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GROWTH PERFORMANCE AND MEAT QUALITY CHARACTERISTICS OF LAMBS FROM DIFFERENT GENOTYPE

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Abstract

Thirty male lambs from three genotype, Tsurcana (TA) und its crossbreed with Palas Meat Breed (PMB) and German Blackface (GBF) (ten from each genotype) were used to determine the effects of breed on growth performance and meat quality characteristics. Average daily gain in the period 0-153 days, final weight and warm carcass weight were higher in GBF x TA lambs than to the lambs from TA and PMB x TA groups, and hot slaughter yield were higher in TA compared to the lambs from GBF x TA and PMB x TA groups. Furthermore, except average daily gain and weight at 28 days (W28), 56 days (W56) and weaning weight (WW), the lambs from the three genotype did not show significant differences for the other traits (P>0.05). PMB x TA lambs had the lowest scores in terms of differences of juiciness and appearance than GBF x TA when compared with TA group, but higher scores in terms of differences of tenderness, flavour, the difference of specific lamb taste and overall difference. In conclusion, when the breed is to be decided, the PMB x TA lambs should be by consumers appreciated for meat quality and GBF x TA for growth performances.

Key words: *flavor, juiciness, German Blackface, Palas Meat Breed, Tsurcana.*

INTRODUCTION

With a population of 9.98 million sheep, Romania occupies in the year 2020 (after Brexit) the second place in sheep breeding sector in UE, the first place being occupied from Spain (FAOSTAT, 2020). Sheep breeding in Romania is usually performed by the use of native breeds (Tsurcana, Tsigai and Merino) and also using traditional methods - which are similar to many countries in the Middle East. Tsurcana sheep breeds are usually triple-purpose breeds, being reared for meat, milk and wool. Romanian indigenous Tsurcana, accounting over 6 million heads (Dărăban et al., 2009; Ilișiu et al., 2010). Its characteristics are the following: adult body weight of 45-50 kg in ewes and 70-75 kg in rams, growth rates of 110-160 g/day and 105-115% prolificacy (Georgescu et al., 2000).

The German Blackface breed is characterized by a birth rate of 94.11%, a prolificity of 150.5%, a percentage of weaned lambs of 132.4% (Dărăban, 2006). It was introduced first in Romania starting in autumn 1993 when a nucleus of males from Germany was brought to the Research Station for Sheep and Goats Reghin, in order to determine the combinability value for meat production with the Tsigai breed, existing in the unit. The crossbreed lambs obtained between German Blackface and the Tsigai breed achieved an average daily gain of 270 g.

The Palas Meat Breed is a new Romanian breed, approved in 2012, which was formed by crossing of the Ile-de-France and Merino of Palas breeds, followed by breeding isolation and selection in the direction of increasing meat production. The lambs in the pure breed realize at intensive fattening an average daily gain of 280-300 g and a slaughter yield of 45-48%.

The globalization of markets has resulted in greater economic integration, but at the same time has imposed the need to meet quality requirements to satisfy consumer demands. The meat industry and sheep producers must comply with certain quality standards to meet consumer demands and remain competitive in the global market. Eating quality of lamb and sheep meat has been examined by many researchers throughout the years (Weller et al., 1962; Dransfield et al., 1979; Crouse et al., 1981; Jeremiah et al. 1993; Braggins, 1996; Young et al., 2003; Gkarane et al. 2017) and has been shown to be affected by many pre- and post-slaughter factors such as gender, castration, diet, maturity, breed, processing methods, aging, freezing, and packaging. However, the method of action and influence of these factors and their possible interactions on lamb eating quality have frequently remained unclear.

Studies that have examined breed effects on lamb flavor characteristics have produced inconsistent results. Cramer et al. (1970) compared the flavor of meat produced by Rambouillet, Targhee, Columbia, and Hampshire lambs and reported that among-breed differences in meat flavor intensity paralleled differences in wool fineness - increased wool fineness was associated with more intense meat flavor. Based on these findings, they concluded that mutton flavor was most detectable in meat from fine wool breeds of sheep (Cramer et al., 1970). Similarly, Safari et al. (2001) reported a stronger meat flavor for straight-bred Merino lambs compared with Border Leicester × Merino crossbred lambs. In contrast, other reports suggest that breed has no effect on lamb flavor (Dransfield et al., 1979; Crouse et al., 1981; Duckett et al., 1999). In a more recent study, Shackelford et al. (2012) compared sensory properties of lamb produced by progeny of several different sire breeds, including Dorper, Dorset, Finnsheep, Katahdin, Rambouillet, Romanov, Suffolk, Texel, White Dorper, and Composite (1/2 Columbia, 1/4 Suffolk, 1/4 Hampshire). When compared at the same age, lamb flavor intensity scores were greater for progeny of Katahdin, Romanov, and Texel sires than for progeny of Suffolk, Composite, and Rambouillet sires; however, it was noted by the researchers that the observed breed differences in lamb flavor intensity were relatively small (Shackelford et al., 2012).

In this context, it is necessary to know how the breed affects the main characteristics of meat and carcass quality. Investigations have determined that breed (Crouse et al., 1981; Hopkins and Fogarty, 1998), can affect the characteristics of carcass and meat.

The aim of this study was to determine the growth performance and meat quality of Tsurcana lambs and its crossbreed lambs with Palas Meat Breed and German Blackface.

MATERIALS AND METHODS

Animals and experimental design

The study was conducted at a private sheep farm in Mureș County, 46°46' N/ 22°42'E; 395 m altitude; annual rain fall varies between 650-700 mm; average temperatures 19/–3°C during summer/winter, in the period September 2018-September 2019. A total of 45 ewes were separated from the herd and put into three groups at the beginning of the breeding season (15 ewes/groups), and mated with rams from three genotype, as follows: Tsurcana breed (TA), Palas Meat Breed (PMB) and German Blackface (GBF) breed. 30 male lambs from above mentioned genotype (10 from each group) were used in the research. Lambs were born in January-March interval. At birth or shortly thereafter, lambs were identified with ear tags and weighed (± 0.1 kg). Sex, date of birth, type of birth, dam and ram group were recorded. The lambs were also weighed monthly (± 0.1 kg) up to 5 month age. Ewes and their lambs were kept together under the same management condition. Up to weaning, the lambs were creep fed (*ad libitum*, 16% crude protein pellets) and weaned at 75 days of age. After weaning up to 5 month (153 days), the lambs are raised on pastures, and the diet consisted of pastures *ad libitum* and 300 g/head pellets with 16% crude protein content.

The research activities were performed in accordance with the European Union' Directive for animal experimentation (Directive 2010/63/EU).

Slaughter procedure, carcass characteristics and dissections

At the end of rearing, 3 male lambs from each genotype were brought to the abattoir for small and large animals from Reghin City. The lambs were weighed and then slaughtered. After the removal of non-carcass components, the carcass weights were recorded. Hot carcass yield was calculated based on pre-slaughter live body weight (LBW) and warm carcass weight (WCW), after formula:

HSY% = WCW x 100/LBW.

Meat sensory evaluation

In order to be used in meat quality analyses, LD muscle was removed from right side of the carcasses at 2 h post-slaughter and were packed. For sensory evaluation, meat samples were frozen and kept at –18°C until the day before of panel evaluation. Meat samples, which were served to untrained panelists, were prepared according to the methodology described by AMSA (2015). Sensory characteristics of cooked samples were assessed by 24 panelists using the degree of difference test. The panelists assessed the lambs breed difference in juiciness, tenderness, flavour, appearance, the difference of specific lamb taste and overall difference. The scale used has a seven point category (scale 1 = no difference, 2 = very small difference, 3 = small difference, 4 = moderate difference, 5 = big difference, 6 = very big difference, 7 = extremely big difference). Were evaluated meat from GBF x TA and PMB x TA crossbreed lambs, compared to TA pure breed.

Traits Definition

The traits investigated were classified as lamb, carcass, and meat traits. Early growth traits consisted of birth weight (BW); weight at 28 day (W28); weight at 56 day (W56); weaning weight (WW); post-weaning weights at 5 months (W5M).

Carcass traits included warm carcass weight (WCW) and hot slaughter yield (HSY).

Meat sensory characteristic refers to juiciness, tenderness, flavor, appearance the difference of specific lamb taste and overall difference.

Statistical analyses

In order to determine the effect of breed on growth performance, carcass and meat quality characteristics, the mean comparisons between the three groups of the variables were carried out using independent samples Student t-test of the JASP procedure.

RESULTS AND DISCUSSIONS

The effects of breed on lamb growth performance are presented in Table 1. Significant differences (P< 0.05) were recorded between the crossbreed lambs PMB x TA and the others two groups with regard at W28, W56 and WW. Also, significant differences (P<0.05) were found between PMB x TA and GBF x TA with regard at W5M.

Table 1. Means ± SE (standard errors) for body weight evolution from birth up to 5 months for the lambs from different genotype (kg)

Characteristics	GBF x TA	PMB x TA	TA x TA
BW	4.04 ± 0.22^{a}	4.09 ± 0.10^{a}	4.04 ± 0.11^{a}
W28	12.45 ± 0.71^{a}	10.21 ± 0.66^{ab}	12.95 ± 0.91^{a}
W56	19.00 ± 0.87^{a}	15.98 ± 1.06^{ab}	20.40 ± 1.51^{a}
WW	23.19 ± 1.33^{a}	18.90 ± 1.38^{ab}	24.27 ± 1.69^{a}
W5M	32.79 ± 2.49^{a}	25.86 ± 1.80^{b}	28.68 ± 1.65^{a}

^{a,b}Means in the same line with different superscripts are significantly different (P<0.05).

The average daily gain (Table 2) were significantly higher in Tsurcana lambs than in GBF x TA crossbreed lambs (P<0.001) in birth-weaning period and in GBF x TA compared with PMB x TA in birth - 28 days (P<0.01) and birth - 5 months (P<0.05). Also, significant differences (P<0.05) were found between PMB x TA and TA x TA with regard at ADG birth - 28 days and ADG birth - weaning.

The effects of the breed on carcass quality characteristics are shown in Table 3. TA x TA lambs presented higher hot slaughter yield. However, there were no significant differences between the three genotypes in terms of these traits.

Table 2. Means ± SE (standard error) for average daily gain (ADG - g) evolution from birth up to 5 months for lambs from different genotype

Characteristics	GBF x TA	PMB x TA	TA x TA
ADG birth - 28 days	300.36 ± 20.00^{a}	218.57 ± 24.3^{ab}	318.21 ± 32.36^{a}
ADG 28 - 56 days	233.94 ± 26.69^{a}	206.07 ± 20.18^{a}	266.07 ± 36.88^{a}
ADG birth - weaning	253.59 ± 13.60^{a}	226.00 ± 17.00^{ab}	271.00 ± 17.00^{b}
ADG birth - 5 months	182.20 ± 14.10^{a}	147.12 ± 10.76^{b}	157.48 ± 9.58^{a}

^{a,b}Means in the same line with different superscripts are significantly different (P<0.05, P<0.01, P<0.001).

Table 3. Means ± SE for hot slaughter yield of lambs from different genotype

Characteristics	GBF x TA	PMB x TA	TA x TA
LBW, kg	38.33 ± 1.59	35.50 ± 1.26	36.50 ± 0.29
WCW, kg	18.05 ± 1.59	17.08 ± 0.68	17.80 ± 0.17
HSY, %	46.90 ± 2.20	48.37 ± 3.52	48.78 ± 0.86

GBF x TA crossbreed lambs were slaughtered at higher slaughter weight than PMB x TA and TA x TA lambs, although all lambs were at similar ages in the research. These differences in final live weight might be explained by the effect of breed. The average daily gain for the two period (pre-weaning and post-weaning) were higher in the suckling period, and between groups, were higher for TA x TA lambs compared to GBF x TA and PMB x TA. Post-weaning, the ADG were higher for GBF x TA lambs.

Although GBF x TA crossbreed lambs had higher live body weight and warm carcass weight, the hot carcass yield were higher to TA x TA breed, followed of PMB x TA lambs.

Sensory characteristics of meat are presented in Table 4.

Table 4. Means ± SE for meat sensory characteristics of lambs from different genotype

Characteristics	N	Genotype	
		GBF x TA	PMB x TA
Juiciness	24	3.67 ± 0.34	3.29 ± 0.25
Tenderness	24	4.13 ± 0.34	4.18 ± 0.27
Flavour	24	3.58 ± 0.31	3.92 ± 0.27
Appearance	24	3.29 ± 0.32	2.88 ± 0.23
The difference of specific lamb taste	24	3.46 ± 0.37	4.08 ± 0.32
Overall difference	24	3.83 ± 0.32	4.21 ± 0.28

Discussions

GBF x TA crossbreed lambs were slaughtered at higher slaughter weight than PMB x TA and TA x TA lambs, although all lambs were at similar ages in the research. These differences in final live weight might be explained by the effect of breed. The average daily gain for the two period (pre-weaning and post-weaning) were higher in the suckling period, and between groups, were higher for TA x TA lambs compared to GBF x TA and PMB x TA. Post-weaning, the ADG were higher for GBF x TA lambs. Although GBF x TA crossbreed lambs had higher live body weight and warm carcass weight, the hot carcass yield were higher to TA x TA breed, followed of PMB x TA lambs.

Lamb flavour, tenderness, the differences of specific lamb taste and overall difference perception of panelists were influenced by breed in the present study. Meat preferences of consumers are associated with socio-economic factors, ethics or religious believe and tradition (Font-i-Furnols and Guerrero, 2014). For instance, a highly preferred meat flavour in one culture, region or country may be perceived as less preferable or unacceptable in another (Schreurs et al., 2008). Overall difference scores given to lamb could be reflection of the meat tenderness, flavour intensity and quality perception of panelists (Ekiz et al., 2012). In particular, flavour which can be the determining feature in acceptance or rejection of the meat, is an important aspect for consumer preferences (Schreurs et al., 2008). The highest scores in terms of flavour and tenderness difference, as well as for the differences of specific lamb taste and overall difference were given to meat from PMB x TA crossbreed lambs.

The effect of breed on lamb flavor has been a topic of interest for many years (Jacobson and Koehler, 1963; Duckett et al., 1999; Elmore et al., 2000; Sanudo et al., 2000) many of which have reported no differences in lamb flavor due to breed or sire breed in crossbred studies (Fox et al., 1962; Dransfield et al., 1979; Mendenhall and Ercanbrack, 1979; Crouse et al., 1981).

Researchers who have found significant differences in flavor based on breed or sire breed have hypothesized why breed may or may not have an influence on flavor. Cramer (1983) suggested that wooled sheep might possess a mechanism for sulphur (S) storage, because wool is abundant in the amino acid cysteine. It is known that cysteine contains disulfide bonds between their thiol groups which in theory would cause sheep to have a higher S requirement than other meat producing livestock.

CONCLUSIONS

We found that growth rate and carcass weight were higher for GBF x TA crossbreed lambs. On the other hand, TA pure breed and PMB x TA lambs had higher values in terms of hot slaughter yields than GBF x TA lambs. Furthermore, results of sensory analyses indicate that meat from PMB x TA lambs had higher value of tenderness, flavour, the difference of specific lamb taste and overall difference as meat from GBF x TA lambs, when compared with meat from TA pure breed lambs. The results of the current study indicate that GBF x TA lambs had higher growth performances than TA pure breed and PMB x TA lambs, and meat of PMB x TA is better appreciated by consumers.

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