Particularities on the Development of Body Weight from Birth to Weaning of the Merino of Cluj Lambs

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Abstract

The aim of this study was to highlight the body weight development from birth to 28 days and 56 days, of the Merino of Cluj lambs, determined by three main factors, namely: the type of birth, sex lambs and physiological status of the ewes. The study was conducted during 2008-2015 in the SDE UASVM Cluj-Napoca, where they were registered annually: lambs birth weight and gender, type of birth and age of sheep. Average weight at birth of lambs in 8 years of study was 3.88 ± 0.14 kg and, after statistical analysis were observed significant differences (P≥0.001) depending of the three factors. The evolution of the body weight at birth until weaning was calculated using the indices of growth, and thus it was found that the lambs were made accumulation of body weight daily average of 259.11 ± 2.37 g in the first 28 days after lambing and 222.62 ± 1.33 g in 56 days. In conclusion it can be argued that Merino of Cluj sheep have a potentially high lactogenic and lambs have good body development and high capacity by efficient utilization of food.

Keywords: average daily gain; body weight; lambs; Merino of Cluj

1. Introduction

The management of sheep has evolved from centuries of tradition based on religious rituals, cultural heritage, socioeconomic constraints, genetically diverse sheep populations and agriculture in arduous terrains under diverse climatic conditions [1,2]. The exploitation system, the development and application of the most appropriate technologies for ovine youth, is of particular importance for the numerical increase of sheep flocks and their productions [3]. The importance of ovine meat for Romanian people evolution is un-contesting but being put in evidence the fact that, in the exploitation of ovine species the meat had a secondary role, after wool and milk production, until 60-70 years of past century. In the previous period it was nearly generalized milk-lamb meat consumption in spring and occasionally it was also consumed adult reformed ovine meat. In years 60-90 in past century, the economic interest for systematic production of lamb and fattening young meat had much increased in our country in the context of advantageous supplying possibility on Arabian countries markets [4]. Geographically, Romania is being situated in a favourable site from the two main markets for lamb meat, the European Union markets which imports around 50% of the total production, and the Arabian States markets, which import around 30% of the lamb production of the country [5]. Preferences of lamb by consumers are affected by production systems, given that production systems are linked with the sensory characteristics of the lamb meat, and associated furthermore with cultural aspects or consumption habits, consumer attitudes and beliefs, feelings [2,6]. Merino of Cluj breed appeared in 1968 and was officially recognized and approved 20 years later [7]. It is a mixed breed, and their production proportion being of 61.70% meat, milk 30.10% and 8.29% wool and leathers, from total value of

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productions obtained [8]. The effective was multiplied by reproductive isolation and developed independently and through this system it was intended to keep the breed relatively constant in parallel with the improvement of the morpho-productive traits for the next generation [9]. Young sheep in the Merino of Cluj have superior skills to the domestic sheep breed in Transylvania because, in terms of meat production, they achieve intensive fattening over 100 days of daily average accumulation of body mass ranging from 233.88 g and 253.13g and for fattening exclusively on the pasture for 150 days, average body mass gains of over 107,06g. The evolution of body weight, total gain and daily mean, as the degree of turning into account of food young fattened ovine in different systems it's presented in Table 1.

Table 1. Total accumulation and daily mean of body weight recorded in ovine young Merino of Cluj stock, intensively on pasture fattened

Authors, year	Fattening period of time (days)	Body weight (kg)		Gain		Specific consumption	
		Start fattening	Final fattening	Total (kg)	Daily average (g)	Net energy ruminants (kcal)	DP (g)
Mireșan, 1996 [10]	100	15.22 ± 0.18	40.04 ± 0.51	24.82 ± 0.40	248.23 ± 4.59	7782.50	850.50
Dărăban, 2004 [11]	150	21.69 ± 0.39	37.75 ± 0.30	16.06 ± 0.30	107.06 ± 2.02	13088.75	970.70
Coroian, 2006 [12]	100	15.47 ± 0.46	40.78 ± 0.75	25.31 ± 0.68	253.13 ± 22.2	7924.00	822.27
Dărăban et al., 2007 [13]	150	21.69 ± 0.39	37.75 ± 0.30	16.06 ± 0.09	107.06 ± 2.02	-	970.00
		21.50 ± 0.34	42.00 ± 0.17	20.50 ± 0.17	136.66 ± 2.33	-	934.10
	100	15.52 ± 0.27	40.62 ± 0.40	25.10 ± 0.13	251.00 ± 5.13	-	834.06
Dărăban et al., 2010 [14]	100	15.52 ± 0.28	40.62 ± 0.40	25.10 ± 0.32	251.00 ± 5.13	8042.88	834.06

Even if it is not specialized for meat production, this breed achieves a good yield at slaughter, and this can be improved in the future by assuring an optimal breeding technology, or by cross-breeding with races specialised for meat production [15]. Until now, the focus has been on the capacity of fattening young sheep in different systems of exploitation or different feed structures, the present paper aims to highlight the particularities of the evolution of body weight from birth to 28 and 56 days respectively, according to the type of the birth, their sex and the age of the ewes.

2. Materials and methods

This study was carried out at the Research and Development Station for sheep of the University of Agricultural Science and Veterinary Medicine from Cluj-Napoca (SDE USAMV Cluj-Napoca), between years 2008-2015 on a total of 1737 lambs obtained in all eight years. Each lamb was weighed immediately after birth using an electronically scale which had a precision of 0.05 kg, ear tagged and opening of an individual record with date of birth, sex, birth type and weight at lambing, 28 and 56 days. Growth performance recordings were registered in lamb during morning time at the same hour each time. All lambs were born yearly in February-March, and after lambing the ewes were kept with their lambs in pens for 2-3 days. Lambs were allowed to suckle freely and were not provided with any additional feed for the first 2 weeks. Starting from the third week of lambing, the ewes with their lambs were combined into bigger pens, and the lambs were allowed ad libitum access to alfalfa hay and lamb starter feed for 2 weeks. Lambs were separated from the ewes at 28 days of age, allowed to suckle twice a day and were fed with concentrate feed containing mostly barley and ad libitum alfalfa until reaching 56 days of age.

Growth can be assessed both gravimetrically and biometrically, and in the present case the growth assessment was estimated using the following growth indices:

- Growth energy (E);
- Growth rate (absolute(A) and relative(R));
- Growth intensity (I);
- Growth factor (F).

Growth energy represents the overall growth potential from birth to adult stage. The growth

rate, both absolute and relative, represents the average body mass accumulation recorded by the animal between two determinations and is calculated with the formulas (1) and (2). Growth intensity is the increase in body mass over a certain period of time (t) and is calculated by the formula (3). The growth factor is the mass achieved in a given growing period (m_t) of the final animal mass (m_f) expressed as a percentage and is calculated using formula (4) [9].

$$A = \frac{m_2 - m_1}{t} \quad (1)$$

$$R = \frac{m_2 - m_1}{m_1} * 100 \quad (2)$$

$$I = \frac{m_2 - m_1}{m_2 + m_1} * 2 * 100 \quad (3)$$

$$F = \frac{m_t * 100}{m_f} \quad (4)$$

m_1=body mass accumulation recorded at time t_1 (kg);
m_2=body mass accumulation recorded at time t_2 (kg);
t=time period between t_1 and t_2 (days);

The effects of birth type, lamb sex and physiological status of ewes on the growth (birth weight and lambs weight at days 28 and 56) of the lambs were analysed by an analysis of variance (ANOVA) using least squares means. A Student test was used to calculate the significant differences between the lambs weight of the lamb yearly.

3. Results and discussion

The sheep flock of the Merino of Cluj breed, which was in exploitation at SDE USAMV Cluj-Napoca in the period 2008-2015, had a variable number of ewes, and this fluctuation is based on maintenance activities and economic factors. In the first graph can be observed the variability of the number of sheep and their products obtained annually on the farm. Of the total number of attendants on the farm the number of primiparous sheep does not exceed 20% and this report is kept approximately the same yearly, as can be seen on figure 2. In the next graph (Fig.3) is presented the number of birth according of birth type. The average number of twin recorded in the eight years, representing 11.39% of the total number of birth.

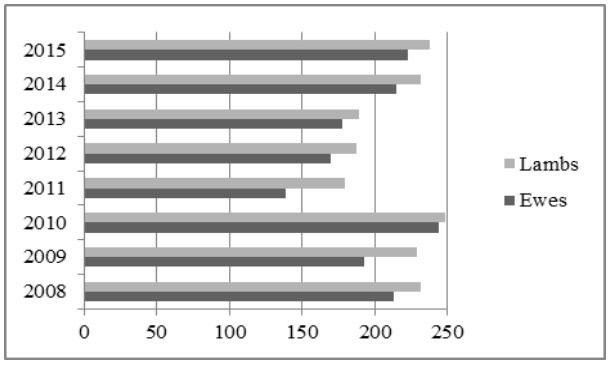

Fig. 1 Variability number of ewes and their lambs between years 2008-2015 on the farm

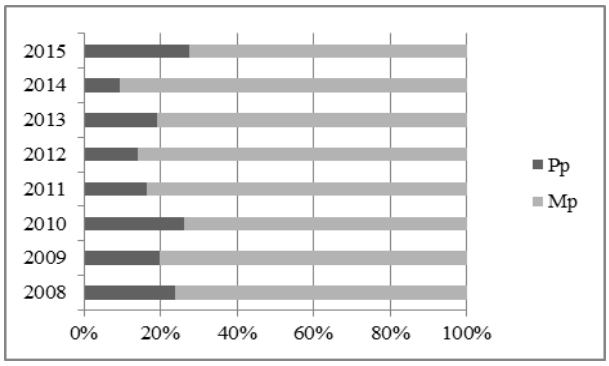

Fig. 2 Percentage of annual number of primiparous (Pp) and multiparous (Mp) between years 2008-2015

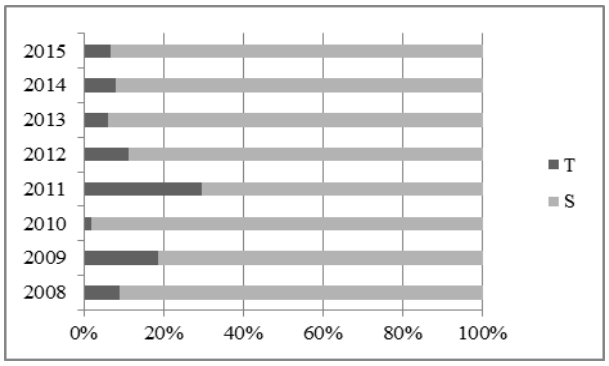

Fig. 3 Number of twin (T) and single (S) births (%) registered annually during 2008-2015

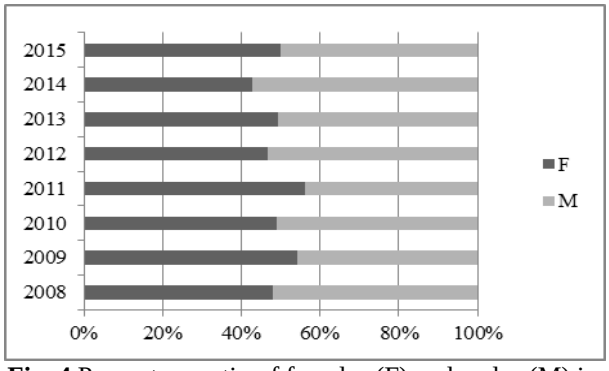

Fig. 4 Percentage ratio of females (F) and males (M) in lambs obtained during 2008-2015

In the last graph (Fig. 4) is presented the number of lambs (%) according to their sex obtained yearly on the farm. As can be seen in the graphical representation, the number of females is close to that of males registered in each of the eight years of study. The average value of products by gender was 49.47% females (F) and 50.53% males (M).
A large number of males obtained annually represent an economic advantage for the farm, as they accumulate body mass in relatively short time than females [16]. The weight of the lambs at birth, the coefficient of variation, the minimum and maximum values and the significance of the statistical differences, recorded annually, in the lambs of the Merinos de Cluj breed obtained during the years 2008-2015 at SDE USAMV Cluj-Napoca are presented in the table 2. In the current study, the lambs had an average birth weight equal to 3.88 ± 0.14 kg, value between the limits 1.80 and 5.80 kg.

Table 2. The average birth weight (kg), the coefficient of variation, the minimum and maximum values and the significance of the statistical differences recorded each year in the lambs of the Merino breed obtained in the period 2008-2015 according to the type of lambing, their sex and the physiological state of the parturients (kg)

Year	Trait		N	$X \pm s_X$	CV %	Min.	Max.
2008	At birth		232	4.08 ± 0.06	21.83	1.80	5.50
	Birth type	S	194	4.31 ± 0.05**	16.37	1.80	5.50
		T	38	2.94 ± 0.14***	29.51	2.20	4.80
	Level of significance				± 1.37***		
	Sex	M	121	4.17 ± 0.08^{ns}	20.84	2.20	5.50
		F	111	3.99 ± 0.09^{ns}	22.80	1.80	5.40
	Level of significance				± 0.18^{ns}		
	Physiological status	Pp	57	3.27 ± 0.06***	13.80	2.50	3.80
		Mp	175	4.35 ± 0.06**	19.27	1.80	5.50
	Level of significance				± 1.08***		
2009	At birth		229	3.99 ± 0.05	17.10	2.40	5.80
	Birth type	S	158	4.16 ± 0.05*	14.86	2.40	5.80
		T	71	3.63 ± 0.08***	18.91	2.50	5.00
	Level of significance				± 0.53***		
	Sex	M	106	4.01 ± 0.07^{ns}	17.68	2.40	5.80
		F	123	3.98 ± 0.06^{ns}	16.65	2.50	5.40
	Level of significance				± 0.03^{ns}		
	Physiological status	Pp	43	3.29 ± 0.07***	13.89	2.50	4.00
		Mp	186	4.16 ± 0.05*	14.95	2.40	5.80
	Level of significance				± 0.87***		
2010	At birth		249	4.33 ± 0.02	8.22	2.90	5.30
	Birth type	S	239	4.25 ± 0.02^{ns}	8.14	2.90	5.30
		T	10	4.33 ± 0.14^{ns}	10.36	3.60	4.90
	Level of significance				± 0.08^{ns}		
	Sex	M	127	4.40 ± 0.03**	7.86	2.90	5.20
		F	122	4.22 ± 0.03**	7.81	3.60	5.30
	Level of significance				± 0.18***		
	Physiological status	Pp	64	3.99 ± 0.02***	4.04	3.60	4.30
		Mp	185	4.45 ± 0.02***	7.40	2.90	5.30
	Level of significance				± 0.46***		
2011	At birth		180	3.48 ± 0.02	9.22	2.80	4.20
	Birth type	S	98	3.46 ± 0.03^{ns}	9.26	2.80	4.10
		T	82	3.50 ± 0.04^{ns}	9.10	2.90	4.20
	Level of significance				± 0.04^{ns}		
	Sex	M	79	3.59 ± 0.04**	8.94	2.90	4.20
		F	101	3.39 ± 0.03*	8.65	2.80	4.00
	Level of significance				± 0.20***		
	Physiological status	Pp	28	3.13 ± 0.03***	5.48	2.90	3.50
		Mp	152	3.55 ± 0.02^{ns}	8.41	2.80	4.20
	Level of significance				± 0.42***		

Year	Trait		N	X ± s_X	CV %	Min.	Max.
2012	At birth		188	3.59 ± 0.02	7.23	2.80	4.10
	Birth type	S	152	3.62 ± 0.02^{ns}	6.35	2.90	4.10
		T	36	3.47 ± 0.06*	9.72	2.80	3.90
	Level of significance				± 0.15**		
	Sex	M	100	3.69 ± 0.03**	6.91	2.90	4.10
		F	88	3.47 ± 0.02***	6.08	2.80	3.90
	Level of significance				± 0.22***		
	Physiological status	Pp	29	3.36 ± 0.04***	7.10	2.80	3.70
		Mp	159	3.63 ± 0.02^{ns}	6.63	2.80	4.10
	Level of significance				± 0.27***		
2013	At birth		189	3.85 ± 0.02	8.67	2.40	4.40
	Birth type	S	167	3.91 ± 0.02^{ns}	5.19	2.90	4.40
		T	22	3.44 ± 0.15***	19.97	2.40	4.20
	Level of significance				± 0.47***		
	Sex	M	99	3.96 ± 0.03**	6.76	2.70	4.40
		F	90	3.74 ± 0.04**	9.69	2.40	4.20
	Level of significance				± 0.22***		
	Physiological status	Pp	34	3.51 ± 0.07***	11.19	2.70	3.90
		Mp	155	3.93 ± 0.02*	6.80	2.40	4.40
	Level of significance				± 0.42***		
2014	At birth		232	3.34 ± 0.03	13.10	2.20	5.50
	Birth type	S	198	3.45 ± 0.02**	9.33	2.40	5.50
		T	34	2.71 ± 0.09***	18.39	2.20	3.80
	Level of significance				± 0.74***		
	Sex	M	131	3.37 ± 0.04^{ns}	13.79	2.30	5.50
		F	101	3.31 ± 0.04^{ns}	12.10	2.20	3.90
	Level of significance				± 0.06^{ns}		
	Physiological status	Pp	23	2.86 ± 0.10***	17.21	2.30	3.40
		Mp	209	3.39 ± 0.03^{ns}	11.72	2.20	5.50
	Level of significance				± 0.53***		
2015	At birth		238	4.38 ± 0.03	9.51	2.80	4.90
	Birth type	S	208	4.49 ± 0.02**	5.22	3.20	4.90
		T	30	3.64 ± 0.11***	17.01	2.80	4.60
	Level of significance				± 0.85***		
	Sex	M	119	4.45 ± 0.03^{ns}	8.16	3.10	4.90
		F	119	4.31 ± 0.04^{ns}	10.51	2.80	4.80
	Level of significance				± 0.14**		
	Physiological status	Pp	63	3.95 ± 0.06***	11.29	3.00	4.30
		Mp	175	4.53 ± 0.02***	6.08	2.80	4.90
	Level of significance				± 0.58***		

^{ns}-p<0.5; *-p>0.5; **-p>0.1; ***-p>0.01; X-average; s_x-standard error; CV- coefficient of variation; S-single; T-twin; M-male; F-female; Pp-primiparous ewes; Mp-multiparous ewes.

The weight of the lambs at birth was influenced by the birth type, gender and the physiological status of the sheep, as very significant differences can be observed between the lamb weights in all three cases under the study. In addition to these three main factors, growth technology, maintenance levels and microclimate factors influence the growth and development of lambs from birth to adult stage. The weights of lambs were higher in the males than the females and in the singleton than the multiples in all periods. Reproductive performance of primiparous sheep is lower than multiparous. Several factors are reported to influence reproductive performance, and the number of lambs marketed per ewe in the breeding flock is a major contribution to profitability [17]. Sheep live weights and age along with nutrition, weather and season, have been reported to influence reproductive performance and then the weight of the lamb on the birth. Similarly results obtained Aktaş et al. (2015) and Dărăban at al. (2012) on different breed of ewes. [18, 19].

Table 3. Variation of growth indices calculated according to type of lambing, lamb's sex and the physiological status of mother sheep to 28 days and 56 days

Trait		N	W (kg) $X \pm s_X$ Cv(%)	A (g) $X \pm s_X$ Cv(%)	R (%) $X \pm s_X$ Cv(%)	I (%) $X \pm s_X$ Cv(%)	F (%) $X \pm s_X$ Cv(%)
0-28 days		238	11.63±0.08 10.74	259.11±2.37 14.11	166.37±1.60 14.83	90.34±0.48 8.19	62,14±0,24 5,91
Birth type	S	208	11.94±0.05** 6.37	266.26±1.70* 9.22	166.56±1.20^{ns} 10.35	90,64±0,36^{ns} 5,77	62,33±0,18^{ns} 4,07
	T	30	9.51±0.33*** 19.06	209.52±10.09*** 26.38	163.68±7.99^{ns} 26.72	88,43±2,55^{ns} 15,78	60,99±1,29^{ns} 11,62
Level of significance			± 2,43***	± 56.74***	± 2.88^{ns}	± 2.21^{ns}	± 1.34*
Sex	M	119	11.86±0.10^{ns} 9.43	264.53±3.69^{ns} 15.23	168.13±3.16^{ns} 20.51	90,40±0,95^{ns} 11,46	62,08±0,47^{ns} 8,29
	F	119	11.41±0.12^{ns} 11.69	253.69±2.90^{ns} 12.47	164.61±0.48^{ns} 3.19	90,27±0,15^{ns} 1,79	62,19±0,07^{ns} 1,25
Level of significance			± 0,45**	± 10.84*	± 3.52^{ns}	± 0.13^{ns}	± 0.08^{ns}
Physiological status	Pp	63	10.34±0.16*** 12.35	228.40±3.76*** 13.05	161.40±0.60^{ns} 2.96	89,30±0,19^{ns} 1,69	61,73±0,09^{ns} 1,18
	Mp	175	12.10±0.06*** 7.07	270.16±1.63*** 8.00	166.78±0.53^{ns} 4.24	90,89±0,19^{ns} 2,77	62,48±0,10^{ns} 2,08
Level of significance			± 1,76***	± 41.76***	± 5.38***	± 1.59***	± 0.75***
28-56 days		238	5.21±0.07 20.52	187.52±2.22 18.25	46.35±0.90 19.84	37.17±0.54 12.43	68,86±0,37 8,24
Birth type	S	208	5.10±0.10^{ns} 17.33	182.31±3.45^{ns} 17.33	43.45±1.02* 13.97	35,13±0,66* 17,21	70,40±0,49* 9,98
	T	30	5.95±0.41** 17.54	212.62±14.57** 17.54	68.33±6.40*** 21.27	48,49±3,55*** 20,07	61,93±2,33*** 20,63
Level of significance			± 0,85**	± 30.30**	± 24.88***	± 13.37***	± 8.47***
Sex	M	119	5.31±0.09^{ns} 17.89	189.50±3.11^{ns} 17.89	45.54±1.09^{ns} 16.12	36,75±0,66^{ns} 19,71	69,10±0,46^{ns} 7,19
	F	119	5.12±0.11^{ns} 12.94	185.47±3.18^{ns} 18.68	47.14±1.43^{ns} 12.98	37,57±0,85^{ns} 14,81	68,62±0,58^{ns} 9,20
Level of significance			± 0,19^{ns}	± 4.02^{ns}	± 1.60^{ns}	± 0.82^{ns}	± 0.49^{ns}
Physiological status	Pp	63	5.70±0.12 16.04	203.29±4.11** 16.04	56.62±1.98** 17.77	43,59±1,12*** 20,35	64,42 ± 0,73*** 8,95
	Mp	175	5.07±0.07 17.39	181.16±2.38^{ns} 17.39	42.44±0.77*** 13.98	34,75±0,49** 18,54	70,52±0,34** 6,40
Level of significance			± 0,62***	± 22.12***	± 14.17***	± 8.85***	± 6.11***
0-56 days		238	16.85±0.08 7.48	222.62±1.33 9.19	287.56±2.63 14.09	117.42±0.43 5.60	73,93±0,17 3,55
Birth type	S	208	17.05±0.08^{ns} 6.56	224.29±1.41^{ns} 9.07	281.14±2.34^{ns} 12.02	116,47±0,40^{ns} 4,99	73,56±0,16^{ns} 3,22
	T	30	15.46±0.25*** 8.72	211.07±4.79** 12.42	366.00±14.57*** 23.76	123,70±2,14*** 9,47	76,27±0,83*** 5,96
Level of significance			± 1,59***	± 13.22**	± 84.86***	± 7.23***	± 2.71***
Sex	M	119	17.17±0.11** 7.01	227.01±1.95^{ns} 9.36	288.05±3.87^{ns} 14.67	117,47±0,61^{ns} 5,69	73,95±0,24^{ns} 3,58
	F	119	16.53±0.11** 7.50	218.23±1.71^{ns} 8.57	287.06±3.56^{ns} 13.53	117,37±0,59^{ns} 5,52	73,91±0,24^{ns} 3,53
Level of significance			± 0,64***	± 8.78***	± 0.99^{ns}	± 0.10^{ns}	± 0.04^{ns}
Physiological status	Pp	63	15.97±0.16*** 8.17	214.48±2.48** 9.19	307.17±5.18*** 13.38	120,62±0,82*** 7,52	75,19±0,33*** 3,45
	Mp	175	17.15±0.08* 6.41	225.26±1.34^{ns} 7.88	279.24±2.00** 9.49	116,29±0,35^{ns} 7,71	73,51±0,14^{ns} 2,52
Level of significance			± 1,18***	± 10.78***	± 17.93***	± 4.33***	± 1.68***

^{ns}-p<0.5; *-p>0.5; **-p>0.1; ***-p>0.01; X-average; s_x-standard error; CV- coefficient of variation; S-single; T-twin; M-male; F-female; Pp-primiparous ewes; Mp-multiparou ewes; W-body weight; A-absolute growth rate; R-relative growth rate; I-growth intensity; F-growth factor.

Weight obtained from lambing twin lambs had a weight lower by 13.08% than that of lambs coming from lambing simple. The same thing was observed in the case of lambs with primiparous, their weight was less by 14.47%, than the weight of the lambs obtained from the multiparous parties. Lambs birth weight is a result of smaller weight used in breeding females, but the difference in weight of the product starts to decrease gradually and tends to vanish as they age animal. The birth weight of the lambs from the primiparous ewes was lower (p>0,001) than the birth weight of the lambs from the multiparous ewes. Similar values were reported by Sauer et al. (2013), Pădeanu et al. (2008), Gavojdian et al. (2011) and Dărăban et al. (2011) for lambs from different breed or crossbreed [20,21,22,23]. Sex lamb influenced their weight at birth, as follows: males showed an average weight of about 4% higher females. These results are in accordance with those presented by Popa et al. (2013) and Oldham et al. (2011) which report that birth weight of males is higher than females mass [5,24].

Comparing the mean weight of lambs at birth obtained annually can see significant differences from year to year, and they are due to climate change and the level of maintenance of the farm.

The age of ewes had an effect on the birth weight and weaning weight of lambs (Table 3) [26]. The lamb weight at days 28 and 56 increased with maternal age. The birth weight and weight of lamb at weaning were affected by both lamb sex and birth type (p>0.01). Similarly, the increase in the weaning weights of the lamb was related to increasing dam weights by Aktaş et al. (2015).

When the lamb birth weights were categorized by sex, birth type and physiological status of sheep, lambs had different value of body weight and these findings confirm the theory that birth weights of a litter as a proportion of ewe weight decrease, while maternal weights increase. Most likely, the reason to this phenomenon is the body fat degradation serving as a source for more milk production in the heavy ewes. In addition to this, lighter ewes may be first time lambing young ewes with a lack of experience, which might results in poorer maternal care compared to mature ewes.

As shown in this study along with other studies (Aktaş et al., 2015; Sauer et al., 2012) the highest birth weight is on lambs from multiparous ewes. The data presented are characteristic of the breed and compatible with those presented by the scientific papers. In agreement with several studies a lambs sex and birth type had an important impact on the lambs birth weight at day 56 with an advantage of male and singletons over female and twin lambs.

4. Conclusions

The breed, size, and age of ewes, the birth type, lamb's sex, as well as maintenance and feeding conditions are known to have an important impact on the birth weight and weaning weight of lambs. Whatever the exploitation system, a large number of lambs are breed and weaned are an important way of increasing the flocks, but achieving this goal requires knowing the biological particularities of the growth and development of the lambs. By point of view, body weight of lambs at the age of 60 days is an extremely important trait due to the fact that lambs at this age have the highest marketing values.

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