Influence of Ram on Body Weight Evolution of Tsigai Lambs

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Abstract
The present study was conducted to determine the effect of ram and sex on growth performances of Tsigai lambs – rusty variety from birth to 7 months in two life periods: birth – weaning and aftter weaning. Up to weaning, the research was conducted on a number of 222 lambs, and after weaning on 186 lambs (98 females and 88 males) coming from 10 rams' groups. Significant differences ($p<0.001$) between lots were recorded regarding body weight at 28 days, ADG 0-28 days and ADG 0-weaning.
The overall highest mean weight of lambs at 7 months was 37.29 kg and the smaller 30.15 kg, and between sex, the highest mean weight was 41.50 kg recorded by male lambs from Tsigai breed, while to female was 29.09 kg. No statistical differences were found ($p>0.05$) between the offsprings of the ram groups regarding body weight at 7 months and average daily gain after weaning.

Keywords: growth performances, lambs, ram, Tsigai

1. Introduction

The Tsigai- rusty variety is a rustic breed with modest productions and with a remarkable resilience to diseases and climate changes. In Romania it occupies the second place after Tsurcana breed when referring to population sizes. Tsigai sheep are primarily raised in mountainous and sub-mountainous areas with ample grazing pastures. This versatile breed is mainly valued for cheese production, although there has been a growing interest in lamb production recently due to export opportunities in the EU [1]. To improve this breed into being a more productive breed, it is important that the rams used for breeding to be the best performing rams in the flock.
Genetics play an important role in the growth potential of lambs. Rams that are used for breeding have a strong influence on lamb growth. In this context, farmers need to consider their ram purchases to fit their lamb management, production and marketing system.
New Zeeland developed a program named "Central Progeny Test Rams" [2], a program that allows to know which rams are the best performing. This program compares the offsprings of a ram with offsprings of other rams kept in similar conditions. This program developed by New Zeeland was not meant to compare breeds, but to compare rams. The testing after offsprings focused on identifying the best genetic values regardless of breed. In this sense, they created a brochure that contains the EBV and growth

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indexes of the rams included in the testing program [3].
The aim of this study was to determine the influence of ram and sex on growth performance of Tsigai lambs.

2. Materials and methods

The present research was conducted in Experimental Base Reghin of Research Institute for Sheep and Goat Palas Constanta, Mures 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).
A number of 222 lambs Tsigai pure breed in the birth-weaning period and 186 lambs (98 females and 88 males) in the weaning - 7 months period was used as biological material for this study. The lambs are the results of the lambing of 10 female lots (297 female divided into ten lots L1-L10 were mated with 10 different males, with a rapport of 30 ewes/lot in 2023). From this, in the spring of 2024, 251 sheep lambed 278 lambs (including non-viable lambs). Due to the fact that after first month of life, 30 lambs were weaned and sent to Research Institute for Sheep and Goat Palas Constanta to be included in other research projects, our research were conducted on 222 lambs up to weaning. In the mating period (22.08.2023-6.10.2023), all ewes were kept in the pastures, and the rams were sheltered on the same pasture. The mating was done by the natural controlled mating based on mating plans (choosing ewes in oestrus every morning at 7 o' clock using testing rams and assigning ewes to the rams).
Lambs were born between January and March and were identified and weighed (to the nearest 0.1 kg with model scale WH-A08) within the first 24 hours, during which ear tags were applied. Information on sex, date of birth, birth type, and the corresponding dam and ram groups was recorded. Ewes and their lambs were kept together under the same management conditions for two months after lambing. At 28 days and weaning, the weighing was made with a WL-HY-300 scale (to the nearest 0.1 kg at 28 days and 0.5 kg at weaning); weighing usually took place in the second half of the day, between 1:00 PM and 3:00 PM. Weaning age was comprised between 52 and 64 days. During the suckling period, the lambs' diet was designed to support a growth rate of 250 g per head per day, in accordance with [4] guidelines.
Furthermore, the ewes' diet was designed to fulfil the nutritional requirements of late pregnancy and lactation. Throughout the experiment, they were provided with blocks of mineral and vitamin supplements. The concentrated fodder provided to lambs until and after weaning consisted of 55% corn flour, 30% barley flour, 12% sunflower groats, 2% calcium, and 1% salt. This concentrated fodder, along with hay, water, and salt, was made available ad *libitum*. The composition of the fodder is detailed in Table 1.

Table 1. The structure of the concentrated fodder used in lambs feeding

Specifications	Composition
Corn flour (%)	55.00
Barley flour (%)	30.00
Sunflower groats (%)	12.00
Calcium (%)	2.00
Salt (%)	1.00
DM kg/kg concentrated fodder	0.85
Digestible protein g/kg concentrated fodder	104.30
Digestible protein g/kg DM	122.71
Net energy MJ/kg fodder	10.02
Net energy MJ/kg DM	11.77

The computed composition was determined using tabular values derived from the ingredient composition of the experimental diet, as outlined in the [4] guidelines

Traits Definition

The traits studied were divided into pre-weaning and post-weaning growth traits. Pre-weaning growth traits included birth weight (BW), weight at 28 days (W28), weaning weight (WW) and weaning age (WA). Post-weaning growth traits included weight at 7 months (W7M). For both periods, average daily gain (ADG) and total gain (TG) were studied.

Statistical analyses

To assess the impact of ram and sex on lamb growth performance, mean comparisons between the variables were conducted using the Tukey test in the JASP program.

3. Results and discussion

The evolution of body weight during the birth-weaning period is shown in Table 2. From the data in Table 2, it can be observed that the average weight at birth was comprised between 3.57 kg and 4.18 kg, the differences between the 10 groups not being significant ($p>0.05$).

At 28 days of age, the average weight was comprised between 9.70 kg-13.09 kg, and at weaning between 15.85-21.18 kg. Statistical analysis revealed very significant differences ($p<0.001$) between group 9 and groups 1 and 4 regarding body weight at 28 days, the differences being recorded in favour of group 9. The weaning age was comprised between 51.95 - 63.47 days, the differences recorded not being statistically significant ($p>0.05$).

Table 2. The body weight evolution of lambs during birth-weaning period based on ram groups (mean ± SEM)

Lot	Ram number	N	BW (kg)	W28 (kg)	WW (kg)	WA (days)
1	RO1602228604	23	4.18 ± 0.14	10.07 ± 0.38^{A}	17.20 ± 0.64	61.22 ± 1.96
2	RO1612351621	26	4.11 ± 0.13	10.87 ± 0.36	17.46 ± 0.60	59.53 ± 1.84
3	RO1612351697	28	4.14 ± 0.12	11.61 ± 0.35	18.05 ± 0.58	60.75 ± 1.78
4	RO1612351698	24	3.57 ± 0.13	10.10 ± 0.38^{B}	16.50 ± 0.62	58.79 ± 1.92
5	RO1612351739	32	3.95 ± 0.12	10.69 ± 0.33	18.25 ± 0.54	59.25 ± 1.66
6	RO1619770107	21	4.04 ± 0.14	11.10 ± 0.40	17.19 ± 0.67	51.95 ± 2.05
7	RO1619770131	17	3.85 ± 0.16	10.12 ± 0.45	16.97 ± 0.74	63.47 ± 2.28
8	RO1619770283	30	3.99 ± 0.12	11.03 ± 0.34	17.48 ± 0.56	57.67 ± 1.72
9	RO1619964184	11	3.87 ± 0.20	13.09±0.55^{AB}	21.18 ± 0.92	60.82 ± 2.83
10	RO1619964288	10	3.63 ± 0.21	9.70 ± 0.58	15.85 ± 0.97	60.50 ± 2.97

$^{A, B}$ - Means with the same superscript in each column indicate very significant differences ($p<0.001$);

According to the data presented in Table 3, highly significant differences ($p < 0.001$) in total weight gain from birth to 28 days were observed between L9 and nearly all other lots, with the exception of L6 and L8. No statistically significant differences ($p > 0.05$) were found between the lamb groups in total weight gain from birth to weaning.

Table 3. The evolution of total gain of lambs in the birth-weaning period on ram groups (mean ± SEM)

Lot	Ram number	N	TG 0-28 days (kg)	TG 0-weaning (kg)
1	RO1602228604	23	5.89 ± 0.32^{A}	13.02 ± 0.59
2	RO1612351621	26	5.76 ± 0.30^{B}	13.35 ± 0.55
3	RO1612351697	28	7.47 ± 0.29	13.91± 0.53
4	RO1612351698	24	6.53 ± 0.31^{C}	13.93 ± 0.58
5	RO1612351739	32	6.74 ± 0.27^{D}	14.30 ± 0.50
6	RO1619770107	21	7.06 ± 0.33	13.15 ± 0.62
7	RO1619770131	17	6.27 ± 0.37^{E}	13.12 ± 0.68
8	RO1619770283	30	7.04 ± 0.28	13.49 ± 0.52
9	RO1619964184	11	9.22 ± 0.46^{ABCDEF}	17.31 ± 0.85
10	RO1619964288	10	6.07 ± 0.48^{F}	12.22 ± 0.89

$^{A, B, C, D, E, F}$ - Means with the same superscript in each column indicate very significant differences ($p<0.001$);

Analysis of the average daily gains (ADG) achieved by Tsigai lambs during the suckling period (Table 4) revealed very significant differences ($p < 0.001$) between L 9 and nearly all other groups, with the exception of L6 and L8, during the birth to 28 days of age period.

Very significant differences ($p<0.001$) were recorded from birth to weaning between L9 and the lots L1, L7. Across the two periods, the average daily gain (ADG) was higher during the first month of life in nearly all cases.

A high degree of variability was observed among the lamb groups in both periods. In absolute terms, the greatest difference in average daily gain (ADG) was 118.97 g between L9 and L1 during the birth to 28 days of age period, and 81.49 g during the birth–weaning period.

With regard at average daily gain up to weaning, our findings are superior to those obtained from [5] when following the impact of ram on body weight evolution of offspring coming from 10 groups of rams, the ADG was comprised between 185.78 g – 272.79 g. The evolution of body weight during the weaning -7 months period is presented in Table 5. Between the 10 breeding groups, no significant differences ($p>0.05$) were

recorded in the weaning -7 months period regarding body weight, although the maximum absolute difference recorded was 6.81 kg (between groups L9 and L4), the difference being in favour of group L9.

Table 4. The evolution of the average daily gain of lambs in the birth-weaning period on ram groups (mean ± SEM)

Lot	Ram number	N	ADG (g) Birth to 28 days of age	ADG (g) Birth to weaning
1	RO1602228604	23	210.25 ± 11.29^{A}	213.67 ± 8.90^{A}
2	RO1612351621	26	241.35 ± 10.62^{B}	227.15 ± 8.37
3	RO1612351697	28	266.71 ± 10.24	232.68 ± 8.07
4	RO1612351698	24	233.33 ± 11.06^{C}	221.59 ± 8.72
5	RO1612351739	32	240.62 ± 9.57^{D}	245.57 ± 7.55
6	RO1619770107	21	252.04 ± 11.82	255.32 ± 9.32
7	RO1619770131	17	223.74 ± 13.14^{E}	209.13 ± 10.36^{B}
8	RO1619770283	30	251.43 ± 9.89	235.59 ± 7.80
9	RO1619964184	11	329.22 ± 16.33^{ABCDEF}	282.54 ± 12.87^{ABC}
10	RO1619964288	10	216.79 ± 17.13^{F}	201.05 ± 13.50^{C}

$^{A, B, C D, E, F}$ - Means with the same superscript in each column indicate very significant differences ($p<0.001$);

Table 5. Lambs body weight of lambs after weaning (mean ± SEM)

Lot	Ram number	N	WW (kg)	W7M (kg)
1	RO1602228604	18	17.19 ± 0.75	30.78 ± 1.63
2	RO1612351621	24	17.58 ± 0.65	36.08 ± 1.41
3	RO1612351697	23	17.89 ± 0.66	34.00 ± 1.44
4	RO1612351698	21	16.62 ± 0.70	30.48 ± 1.51
5	RO1612351739	27	18.44 ± 0.61	36.15 ± 1.33
6	RO1619770107	18	17.22 ± 0.75	31.61 ± 1.63
7	RO1619770131	15	17.03 ± 0.82	33.10 ± 1.78
8	RO1619770283	26	17.81 ± 0.62	32.96 ± 1.35
9	RO1619964184	7	20.36 ± 1.20	37.29 ± 2.61
10	RO1619964288	7	16.64 ± 1.20	31.14 ± 2.61

As shown in Table 6, total weight gain from weaning to 7 months ranged between 13.58 kg and 16.93 kg. No statistically significant differences ($p > 0.05$) were observed between the lots in terms of total gain. The highest average daily gain (ADG) during this period was recorded in L9 at 138.91 g, while the lowest was in L1 at 87.59 g. Although the absolute difference in ADG between these two lots was 51.32 g, it was not statistically significant ($p > 0.05$).

Table 6. The total gain and ADG of lambs after weaning (mean ± SEM)

Lot	Ram number	N	TG (g) weaning – 7 months	ADG (g) weaning – 7 months
1	RO1602228604	18	13.58 ± 1.38	87.59 ± 9.04
2	RO1612351621	24	18.50 ± 1.20	119.07 ± 7.83
3	RO1612351697	23	16.11 ± 1.22	105.87 ± 7.99
4	RO1612351698	21	13.86 ± 1.28	93.98 ± 8.37
5	RO1612351739	27	17.70 ± 1.13	115.39 ± 7.39
6	RO1619770107	18	14.39 ± 1.38	95.10 ± 9.04
7	RO1619770131	15	16.07 ± 1.51	104.98 ± 9.90
8	RO1619770283	26	15.15 ± 1.15	107.70 ± 7.52
9	RO1619964184	7	16.93 ± 2.21	138.91 ± 14.49
10	RO1619964288	7	14.50 ± 2.21	111.58 ± 14.49

Body weight evolution from weaning to 7 months of age, analysed by gender and ancestry, is presented in Table 7. At 7 months, the average body weight of females across L1-L10 ranged

from 29.09 to 33.25 kg, while that of males ranged from 30.71 to 41.50 kg.

It should be noted that the differences recorded between the groups of animals, considering the two factors, ancestry and sex, are not statistically represented ($p>0.05$), even if the maximum absolute difference recorded was 12.41 kg. Using two different diet for two lots of lambs of Tsigai breed – rusty variety subjected to intensive fattening (135 g DP with 10.89 MJ NE for entire fattening period at L1 and 100 g DP with 11.29 MJ NE in the first two months of fattening, and 118 g DP with 11.29 MJ NE in the last month at L2), [6] has obtained a total gain of 22.07 kg and 227.19 g ADG at L1, and 22.01 kg TG with 226.76 g ADG at L2.

Table 7. Lambs' bodyweight after weaning depending on sex and ancestry (mean ± SEM)

Lot	Ram number	Sex	N	WW (kg)	W7M (kg)
1	RO1602228604	F	11	17.14 ± 0.96	30.82 ± 2.01
		M	7	17.29 ± 1.20	30.71 ± 2.52
2	RO1612351621	F	12	18.04 ± 0.92	33.25 ± 1.93
		M	12	17.13 ± 0.92	38.92 ± 1.93
3	RO1612351697	F	14	17.57 ± 0.85	32.50 ± 1.78
		M	9	18.39 ± 1.06	36.33 ± 2.23
4	RO1612351698	F	11	15.68 ± 0.96	29.09 ± 2.01
		M	10	17.65 ± 1.01	32.00 ± 2.11
5	RO1612351739	F	12	18.46 ± 0.92	33.00 ± 1.93
		M	15	18.43 ± 0.82	38.67 ± 1.72
6	RO1619770107	F	10	16.80 ± 1.01	31.10 ± 2.11
		M	8	17.75 ± 1.13	32.25 ± 2.36
7	RO1619770131	F	9	17.00 ± 1.06	30.00 ± 2.23
		M	6	17.08 ± 1.30	37.75 ± 2.73
8	RO1619770283	F	12	16.88 ± 0.92	31.92 ± 1.93
		M	14	18.61 ± 0.85	33.86 ± 1.78
9	RO1619964184	F	3	17.33 ± 1.84	31.67 ± 3.85
		M	4	22.63 ± 1.59	41.50 ± 3.34
10	RO1619964288	F	4	17.00 ± 1.59	29.25 ± 3.34
		M	3	16.17 ± 1.84	33.67 ± 3.85

Table 8. The total gain and ADG of lambs after weaning depending on sex and ancestry (mean ± SEM)

Lot	Ram number	Sex	N	Total gain (kg) weaning – 7 months	ADG (g) weaning – 7 months
1	RO1602228604	F	11	13.69 ± 1.69	88.15 ± 11.08
		M	7	13.43 ± 2.12	86.72 ± 13.88
2	RO1612351621	F	12	15.21 ± 1.62	98.33 ± 10.60
		M	12	21.79 ± 1.62	139.81 ± 10.60
3	RO1612351697	F	14	14.93 ± 1.50	96.92 ± 9.82
		M	9	17.94 ± 1.87	119.78 ± 12.24
4	RO1612351698	F	11	13.41 ± 1.69	90.58 ± 11.08
		M	10	14.35 ± 1.77	97.73 ± 11.62
5	RO1612351739	F	12	14.54 ± 1.62	96.50 ± 10.60
		M	15	20.23 ± 1.45	130.50 ± 9.48
6	RO1619770107	F	10	14.30 ± 1.77	95.43 ± 11.62
		M	8	14.50 ± 1.98	94.68 ± 12.99
7	RO1619770131	F	9	13.00 ± 1.87	87.76 ± 12.24
		M	6	20.67 ± 2.29	130.80 ± 15.00
8	RO1619770283	F	12	15.04 ± 1.62	103.08 ± 10.60
		M	14	15.25 ± 1.50	111.65 ± 9.82
9	RO1619964184	F	3	14.33 ± 3.24	109.03 ± 21.21
		M	4	18.88 ± 2.80	161.32 ± 18.37
10	RO1619964288	F	4	12.25 ± 2.80	97.77 ± 18.37
		M	3	17.50 ± 3.24	130.01 ± 21.21

Regarding the average daily gain depending on sex (Table 8), there were no recorded statistically significant differences ($p>0.05$) between males and females from L1-L10. In absolute values, the difference between the maximum (161.32g/day, in males from L9) and the minimum (88.15 g/day in females from L1) ADG recorded was 73.17 g/day. It can be observed that the ADG is higher in fast all lots to male compared to female; except the lots L1, L4 and L6 where the ADG value is fast similar for both male and female, in the all another lots the differences between sexes are high. The highest ADG differences within the same lot (between sexes) is recorded by L9 (52 g), but in other five lots the value of ADG differences are comprised between 22.86 - 43.04 g.

Comparing by periods, it is found that after weaning, the growth rate of lambs was substantially reduced compared to the suckling period, so that the difference between the highest ADG in the two periods was 143.63g (by L9).

4. Conclusions

1. In the period birth - 28 days and birth – weaning period, L9 recorded the highest ADG, with a value of 329.22 g, and 282.54 g respectively, differences being very significant statistically ($p<0.001$) between L9 and other five lots of lambs in the first 28 days, and between L9 and other two lots in the birth – weaning period.

2. The highest total gain in the birth – weaning period was 17.31 kg (by L9) and the lowest 12.22 kg (by L10), but de differences registered were not significant ($p>0.05$).

3. After weaning up to 7 months, the greatest average daily gain recorded was 138.91 g at L9 and the lowest 87.59 g at L1, the differences being not significant ($p>0.05$).

4. Between sexes, the highest ADG value of 161.32 g was recorded by L9 males, and the smallest 88.15 g at L1 females, the differences registered being not significant ($p>0.05$).

Acknowledgements

This research work was carried out with the support of Ministry of Agriculture and Rural Development of Romania, Department of Research and also was financed from Project ADER 7.1.1/2023.

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