African Journal of Biotechnology Vol. 11(75), pp. 14017-14024, 18 September, 2012
Available online at http://www.academicjournals.org/AJB
DOI: 10.5897/AJB12.892
ISSN 1684–5315 ©2012 Academic Journals

Full Length Research Paper

Post-slaughter carcass evaluation in whiteheaded mutton sheep according to the EUROP classification

Marek Stanisz*, Piotr Ślósarz and Ryszard Steppa

Department of Small Mammal Breeding and Animal Origin Materials, Poznań University of Life Sciences, Złotniki, Słoneczna 1, 62-002 Suchy Las, Poland.

Accepted 22 June, 2012

Analyses were conducted on 120 lambs of the whiteheaded mutton sheep (60 tup lambs and 60 ewe lambs). Lambs were weaned at the age of 60 ± 3 days. Lambs were fattened using pelleted balanced feed. 1 kg of feed contained 860 g dry matter, 147 g crude protein and 6.9 MJ (net energy). On the day of slaughter (100 ± 3 days), tup lambs weighed an average of 33.1 kg and ewe lambs weighed 31.0 kg. After slaughter, a point score conformation and fatness evaluation was performed according to the EUROP classification (E is excellent, U is very good, R is Good, O is fair and P is poor), carcass measurements were taken, and the tissue composition of the half-carcass was determined on the basis of complete dissection. In terms of conformation, the carcasses of tested lambs of both sexes were classified to three grades, that is, E: 14.2%, U: 60.8% and R: 25.0%, respectively. A total of 76.7% carcasses of tup lambs and 73.3% ewe carcasses were classified to two highest grades, that is E and U. In terms of fatness, carcasses were classified to 4 grades, denoting small and medium fatness, that is, 2: 15.0%, 3L: 56.7%, 3H: 20.0% and 4L: 8.3%. A higher number of carcasses with the most desirable degree of fatness (grades 2 and 3L), came from tup lambs (78.3%) than ewe lambs (65.0%). A comparison of the subjective EUROP classification with the results of evaluation based on measurements and complete dissection shows that when evaluating conformation, it was not possible to determine precisely the tissue composition of the carcass. In turn, fatness evaluation may be informative on tissue contents in the carcass.

Key words: Lamb, carcass composition, EUROP classification.

INTRODUCTION

In European countries, with a developed sheep production, the appraisal of commercial value of carcasses is based mainly on the EUROP classification system (Council Regulation (EEC) no. 2137/92, 1992; Commission Regulation (EEC) no. 461/93, 1993). Studies conducted to date on lamb carcasses have not definitely confirmed consistency of this classification with the results of tissue composition evaluation (Freudenreich et al., 2001; Ruiz de Huidobro et al., 2003; Johansen et al., 2006; Kongsro et al., 2009; Lambe et al., 2009). In Poland, sheep production is based on pure breeds, with a marginal role of commercial crossing, and over 90% of produced slaughter lambs are exported on the UE market. The Whiteheaded mutton sheep is the synthetic breed, newly formed at the Poznań University of Life Sciences, with the genetic share of 50% Texel, 18% Ile de France, 9% Berrichone du Cher, 11% East Friesian milk sheep, 6% Polish Merino and 6% Wielkopolska sheep. The aim of the conducted investigations was to compare results of the objective post-slaughter evaluation of pure breed Whiteheaded mutton lambs with the classification of lamb carcasses according to the EUROP classification.

MATERIALS AND METHODS

Analyses were conducted in three successive years on 120 lambs of the Whiteheaded mutton sheep breed (60 tup lambs and 60 ewe lambs). Lambs, all born as singles, were weaned at the age of 60 ±

*Corresponding author. E-mail: stanisz@up.poznan.pl. Tel: +48618125520.

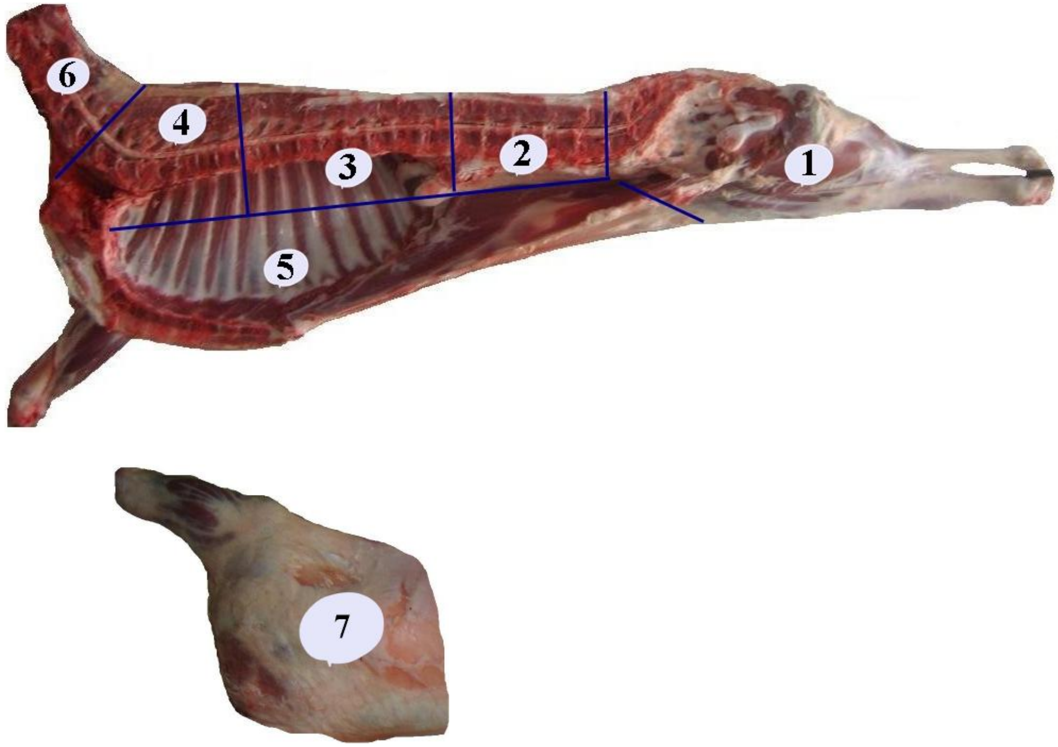

Figure 1. Diagram presenting division of half-carcass into joints (Stanisz, 2010).1, the leg with shank; 2, the rump; 3, the best end of neck; 4, the neck; 5, the flank with ribs and breast; 6, the scrag; 7, the shoulder with shank.

3 days, and after a 10-day transition period, they were fattened, using pelleted balanced feed containing lucerne meal, ground barley and wheat grain, wheat bran, soy and rapeseed meal and mineral additives. The composition of pelleted feed was constant in individual years of the study, and the alimentary value of 1 kg feed was 860 g dry matter, 147 crude protein and 6.9 MJ (net energy). During fattening, lambs had constant access to water. Lambs were slaughtered at the age of 100 ± 3 days, and before slaughter, they were weighed accurately to ± 0.1 kg. Slaughter was performed according to the methodology developed at the National Research Institute of Animal Production. Immediately after slaughter, carcasses were weighed accurately to 0.1 kg and dressing percentage was determined. Next, a panel of three appraisers performed a point score evaluation of conformation and carcass fatness according to the EUROP classification system (Council Regulation (EEC) no. 2137/92, 1992; Commission Regulation (EEC) no. 461/93, 1993). Carcasses were weighed after a 24 h carcass cooling, at a temperature of 2 to 4°C, hanging on hind calcaneal tendons at a spacing of 16 cm. Carcasses were divided into half-carcasses by cutting through the middle of the spine and the sternum (with the tail left on the left half-carcass). The following measurements were taken in the hanging position on the carcass and on the right half-carcass: breast depth measured at the widest part; breast width, measured behind the scapulas in the narrowest part; saddle joint width, measured at the widest part on the legs; leg depth, measured from the base of the tail perpendicular to the long axis of the carcass; outer length of the carcass, measured with a tape measure adjacent to the carcass, from the base of the tail to the lowest point at the bent of neck; Saddle joint length, measured from the cranial edge of the pubic symphysis to the small spinous process with a tape measure adjacent to muscles and leg circumference, measured at a 3/5 distance on the line of saddle joint length measurement line, at the ankle joint (Stanisz, 2010).

Prior to dissection, the right half-carcass was placed in a natural position, and the main dissection line was marked with a knife as a straight line running from the bottom edge of the pubic symphysis to the connection of the first rib with the sternum. Next, the half-carcass was dissected into the following joints: neck, arm piece with the fore knuckle, flank with ribs and the sternum, the best end of neck, rack, saddle joint and leg with shank (Figure 1). The cross-section of the longissimus dorsi muscle *(M. longissimus)* and backfat thickness over *M. longissimus* and over ribs (at its thickest layer) were measured on the rack, at the position where it had been dissected from the saddle joint (behind the last pectoral vertebra). Joints from the right half-carcass were weighed accurately to 1 g and next, their percentages in the half-carcass were calculated. Moreover, the proportions of kidneys and perirenal fat from the half-carcass to half-carcass weight were also calculated. All joints were subjected to dissection, trimming of the muscle, adipose and bone tissue (bones together with tendons), and next, tissues were weighed accurately to 1 g, and their percentage proportions in the half-carcass were calculated.

The effect of main experimental factors, that is sex of lambs and year of analysis (replication) on the level of analyzed slaughter traits were estimated using a least square multivariate analysis of variance, applying the SAS ver. 9.1 system (SAS, 2000).

$$Y_{ijk} = \mu + p_i + r_j + (pr)_{ij} + e_{ijk}$$

Where Y_{ijk} is the phenotypic value of the trait; μ is the the overall mean; p_i is the sex effect (I = 1, 2); r_j is the birth type effect (j =1, 2, 3); $(pr)_{ij}$ is the interaction between factors; e_{ijk} is the random

Table 1. Analysis of carcass dimensions in lambs of whiteheaded mutton sheep.

Trait	Sex		Significant of difference		
	♂♂ n = 60 LSM ± SE	♀♀ n = 60 LSM ± SE	Sex	Year	Interaction
Body weight at slaughter (kg)	33.13±0.35	31.02±0.40	**	ns	ns
Warm carcass dressing percentage (%)	52.01±0.25	53.41±0.28	**	ns	ns
Warm carcass weight (kg)	17.23±0.21	16.56±0.23	**	ns	ns
Depth of chest (cm)	24.89±0.12	24.55±0.14	ns	ns	ns
Width of chest (cm)	17.81±0.13	18.37±0.12	*	ns	ns
Width of rump (cm)	23.71±0.09	24.08±0.09	*	ns	ns
Outer length of carcass (cm)	56.06±0.27	55.24±0.31	*	ns	ns
Depth of leg (cm)	17.36±0.06	17.81±0.08	*	ns	ns
Length of rump (cm)	33.12±0.12	32.63±0.14	*	ns	ns
Leg circumference (cm)	36.24±0.22	36.98±0.19	*	ns	ns
Backfat thickness over *M. longissimus* (mm)	2.08±0.09	2.38±0.10	**	ns	ns
Backfat thickness over ribs (mm)	6.44±0.31	8.73±0.35	**	ns	ns
Loin eye area of *M. longissimus* (cm^2)	14.90±0.21	14.28±0.23	*	ns	ns
Carcasses					
Leg with shank	32.96±0.13	32.95±0.15	ns	ns	ns
Rump	7.38±0.06	7.41±0.07	ns	ns	ns
Best end of neck	8.24±0.07	8.22±0.08	ns	ns	ns
Shoulder with shank	18.19±0.09	17.73±0.11	**	ns	ns
Neck	8.31±0.06	8.02±0.07	**	ns	ns
Flank with ribs and breast	16.51±0.09	17.12±0.11	**	ns	ns
Scrag	6.26±0.06	5.75±0.07	**	ns	ns
Kidney fat	1.49±0.06	2.17±0.07	**	ns	ns
Kidney	0.66±0.01	0.63±0.01	*	ns	ns
Tissue composition of half-carcasses					
Meat	63.42±0.38	62.54±0.42	*	ns	ns
Fat	17.01±0.33	18.51±0.35	**	ns	ns
Bones	19.58±0.21	18.95±0.24	**	ns	ns
Meat/fat ratio	3.96±0.10	3.47±0.11	**	ns	ns
Meat/bones ratio	3.27±0.05	3.34±0.06	ns	ns	ns
Fat/bones ratio	0.88±0.03	0.99±0.03	**	ns	ns
Meat+fat/bones ratio	4.15±0.06	4.33±0.07	**	ns	ns

**P ≤ 0.01; *P ≤ 0.05; ns, difference statistically non significant.

error.

The effect of conformation grade and carcass fatness on the analyzed slaughter traits was estimated using a least square one-way analysis of variance (SAS ver. 9.1).

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

Where Y_{ij} is the phenotypic value of the trait; μ is the the overall mean, m_i is the effect of the class (I = 1, 2, 3 for conformation grade, or i =1, 2 .....4 for fatness grade); e_{ij} is the random error.

RESULTS AND DISCUSSION

Mean age at slaughter for tup lambs and ewe lambs was 100 days, and it was consistent with the adopted methodology. Body weight, reached by the examined lambs (Table 1), was typical of this sheep breed (Stanisz, 2010; Ślósarz et al., 2011). Similarly to what was found in this study, Janicki et al. (2000), Ślósarz et al. (2004), Gutiérrez et al. (2005), Lambe et al. (2009) and Pajor et al. (2009) reported that tup lambs, despite greater body weight before slaughter at the same age had a lower dressing percentage than that of ewe lambs (P ≤ 0.01).

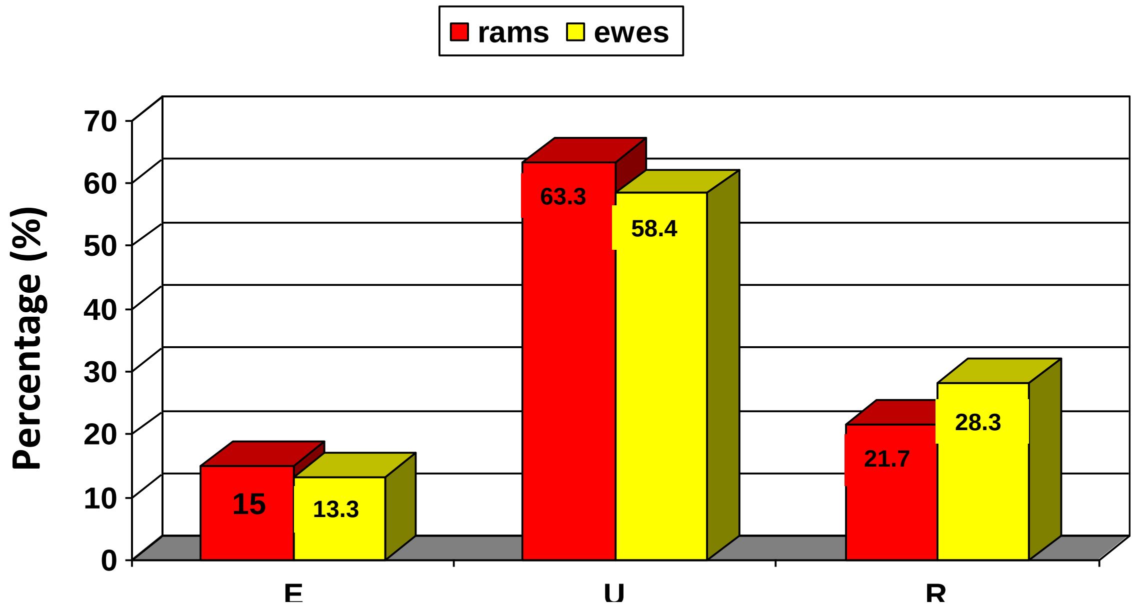

Figure 2. Percentage of rams' and ewes' carcasses by EUROP conformation scores.

Differences in carcass dimensions, percentages of joints, percentage composition and proportions of tissues in half-carcasses of tup lambs and ewe lambs slaughtered at the same age recorded in this study, are typical and confirm to earlier studies by Hammond (1932) and Hammond et al. (1983), who indicated sexual dimorphism, as well as differences in maturing between sexes. When investigating carcasses of lambs slaughtered at a weight of more than 30 kg, Ślósarz et al. (2001), Gutiérrez et al. (2005) and Pajor et al. (2009) reported results similar to the data recorded in this study; significantly higher fatness levels in carcasses of ewe lambs than tup lambs. No effect of the year of birth or interactions was observed in this study on the levels of investigated traits.

In terms of conformation, carcasses of examined lambs of both sexes were classified to three grades; E (14.2%), U (60.8%) and R (25.0%). A total of 76.7% carcasses of tup lambs and 73.3% carcasses of ewe lambs were classified to two highest grades (E and U). Grades E and U were comprised by 1.7 and 4.9% points more carcasses of tup lambs than ewe lambs. In turn, the number of carcasses of ewe lambs classified to the lowest conformation grade R was by 6.6% points higher than that of tup lambs (Figure 2). Similarly as in this study, also Toldi et al. (1999), Lengyel and Toldi (2003), Pajor et al. (2004) and (2009), when evaluating carcasses of meat purpose lambs, indicated better conformation and fleshing of carcasses in case of tup lambs, in the highest conformation grades. Table 2 presents the characteristics of carcasses classified in the EUROP system in terms of conformation and fleshing. Carcass weight had a considerable effect on the evaluation of conformation and fleshing. Carcasses in grade E (17.6 kg) had on average by 4 ($P \leq 0.05$) and by 8% ($P \leq 0.01$) greater weight than carcasses in grades U and R; while at the same time, carcasses in grade U had on average by 4% ($P \leq 0.05$) greater weight than those in grade R. A similar dependence was shown in the study of Freudenreich et al. (2001). Carcasses in grades E and U had similar percentages of joints in half-carcasses. The percentage of leg with shank and arm piece with the fore knuckle increased significantly with higher conformation grades, while percentages of saddle joint and rack decreased significantly. Carcasses in higher conformation grades had deeper and wider breasts, wider and longer saddle joints, longer legs, greater leg circumferences ($P \leq 0.05$), greater cross-section area of *M. longissimus* ($P \leq 0.01$), and they were covered by a thicker layer of superficial fat over *M. longissimus* and over ribs ($P \leq 0.05$). Similar dependencies were shown by Janicki et al. (2000), Russo et al. (2003), Gutiérrez et al. (2005), Peña et al. (2005) and Abdullah and Qudsieh (2008) when examining carcasses of lambs, differing significantly in terms of their weight, and classified to different weight classes.

In this study, no significant differences were found in the percentages of muscle, adipose and bone tissues in carcasses, depending on their conformation classes. Similar tissue compositions in carcasses of lambs classified in three highest conformation grades were reported by Janicki et al. (2000) and Freudenreich et al. (2001). Thus, it may be stated that tissue composition in carcasses of meat purpose lambs may not be precisely assessed on the basis of their conformation evaluation.

In terms of fatness, carcasses were classified to 4 grades, denoting small and medium fatness levels that is, 2 (15.0%), 3L (56.7%), 3H the 20.0% and 4L (8.3%). A

Table 2. Analysis of weight and dimensions of warm carcass, percentage of joints in carcass and tissue composition in half- carcass of lambs of whiteheaded mutton sheep classified in the EUROP system in terms of conformation and fleshing.

Trait	EUROP conformation class			Effect class
	E	U	R	
	LSM ± SE	LSM ± SE	LSM ± SE	
n	**n=17, ♂♂=9, ♀♀=8**	**n=73, ♂♂=37, ♀♀=36**	**n=30, ♂♂=14, ♀♀=16**	
Warm carcass weight (kg)	17.62±0.29^{Ab}	16.92±0.17^{ab}	16.27±0.25^{Aa}	**
Depth of chest (cm)	24.94±0.19^{a}	24.86±0.11^{b}	24.31±0.15^{ab}	*
Width of chest (cm)	18.29±0.23^{a}	18.13±0.14^{b}	17.71±0.19^{ab}	*
Width of rump (cm)	24.34±0.20^{a}	23.95±0.11^{b}	23.56±0.15^{ab}	*
Outer length of carcass (cm)	55.44±0.46	55.82±0.24	55.68±0.36	ns
Depth of leg (cm)	17.79±0.12^{a}	17.68±0.08^{b}	17.43±0.10^{ab}	*
Length of rump (cm)	32.97±0.22	32.95±0.11	32.72±0.16	ns
Leg circumference (cm)	37.96±0.42^{A}	37.33±0.21^{B}	35.98±0.35^{AB}	**
Backfat thickness over *M. longissimus* (mm)	2.46±0.13^{a}	2.38±0.09^{b}	2.14±0.11^{ab}	*
Backfat thickness over ribs (mm)	8.29±0.47^{a}	7.74±0.27^{b}	6.98±0.35^{ab}	*
Loin eye area of *m. longissimus* (cm^2)	15.35±0.32^{AB}	14.38±0.17^{A}	14.03±0.25^{B}	**
Carcasses				
Leg with shank (%)	33.02±0.21^{a}	32.93±0.11^{b}	32.46±0.15^{ab}	*
Rump (%)	7.25±0.09^{a}	7.26±0.06^{b}	7.72±0.09^{ab}	*
Best end of neck (%)	7.89±0.11^{a}	8.17±0.07^{b}	8.51±0.09^{ab}	*
Shoulder with shank (%)	18.43±0.14^{a}	18.21±0.08^{b}	17.87±0.11^{ab}	*
Neck (%)	8.11±0.10	8.13±0.07	8.19±0.09	ns
Flank with ribs and breast (%)	17.02±0.19	16.73±0.12	16.72±0.14	ns
Scrag (%)	5.91±0.09	6.04±0.06	6.03±0.09	ns
Kidney fat (%)	1.79±0.09	1.88±0.06	1.81±0.07	ns
Kidney (%)	0.58±0.02^{AB}	0.65±0.01^{AC}	0.69±0.01^{BC}	**
Tissue composition of half-carcasses				
Meat (%)	63.31±0.61	62.89±0.32	62.72±0.45	ns
Fat (%)	17.78±0.48	17.68±0.29	17.79±0.36	ns
Bones (%)	18.91±0.32	19.43±0.16	19.48±0.25	ns
Meat/fat ratio	3.69±0.12	3.76±0.08	3.69±0.13	ns
Meat/bones ratio	3.38±0.08	3.27±0.05	3.25±0.06	ns
Fat/bones ratio	0.95±0.04	0.93±0.02	0.93±0.03	ns
Meat+fat/bones ratio	4.34±0.09	4.21±0.05	4.17±0.07	ns

A, B, (a, b…), means denoted with identical capital (small) letters differ significantly at P ≤ 0.01 (P ≤ 0.05); **P ≤ 0.01; *P ≤ 0.05; ns, difference statistically non significant.

higher number of carcasses with the most desirable degree of fatness (grades 2 and 3L) came from tup lambs (78.3%) than ewe lambs (65.0%). Grades 2 and 3L comprised of 6.6 and 6.7% points more carcasses of tup lambs than ewe lambs. In contrast, more carcasses with a less desirable degree of fatness (grades 3H and 4L) came from ewe lambs (35.0%) than tup lambs (21.7%). Grades 3H and 4L comprised of 6.7 and 6.6% points more carcasses coming from ewe lambs than tup lambs (Figure 3). Toldi et al. (1999), Pajor et al. (2004) and (2009), when evaluating fatness in carcasses of meat purpose lambs, indicated similarly as it was found in the present study, that with an increase in fatness grade, the share of carcasses coming from tup lambs decreased, while the proportion of carcasses of ewe lambs increased. Table 3 presents the characteristics of carcasses classified in the EUROP system according to fatness classes. Carcasses in grade 2 (15.5 kg) had on average by 7, 12 and 14% greater weight than carcasses in grades 3L, 3H and 4L (P ≤ 0.01). With an increase in fatness grade, carcasses had deeper and wider chests, wider and longer saddle joints, longer legs, greater leg circumferences and greater lengths (P ≤ 0.01). Fatness grade had a highly significant effect on the percentage of

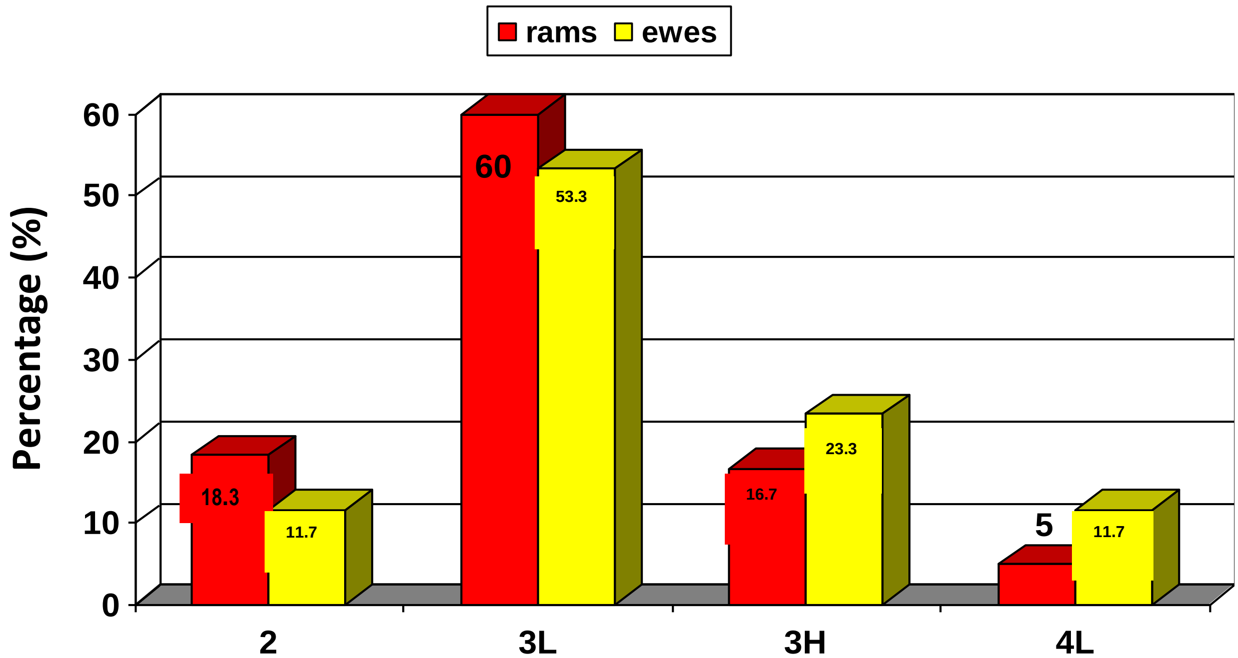

Figure 3. Percentage of rams' and ewes' carcasses by EUROP fat cover scores.

Table 3. Analysis of weight and dimensions of warm carcass, percentage of joints in carcass and tissue composition in half- carcass of lambs of whiteheaded mutton sheep classified in the EUROP system according to fatness classes.

Trait	EUROP fat class				Effect class
	2 LSM ± SE	3L LSM ± SE	3H LSM ± SE	4L LSM ± SE	
	n=18, ♂♂=11, ♀♀=7	n=68, ♂♂=36, ♀♀=32	n=24, ♂♂=10, ♀♀=14	n=10, ♂♂=3, ♀♀=7	
Warm carcass weight (kg)	15.52±0.23^{ABC}	16.58±0.18^{ADE}	17.45±0.21^{BD}	17.64±0.24^{CE}	**
Depth of chest (cm)	24.11±0.12^{ABC}	24.61±0.11^{ADa}	24.99±0.13^{Ba}	25.36±0.14^{CD}	**
Width of chest (cm)	17.52±0.17^{ABa}	17.93±0.14^{abc}	18.40±0.21^{Ab}	18.47±0.24^{Bc}	**
Width of rump (cm)	23.55±0.16^{ABa}	23.91±0.11^{ab}	24.09±0.21^{A}	24.43±0.22^{Bb}	**
Outer length of carcass (cm)	54.61±0.44^{ABa}	55.51±0.24^{ab}	56.04±0.33^{A}	56.45±0.49^{Bb}	**
Depth of leg (cm)	17.31±0.12^{ABa}	17.61±0.09^{ab}	17.78±0.11^{A}	17.86±0.12^{Bb}	**
Length of rump (cm)	32.56±0.19^{A}	32.67±0.12^{a}	32.86±0.18	33.21±0.19^{Aa}	**
Leg circumference (cm)	35.84±0.36^{ABa}	36.68±0.24^{ab}	36.84±0.34^{A}	37.66±0.38^{Bb}	**
Backfat thickness over *m. longissimus* (mm)	1.76±0.12^{ABC}	2.11±0.09^{ADE}	2.61±0.11^{BDF}	3.08±0.21^{CEF}	**
Backfat thickness over ribs (mm)	5.22±0.39^{ABC}	6.51±0.26^{ADE}	7.86±0.29^{BDF}	10.75±0.65^{CEF}	**
Loin eye area of *m. longissimus* (cm^2)	14.45±0.25	14.67±0.18	14.86±0.25	14.38±0.31	ns
Carcasses					
Leg with shank (%)	33.97±0.21^{ABC}	32.35±0.12^{AD}	31.93±0.16^{BE}	31.01±0.26^{CDE}	**
Rump (%)	7.31±0.10^{A}	7.28±0.06^{B}	7.24±0.09^{C}	7.93±0.12^{ABC}	**
Best end of neck (%)	7.58±0.11^{ABC}	8.14±0.07^{ADE}	8.44±0.09^{BD}	8.47±0.16^{CE}	**
Shoulder with shank (%)	18.52±0.14^{A}	18.56±0.08^{B}	18.25±0.11^{a}	17.71±0.19^{ABa}	**
Neck (%)	8.18±0.10	8.22±0.06	8.07±0.08	8.08±0.13	ns
Flank with ribs and breast (%)	16.29±0.21^{ABa}	16.98±0.11^{CDa}	17.53±0.16^{AC}	18.16±0.26^{BD}	**
Scrag (%)	6.09±0.10	6.08±0.07	5.96±0.09	5.81±0.15	ns
Kidney (%)	0.63±0.02	0.65±0.01	0.64±0.02	0.63±0.03	ns
Kidney fat (%)	1.43±0.09^{ABC}	1.74±0.06^{ADE}	1.94±0.07^{BDa}	2.20±0.12^{CEa}	**

Table 3. Count'd.

Tissue composition of half-carcasses					
Meat (%)	64.74±0.62^{AB}	63.61±0.33^{CD}	62.19±0.41^{AC}	61.35±0.75^{BD}	**
Fat (%)	15.16±0.56^{ABC}	17.03±0.29^{ADE}	18.82±0.38^{BD}	20.01±0.65^{CE}	**
Bones (%)	20.09±0.32^{ABa}	19.35±0.18^{a}	19.00±0.24^{A}	18.64±0.42^{B}	**
Meat/fat ratio	4.43±0.15^{ABC}	3.87±0.08^{ADE}	3.41±0.11^{BD}	3.15±0.21^{CE}	**
Meat/bones ratio	3.26±0.08	3.33±0.05	3.32±0.06	3.32±0.11	ns
Fat/bones ratio	0.77±0.04^{ABC}	0.88±0.02^{ADE}	1.01±0.02^{BD}	1.08±0.05^{CE}	**
Meat+fat/bones ratio	4.03±0.09^{ABa}	4.21±0.05^{a}	4.33±0.07^{A}	4.40±0.12^{B}	**

A, B, (a, b…), means denoted with identical capital (small) letters differ significantly at P ≤ 0.01 (P ≤ 0.05); **P ≤ 0.01; *P ≤ 0.05; ns, difference statistically non significant.

joints in the carcass. With an increase in fatness grade, the percentage of leg with shank and arm piece with the fore knuckle decerased, while the percentage of saddle joint, rack and flank with ribs and the sternum increased. This is mainly caused by the fact that the proportions of individual joints and the rate of development for individual tissues vary with an increase in carcass weight in individual fatness grades, which confirms to earlier studies by Hammond (1932) and Hammond et al. (1983). An increase in fatness grade was accompanied by a deterioration of carcass leanness indexes. Backfat thickness over *M. longissimus* and over the ribs increased, the proportion of adipose tissue increased, while the proportion of muscle and bone tissues in the carcass decreased and the tissue ratio deteriorated. In contrast, the cross-section area of *M. longissimus* was similar in all fatness grades. A similar dependence was shown by Janicki et al. (2000).

Conclusion

A comparison of a subjective evaluation of conformation and fatness (EUROP) for carcasses of Whiteheaded mutton sheep, with the results of evaluation based on measurements and complete dissection, shows that when evaluating conformation, it is not possible to precisely determine the tissue composition of the carcass. In contrast, evaluation of fatness may be highly informative on the content of tissues in the carcass.

ACKNOWLEDGEMENTS

The study was supported by grant no. N N312 212136 from the Polish Ministry of Science and Higher Education.

REFERENCES

Abdullah AY, Qudsieh RI (2008). Carcass characteristics of Awassi ram lambs slaughtered at different weights. Livest. Sci. 117: 165-175.

Commission Regulation (EEC) (1993). Commission Regulation (EEC) no. 461/93 of 26 February laying down detailed rules for the Community scale for the classification of carcasses of ovine animals. pp. 93-461

Council Regulation (EEC) (1992). Council Regulation (EEC) no. 2137/92 of 23 July 1992 concerning the Community scale for the classification of carcasses of ovine animals and determining the Community standard quality of fresh or chilled sheep carcasses and extending Regulation (EEC). 2137(92):91-338.

Freudenreich P, Dobrowolski A, Branscheid W (2001). Ermittlung der Schlachtkörperqualität beim Lamm – Eine kritische Untersuchung zum EUROP - Klassifizierungssystem. Arch. Tierz. 44:336-343.

Gutiérrez J, Rubio MS, Méndez RD (2005). Effects of crossbreeding Mexican Pelibuey sheep with Rambouillet and Suffolk on carcass traits. Meat Sci. 70:1-5.

Hammond JH (1932). Growth and the Development of Mutton Qualities in the Sheep. Oliver and Boyd. Edinburgh. pp. 1-597

Hammond JRJ, Bowman JC, Robinson TJ (1983). Hammond's Farm Animals, fifth ed. Edward Arnold Ltd. London. p. 305.

Janicki B, Borys B, Simińska E (2000). Wartość rzeźna jagniąt sklasyfikowanych według systemu ''EUROP". [The slaughter value of lambs classified according to "EUROP" standards]. Zesz. Nauk. AR Wrocław. 399:151-158.

Johansen J, Aastveit AH, Egelandsdal B, Kvaal K, Røe M (2006). Validation of the EUROP system for lamb classification in Norway; repeatability and accuracy of visual assessment and prediction of lamb carcass composition. Meat Sci. 74:497–509.

Kongsro J, Røe M, Kvaal K, Aastveit AH, Egelandsdal B (2009). Prediction of fat, muscle and value in Norwegian lamb carcasses using EUROP classification, carcass shape and length measurements, visible light reflectance and computer tomography (CT). Meat Sci. 81: 102–107.

Lambe NR, Navajas EA, Bünger L, Fisher AV, Roehe R, Simm G (2009). Prediction of lamb carcass composition and meat quality using combinations of post-mortem measurements. Meat Sci. 81:711-719.

Lengyel A, Toldi GY (2003). Relationship between S/EUROP conformation and slaughter value in sheep. Magyar juhászat és kecsketenyésztés 12:3-6.

Pajor F, Póti P, Láczó E (2004). Comparison of slaughter performance of Hungarian Merino, German Mutton Merino and German Blackheaded lambs. Acta Agronomica Óváriensis 46(1):77-83.

Pajor F, Láczó E, Erdős O, Póti P (2009). Effects of crossbreeding Hungarian Merino sheep with Suffolk and Ile de France on carcass traits. Arch. Tierz. 52:169-176.

Peña F, Cano T, Domenech V, Alcalde MJ, Martos J, García-Martinez A, Herrera M, Rodero E (2005). Influence of sex, slaughter weight and carcass weight on "non-carcass" and carcass quality in Segureña lambs. Small Rumin. Res. 60:247-254.

Ruiz de Huidobro F, Miguel E, Díaz MT, Velasco S, Lauzurica S, Pérez C, Onega E, Blázquez B, Cañeque V (2003). Carcass classification in suckling lambs. II. Comparison among subjective carcass classification methodsis the fatness scales and conformation scales with 0.25 point-intervals. Meat Sci. 63:135-142.

Russo C, Preziuso G, Verita` P (2003). EU carcass classification

systemis the carcass and meat quality in light lambs. Meat Sci. 64:411–416.
SAS (2000). SAS User's Guide, version 9.1. Cary, NCis the SAS Institute Inc.
Stanisz M (2010). Uproszczona, poubojowa metoda szacowania składu tkankowego tuszy jagniąt mięsnego typu użytkowego. [A simplified, post-slaughter method of estimating carcass tissue composition in meat-type lambs.] Wydawnictwo Uniwersytetu Przyrodniczego w Poznaniu. Rozprawy Naukowe. 415:1-142 .
Ślósarz P, Gut A, Stanisz M, Steppa R, Wójtowski J, Danków R (2001). Assessment of intramuscular fat content in the *Longissimus dorsi* muscle in live lambs on the basis of ultrasound image. Arch. Tierz. 44:344-350.
Ślósarz P, Stanisz M, Pietrzak M, Gut A, Łyczyński A, Steppa R (2004). The use of computer image analysis for evaluation of selected meat quality indices in lambs. Arch. Tierz. 47: 169-174.
Ślósarz P, Stanisz M, Boniecki P, Przybylak A, Lisiak D, Ludwiczak A (2011). Artificial neural network analysis of ultrasound image for the estimation of intramuscular fat content in lamb muscle. Afr. J. Biotechnol. 10(55):11792-11796.
Toldi Gy, Mezőszentgyörgyi D, Lengyel A (1999). Connection between sheep carcasses', S/EUROP qualification and several cutting parameters. Acta Agraria Kaposvariensis 3:25-34.