięsie pochodzącym od buhajków ubijanych przy wyższej masie ciała obserwowano zmiany składu chemicznego, obniżenie zawartości białka oraz wzrost zawartości tłuszczu. W grupie tej stwierdzono również mniej korzystny poziom kwasów tłuszczowych PUFA *n-3*, a także stosunek PUFA *n-6/n-3*.