Research Regarding the Quality of Lambs Carcass Resulted from Tsigaia Purebred Compared with Hybrids of Tsigaia Ewes Crossed with Blanc du Massif Central Rams

Mihai Marian BORZAN^{1*}, Dana PUSTA¹, Liviu BOGDAN², Alexandra TĂBARAN¹, Attila MÁTÉ², Ioan PAȘCA¹

¹Department of Animal Productions and Food Safety, University of Agricultural Sciences and Veterinary Medicine, Cluj-Napoca, Romania

²Department of Clinics, University of Agricultural Sciences and Veterinary Medicine, Cluj-Napoca, Romania

³Agricultural Research and Development Station, Turda, Romania

*corresponding author: mihai_borzan@yahoo.com

Bulletin UASVM Veterinary Medicine 74(1) / 2017,
Print ISSN 1843-5270; Electronic ISSN 1843-5378
DOI:10.15835/buasvmcn-vm: 12431

Abstract

The research aims to compare some qualitative characteristics of purebred Tsigaia lambs and Tsigaia crossed with Blanc du Massif Central lambs. The criteria assessed were: the chemical composition of purebred and hybrid meat, the live body weight, the slaughtering performance and, the weight of different carcass cuts. For almost all criteria chosen the hybrid individuals recorded better results.

Keywords: *lamb carcasses, Blanc du Massif Central hybrids, meat quality, Tsigaia*

INTRODUCTION

The Tsigaia sheep breed has good meat production characteristics and it is suitable for crossing with other sheep breeds specialized for meat production to obtain F1 hybrids according to market demands (Georgescu *et al.*, 2000; FAO 2014). The quality of the sheep meat is influenced by many factors including genetic and environmental factors (Băia, 2005; Pascal *et al.*, 2014).

The crossing the of the Tsigaia breed with a French meat breed like Blanc du Massif Central (BMC) is important to increase the quality of the resulting lambs carcasses. The Blanc du Massif Central breed has never been used before in crossings with Romanian breeds.

This is an original research and presents preliminary data regarding the carcass characteristics of the hybrid lambs resulted from the crossing of the French sheep breed with the Tsigaia breed.

The aim of this research was to compare some quality parameters of Tsigaia lamb meat and Tsigaia crossed with Blanc du Massif Central lambs.

Hypothesis **H1**₀ = The carcass quality of purebred Tsigaia (μ_1) and Tsigaia with Blanc de Massif Central lambs crossed (μ_2) is identical: $\mu_1 = \mu_2$

Hypothesis **H1**₁ = The carcass quality of purebred Tsigaia (μ_1) and Tsigaia with Blanc de Massif Central lambs crossed (μ_2) is different: $\mu_1 \neq \mu_2$

Hypothesis **H2**₀ = Carcass quality of Tsigaia crossed with Blanc de Massif Central lambs (μ_2) is identical with those of purebred Tsigaia (μ_1),

Tab. 1. Mean values and standard deviation for certain chemical compounds of meat from purebred Tsigaia and Tsigaia with BMC hybrid lambs

	Water (%)	Fat (%)	Protein (%)	Collagen (%)
Crossbred Tsigaie with BMC	69.23±2.72	12.51±3.84	16.28±1.04	1.93±0.20
Purebred Tsigaia	74.73±1.08	4.93±1.27	17.31±0.59	1.70±0.23

regardless of the body cut analyzed (full leg, shoulder, Longissimus dorsi, ribs): $\mu_1 = \mu_2$

Hypothesis **H2₁** = Carcass quality of Tsigaia crossed with Blanc de Massif Central lambs (μ_2) is different of those purebred Tsigaia (μ_1), regardless of the body cut analyzed (full leg, shoulder, Longissimus dorsi, ribs): $\mu_1 \neq \mu_2$

MATERIALS AND METHODS

The study has been carried out in 2015-2016 years.

The purebred and crossbred lambs were produced at Agricultural Research and Development Station, Turda following estrus synchronization and a grouped lambing. The lambs selected for slaughtering had the same age and were kept in similar housing and feeding conditions. After slaughtering, for each lamb the carcass weight was assessed and the best cuts of the carcass were weighted and recorded. Then the bones to muscles and muscles to fat ratios were assessed according to protocols found in literature (Fahmy *et al.*, 1992; Geay *et al.*, 2002; Laville *et al.*, 2002). Fourteen samples were collected from the carcass in order to be analyzed with a Food scanner which can accurately detect the protein content, the water, the fat, and the collagen percentage of the carcass (Mihaiu *et al.*, 2015). The chemical analysis was performed with the FoodScan™ for meat.

The quality parameters assessed in this study were as follows:

- the first quality criterion chosen in this study was the chemical composition of purebred and Tsigaia crossbred lamb meat;
- the second quality criterion were the live body weight and the slaughtering performance;
- the third criterion were the weight of different carcass cuts (full leg, shoulder, Longissimus dorsi, ribs).

The results were statistical evaluated using ANOVA test and t-Test, mean values and standard deviation, at $p=0.05$.

RESULTS AND DISCUSSION

Comparing the results of the chemical analysis for the carcasses of purebred Tsigaia lambs and crossbred lambs revealed that the water had higher values in the meat of purebred Tsigaia lambs (74.73±1.08 compared with 69.23±2.72), and the fat quantity was superior in the carcass of crossbred lambs (12.51±3.84 compared with 4.93±1.27).

The percent of the protein and collagen were almost equal for both the carcasses of purebred and crossbred lambs, slightly higher values for protein were recorded in purebreds and slightly higher collagen values were recorded in crossbreds (table 1).

Mean values and standard deviation of body weight in Tsigaia and BMC crossbreds and in Tsigaia purebred are shown in Table 2. It can be observed that the average slaughtering performance is superior in crossbreds than in the purebred lambs and all the averages of all the analyzed cuts, even though they had the same age and were kept in the same conditions.

Statistical analysis using ANOVA single factor test and T-test confirms that there is a statistical difference between the live weight of the purebred Tsigaia lambs compared with crossbreds, at $p=0.05$ ($\mu_1 \neq \mu_2$). The average of the live body weight in crossbreds is superior to that of the purebreds at the same age and kept in the same conditions (Table 3 and 4).

Statistical analysis using ANOVA single factor test and T-test revealed that there is no statistical difference at $p=0.05$ between the slaughtering performance of the crossbred Tsigaia lambs and purebreds ($\mu_1 = \mu_2$) (Table 5 and 6).

In the literature, there were no other similar studies to compare the results of our study. The research is original and represents the first crossing between Blanc du Massif Central breed and Tsigaia breed.

Concerning the carcass weight, the full leg, the shoulder, Longissimus dorsi and the ribs

Tab. 2. Mean values and standard deviation of body weight at slaughtering in purebreds and in crossbreds lambs

Lambs	Live weight (kg)	Carcass weight (kg)	Full leg weight (kg)	Shoulder weight (kg)	Longissimus dorsi weight (kg)	Ribs weight (kg)	Slaughtering performance%
Crossbred Tsigaia with BMC	26.63±2.92	13.30±1.21	4.72±0.35	2.71±0.23	1.14±0.15	4.20±0.31	50.00±1.41
Purebreds Tsigaia	16.11±0.97	7.90±0.38	2.80±0.13	1.63±0.18	0.41±0.04	2.94±0.15	49.00±1.15

Tab. 3. Anova test of the live weight of crossbred Tsigaia with BMC and purebred Tsigaia lambs (at p=0,05)

Anova: Single Factor						
SUMMARY						
Groups	Count	Sum	Average	Variance		
Column 1	7	186,4	26,628571	8,545714286		
Column 2	7	112,8	16,114286	0,931428571		
ANOVA						
Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	386,9257	1	386,92571	81,65450708	1,05813E-06	4,74723
Within Groups	56,86286	12	4,7385714			
Total	443,7886	13				

Tab. 4. t-Test of the live weight of crossbred Tsigaia with BMC and purebred Tsigaia lambs (at p=0,05)

t-Test: Two-Sample Assuming Equal Variances		
	Variable 1	Variable 2
Mean	26,62857143	16,11428571
Variance	8,545714286	0,931428571
Observations	7	7
Pooled Variance	4,738571429	
Hypothesized Mean Difference	0	
df	12	
t Stat	9,036288347	
P(T<=t) one-tail	5,29067E-07	
t Critical one-tail	1,782287548	
P(T<=t) two-tail	1,05813E-06	
t Critical two-tail	2,178812827	

Tab. 5. ANOVA test for slaughtering efficiency of crossbred Tsigaia with BMC lambs and purebreds (at $p=0,05$)
Tsigaia lambs

Anova: Single Factor						
SUMMARY						
Groups	Count	Sum	Average	Variance		
Column 1	7	350	50	2		
ANOVA						
Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	3,5	1	3,5	2,1	0,172924218	4,747225336
Within Groups	20	12	1,666666667			
Total	23.5	13				

Tab. 6. T-test for slaughtering efficiency of crossbred Tsigaia with BMC lambs and purebreds Tsigaia lambs (at $p=0,05$)

t-Test: Two-Sample Assuming Equal Variances		
	Variable 1	Variable 2
Mean	50	49
Variance	2	1,333333333
Observations	7	7
Pooled Variance	1,666666667	
Hypothesized Mean Difference	0	
df	12	
t Stat	1,449137675	
P(T<=t) one-tail	0,086462109	
t Critical one-tail	1,782287548	
P(T<=t) two-tail	0,172924218	
t Critical two-tail	2,178812827	

weights resulted after the butchering of the lambs, the results of ANOVA test revealed that: $F > F_{crit}$, the results cancel the H_{2_0} hypothesis and accepts the H_{2_1} hypothesis, according to which the weights of the cuts are different between purebreds and crossbreds Tsigaia lambs (Table 7, 8, 9, 10, 11).

The carcass weight, the full leg, the shoulder, Longissimus dorsi and the ribs weights resulted after the butchering of the lambs were statistical analyzed using the t-Test method: $t_{Stat} \geq t_{Critical}$ two-tail, respectively $11.27 \geq 2.17$; $13.72 \geq 2.17$; $9.92 \geq 2.17$; $12.36 \geq 2.17$; $9.75 \geq 2.17$. The results suggest that H_{2_0} hypothesis is rejected and the H_{2_1} hypothesis is accepted meaning that carcass, full leg, shoulder, Longissimus dorsi and ribs weights

resulted from the crossed Tsigaia with Blanc de Massif Central lambs are different that the weights of purebred Tsigaia lambs.

The carcass, full leg, shoulder, Longissimus dorsi and ribs weights are different between the crossbred Tsigaia and BMC lambs compared with purebred Tsigaia, fact confirmed by the statistical difference at $p=0.05$.

There is a statistical difference at $p=0.05$ between carcass, full leg, shoulder, Longissimus dorsi and ribs weights to crossbred Tsigaia compared with purebred Tsigaia, the crossbred recording superior weights.

The bones/meat ratio reveals similar values, with a slight difference for the crossbreds. Superior values were recorded for the crossbred Tsigaia

Tab. 7. ANOVA test for carcass weight (kg) for purebred Tsigia and crossbred Tsigia with BMC lambs (at $p=0,05$)

Anov a: Single Factor

SUMMARY

Groups	Count	Sum	Average	Variance
Column 1	7	93,1	13,3	1,46
Column 2	7	55,3	7,9	0,146666667

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	102,06	1	102,06	127,0456432	9,68646E-08	4,747
Within Groups	9,64	12	0,803333333			
Total	111,7	13				

Tab. 8. ANOVA test for full leg weight (kg) for purebred Tsigia and crossbred Tsigia with BMC lambs (at $p=0,05$)

Anova: Single Factor

SUMMARY

Groups	Count	Sum	Average	Variance
Column 1	7	33,100	4,729	0,122
Column 2	7	19,600	2,800	0,016

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	13,018	1	13,018	188,508	1,06426E-08	4,74723
Within Groups	0,829	12	0,069			
Total	13,847	13				

Tab. 9. ANOVA test for shoulder weight (kg) for purebred Tsigia and crossbred Tsigia with BMC lambs (at $p=0,05$)

Anova: Single Factor

SUMMARY

Groups	Count	Sum	Average	Variance
Column 1	7	19	2,714285714	0,051428571
Column 2	7	11,4	1,628571429	0,032380952

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	4,125714	1	4,125714286	98,45454545	3,89546E-07	4,747225336
Within Groups	0,502857	12	0,041904762			
Total	4,628571	13				

with BMC lambs carcass analysis compared with purebred Tsigia. The meat/fat ratio in crossbreds was superior for crossbreds compared with the ratio recorded for purebreds Tsigia lambs (Table 12).

The full leg and the cutlet are the primary cuts with high commercial value and with higher meat share in the carcass representing superior quality (Fahmy *et al.*, 1992; Pascal *et al.*, 2014). The crossbreds Tsigia lambs recorded

Tab. 10. ANOVA test for Longissimus dorsi weight (kg) for purebred Tsigaia and crossbred Tsigaia with BMC lambs (at $p=0,05$)

Anova: Single Factor

SUMMARY

Groups	Count	Sum	Average	Variance
Column 1	7	8	1,142857143	0,022857143
Column 2	7	2,9	0,414285714	0,001428571

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	1,857857143	1	1,857857143	153	3,44737E-08	4,747225336
Within Groups	0,145714286	12	0,012142857			
Total	2,003571429	13				

Tab. 11. ANOVA test for Ribs weight (kg) for purebred Tsigaia and crossbred Tsigaia with BMC lambs (at $p=0,05$)

Anova: Single Factor

SUMMARY

Groups	Count	Sum	Average	Variance
Column 1	7	29,4	4,2	0,093333333
Column 2	7	20,6	2,942857143	0,022857143

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	5,531428571	1	5,531428571	95,21311475	4,66499E-07	4,747225
Within Groups	0,697142857	12	0,058095238			
Total	6,228571429	13				

Tab. 12. Meat/bone ratio and meat/fat ratio at crossbred Tsigaia with BMC and purebred Tsigaia lambs

	Bone/meat ratio	Meat/fat ratio
Tsigaia with BMC	1:3.95	5.36 :1
Purebred Tsigaia	1:3.89	10.01:1

Tab. 13. The carcass share of the primary cuts with high commercial value (%)

Cuts	Tsigaia x BMC	Purebred Tsigaia
Full leg	29.8	28.2
Cutlet	15.8	15.4
Neck and shoulder blade	26.4	30.8
Breast and chump	25.9	25.6

a higher percent in the carcass comparative to the purebred Tsigaia lambs for the primary cuts (Table 13).

The study confirmed the hypothesis which stated that there are significant differences at

$p=0.05$ between the analyzed data of crossbreds Tsigaia with BMC lambs and purebreds lambs, except for the slaughtering performance.

CONCLUSION

The research confirmed the advantages of crossing the local Tsigaia breed with Blanc du Massif Central breed; the resulted crossbred lambs presented superior development compared with purebred Tsigaia lambs.

The study recorded the preliminary results of a research concerning a technology to improve the meat quality in sheep sector. The hybrid lambs obtained proved their

The quality of meat parameters evaluated (bone-meat ratio, meat-fat ratio, chemical content of the carcass) was associated with the fattening status of the carcasses and were superior for the hybrid lambs compared with the purebred Tsigaia lambs.

The analysis performed on crossbreds (live bodyweight and carcass) confirmed that the crossing of the Tsigaia ewes with BMC rams improves the quality characteristics of the Romanian lambs, demanded in the EU market.

Acknowledgements: This work has benefited from financial support through the PN-II-PT-PCCA-2013-4-1239 project, No: 152/01.07.2014, "Obtaining the Romanian meat lamb - OVICARO".

REFERENCES

1. Băia G. (2005). Studiu privind unele caractere de baza ale rasei de oi Tigaie, varietatea ruginie. Analele IBNA vol. 21: 89-98.
2. Fahmy MH, Boucher MJ (1992). Feed efficiency, carcass characteristics and sensory quality of lambs. Journ. of Anim. Sci. 70(5).
3. FAO STATISTICAL YEARBOOK (2014). Europe and Central Asia Food and Agriculture, Food and Agriculture Organization of the United Nations Regional Office for Europe and Central Asia Budapest, E-ISBN 978-92-5-108168-6.
4. Geay Y. (2002). Valeur dietetique et qualites sensorielles des viands de ruminantes. Incidence de l'alimentation des animaux. INRA Prod. Anim., 15(1), 37-52.
5. Georgescu B, Banu C, Croitoru C, Savu C, Tafta V, Van I, Lungu S, Movileanu G (2000). Tratat de producerea, procesarea si valorificarea carni. Ed. Ceres, Bucuresti.
6. Laville E, Bouix J, Sayd T, Eychenne F, Marcq F, Leroy PL, Elsen JM, Bibe B (2002). La conformation bouchere des agneaux. Etude d'apres la variabilite genetique entre races. INRA, Productions animales 15(1).
7. Mihaiu M, Tăbăran A, Mihaiu R, Dan SD, Reget O (2015). Compositional Studies on Some Additive Concentrations Found in Meat Products Marketed in a Regional Area, Bulletin UASVM Veterinary Medicine 72(1): 53-56.
8. Pascal C, Nechifor I (2014). The effect of crossing romanian sheep breeds with rams of meat breeds over the specific indicators of meat production, Lucrări Științifice - Seria Zootehnie, vol. 61.
9. Schmid A (2006). Conjugated linoleic acid in meat and meat products. A review, Meat Sci. 73(1): 29-41.