Emir. J. Food Agric. 2015. 27 (3): 291-301
doi: 10.9755/ejfa.v27i3.18903
http://www.ejfa.info/

REGULAR ARTICLE

Growth, rumen development and meat quality in lambs of Blackhead Pleven breed, weaned at 25 and 70 days of age

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Abstract

The objective of this study was to compare the growth rate, rumen development and some quality parameters of carcass and meat in lambs weaned at 25 and 70 days of age. The average live weight gain during experimental period was 268 g per day for suckling lambs and 233 g per day for lambs on dry feed. The difference of 13.1% in daily gain was not significant at P<0.05. The lambs weaned at 25 days of age showed tendency for higher dressing percentage and carcass weight, more separable internal fat, and better carcass fattiness (P>0.05), compared to those weaned at 70 days of age. Therefore it is possible to obtain approximately the same growth in live weight and carcass in lambs weaned at 25 and 70 days of age. The lambs weaned at 25 kg live weight had higher weight of internal organs than the lambs weaned at 70 days, but the difference was significant (P<0.05) only for lung liver, small intestine, thick intestine and rumen. The length and thickness of rumen papillae were higher in lambs weaned at 25 days of age compared to the lambs weaned at 70 days of age (P<0.05). Significantly thicker was the rumen wall in the lambs weaned at 25 days of age compared to the weaned at 70 days (P<0.05).

Key words: Body weight gain, Early weaning, Lambs, Meat chemical composition, Rumen histology

Introduction

The age and the live weight are the main parameters to be considered when weaning the lambs. In some Mediterranean countries such as Italy, Portugal and Spain a part of the lambs are not weaned, but slaughtered between 30-60 days of age at low live weight (Sañudo et al., 1998). The others are weaned at the second day after birth and are fed with milk replacers to increase the milk yield (Napolitano et al., 2008). In Turkey a lot of farmers leave the lambs to suckle until they reach the live weight for slaughter, but this decreases the milk yield, which makes it necessary to wean the lambs between 1.5-3 months of age (Gürsoy, 2006). In Bulgaria the lambs are weaned after 60 days of age and 16-18 kg average live weight, which is the reason for decreased milk yield with an average of 55 kg (Simeonov et al., 2012). This indicates that one of the methods for increasing the milk yield is the early weaning (Duzgunes et al., 1961). The stress at early weaning contradicts the human attitude toward animals (Kilgour et al., 2008). When stressed, the lambs showed an increase of blood cortisol levels (Rhind et al., 1998; Napolitano et al., 2008), and a reduction of the feed consumption and the weight gain (Cañeque et al., 2001).

Aksakal et al. (2009) conclude that the lambs can be weaned at the age of 45 days, thus the milking period will be longer and their growth will not be influenced significantly when compared with lambs weaned at 75 days of age. The term “early weaning” is linked to slow growth (Lane and Albrecht, 1991), due to insufficient nutrient intake or digestion damage, caused by stress at the early weaning (Dantzer and Mormede, 1979). According to Lane and Jesse (1997), the proventriculus of the ruminant animals does not develop normally when they are fed only milk. Abou Ward et al. (2008) point that the success of the early weaning depends on the rumen development. Poe et al. (1969) find that the inuring of the lambs at early age to dry feed

Received 30 September 2014; Revised 30 November 2014; Accepted 05 December 2014; Published Online 01 March 2015

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helps for faster rumen development and diminishes the stress at weaning.

After birth, the growth of the lambs depends mainly on the quantity of the milk consumed. With aging and the increase of live weight, the growth rate decreases due to the impossibility to be maintained only by the consumed milk. According to data by the National Research Council (1985), 60 days after lambing, the milk yield of the ewes reduces which causes the lambs to eat the feed of their mothers. This makes necessary to construct creeps and to inure the lambs to dry feed because the growth rate is fastest between the first and the fifth month after birth (Owen, 1976).

The aim of this study is to compare the growth, rumen development and some parameters of carcass and meat quality in lambs weaned at 25 and 70 days of age.

Materials and Methods

Experimental lambs, weaning and rearing

The experiment was carried out in 2013 with 43 lambs from the Blackhead Pleven Sheep breed. The lambs together with the ewes were divided in two groups. From the age of 5 days on, the lambs had ad libitum access to feed and water in a creep (Alcock, 2006). The lambs of the first group, weaned at 25 days of age were inured to enter the creep and consume dry feed (maize, soybean meal and wheat bran) sprayed with milk replacer (Simeonov et al., 2013). No bait on the feed was put for the second group of lambs. Additionally, until weaned, the lambs of both groups received alfalfa hay.

The first group of 22 lambs was gradually weaned, as for 5 days the animals were separated from their mothers for increasing intervals (8, 9, 10, 12 and 14 hours), followed by complete weaning at the age of 25 days and live weight (LW) of 11.6 kg. The lambs were separated from their mothers in the evening and then returned back in the morning after milking.

After the weaning, the diet included dry distillers' maize grain with solubles (DDGSc), whole maize grain, fixed amount of soybean meal and hay. During the experimental period the DDGSc and the maize grain were given ad libitum to the animals in a ratio 1:1 with increasing amount in order to remain 5-15% of the two feed daily. The soybean meal was given in amounts of 100g/day/animal until reaching of 16 kg LW (average for the whole group), after which it was excluded from the diet. The remains of the feed and hay were collected and measured every morning during the trial, after which the amount of feed for the day was determined.

The lambs had free access to vitamin-mineral mixture (Todorov et al., 2013), containing 57% limestone, 34% salt and 9% vitamin–mineral premix for lambs and ewes.

The second group of 21 lambs was abruptly weaned at the age of 70 days. The feed consumption was controlled every other day. When feed was given to the ewes the lambs were closed in the creep in order to be unable to eat the ewes' feed.

The chemical composition of the diets of both groups determined by the standard methods (AOAC, 2007) is presented in Table 1.

Table 1. Composition and nutritive value of feedstuffs (g.kg^{-1}at natural moisture).

Chemical composition	Feedstuffs					
	Alfalfa hay	DDGSc	Maize	Soybean meal	Sunflower meal	Sheep milk
Dry matter	864.1	882.1	866.7	861.3	865.9	190.0
Crude protein	127.8	248.0	82.3	473.6	355.4	59
Ether extract	23.3	74.6	24.1	17.5	3.3	65
Crude fiber	343.9	93.1	31.2	42.2	170.1	0
Crude ash	68.7	48.0	12.8	65.4	74.3	10
Feed units for growth* #	0.58	1.13	1.53	1.21	0.93	0.48
Protein truly digestible in small intestine *	70.5	137.2	93.6	233.7	129.4	14
Balance of protein in the rumen *	20.8	27.4	-35.9	163.4	159.2	34
Calcium	14.1	0.94	0.49	3.27	5.72	2.00
Phosphorus	1.95	7.77	2.33	7.29	13.32	1.41

* By Todorov et al. (2007); # 1 FUG (Feed units for growth) = 6 MJ NE

The LW of lambs in the groups was controlled at birth, at the age of 20, 25 and 31 days and afterwards on each 7-th day until the end of the experimental period. The lambs left gradually the experiment when they reached 22 kg LW, which was determined after 12 h with no water and 24 h with no feed.

Slaughtering and sampling

At the end of the experimental period 5 ram lambs of each group were slaughtered at 28 kg LW. The internal organs were separated and weighed. Samples of the rumen and perirenal fat were taken for histological and lipid analysis respectively. The classification of the carcasses was done up to 1 h postmortem according to (S)EUROPE system (Raicheva and Marinova, 2002). The carcasses were then split in halves and after storage for 24 h at 4˚C, slaughter analysis of the carcasses was done according to the method of Zahariev and Pinkas (1979). Muscle *Longissimus dorsi* was carefully dissected from each half carcass and samples for analysis of the chemical composition and meat quality were taken and stored at -20°C.

Histological analysis

The histological analysis of the rumen was done on samples taken from the ventral part of the rumen and fixed in 10% formaldehyde solution. Ten cuts of each sample (8 µm thick) were colored by hematoxyline-eosine (Luna, 1968) and studied under light microscope. Microscopy image processing system DN-2 for Windows XP, Version 1.1., digital camera (Spca 506) and light microscope VDN-200M (Henan Evergreen Import & Export Co., Ltd., China).

Analytical methods

The contents of water, dry matter, protein, fat and ash in muscle *Longissimus dorsi* was determined according to AOAC (2007).

The lipids of the perirenal adipose tissue were extracted according to Bligh and Dyer (1959). The fatty acid profile of the lipids was determined by gas-liquid chromatography on a chromatograph C Si 200, equipped with capillary column (TR-FAME – 60 m × 0.25 mm × 0.25 mm) and hydrogen as a carrier gas. Methyl esters were identified comparing to the retention times of the standards. Fatty acids are presented as percentages of the total amount of the methyl esters (Christie, 1973).

Economical evaluation

The quantity of the milk obtained from the ewes of the early weaned lambs was measured daily and the results were calculated from the beginning of the partial deprivation of milk until reaching of 16 and 22 kg LW.

The price of the bought feed was according to the sum for DDGSc, soybean and sunflower meal. The price of the feed produced in the Institute of Forage Crops, Pleven (maize grain and alfalfa hay) was according to the prices in the country for the respective period, taken from the Newsletter of the System for agrarian market economy.

Statistical analysis

The statistical evaluation of the data was done by the software Statistica for Windows 2006. The groups were compared using t-test, as differences at $P<0.05$ were considered significant.

Results

Growth

The experiment was divided in two periods: until 16 kg and then from 16 to 22 kg LW (Table 2). The lambs from the first group had 11% higher LW at birth compared to the lambs from the second group. Although that the animals from both groups reached 16 kg for a period of 20 days. The average daily gain (ADG) of the lambs of the second group was 252 g/d compared to 199 g/d of the animals of the first group ($P<0.05$). During the second period the lambs reached 22 kg LW for 25.8 and 24.3 days respectively for the first and the second group. No significant difference was found in the ADG between the two groups. For the two periods the ADG of the lambs weaned at 70 days of age was 268 g/d whereas that of the lambs weaned at 25 days was 233 g/d, but difference was not significant (Table 2). The changes in the LW during the separate intervals of the trial are presented in Figure 1.

Feed consumption

The weaning at the age of 25 days is the reason why the lambs have consumed more dry feed compared to the suckling lambs (Table 3). During the first period the lambs of the first group have consumed 0.547 kg/d dry feed and those from the second group 0.094 kg/d, as the difference between the two groups was 82.8%. During the second period, this difference decreased to 52.6% for the lambs weaned at 25 and 70 days respectively. The average dry feed consumption for the two periods for the lambs of the first group was 0.694 kg/d, while for the second group it was 0.243 kg/d. During the first period the energy intake of the lambs of the second group was 7.5% higher when compared to the lambs of the first group. During

the second period of the trial the difference in the energy intake has already become 17%, which has increased the energy per kg daily gain by 11.1% in the lambs of the second group. During the whole experiment the lambs weaned at 25 days of age had higher dry matter expense per 1 kg daily gain (Table 3). The protein expense per 1 kg gain during the first period is 30% higher in the lambs of the first group. During the second period the lambs of the second group showed 26.1% higher expense of crude protein per 1 kg gain.

Slaughter analysis

The lambs weaned at 25 days of age had higher carcass weight and dressing percentage, more internal fat and higher fatness score, in comparison to the lambs, weaned at 70 days of age, but differences were not significant (Table 4). The animals weaned at 25 days had higher weight of the internal organs than those weaned at 70 days of age with significant difference ($P<0.05$) only for the lung and the liver, small and large intestine as well as the rumen (Table 4).

Table 2. Growth of the lambs weaned at 25 and 70 days (mean ± SE).

Indicators	Weaned at 25 days	Weaned at 70 days	Significance
First period *(from 11 to 16 kg LW)*:			
LW at birth (kg)	5.150 ± 0.257	4.576 ± 0.246	ns
LW at 25 days of age (kg)	11.775 ± 0.580	11.115 ± 0.601	ns
ADG (kg)	0.199 ± 0.013	0.252 ± 0.012	*
Age at the beginning of the experiment (day)	25.1 ± 0.322	24.3 ± 0.279	ns
Duration of the period (day)	20	20	
Second period *(from 16 LW to the end of the experiment)*:			
LW at beginning (kg)	15.758 ± 0.705	16.164 ± 0.807	ns
LW at the end of the experiment (kg)	22.458 ± 0.768	22.931 ± 0.929	ns
ADG (kg)	0.260 ± 0.019	0.278 ± 0.022	ns
Duration of the period (day)	25.8 ± 1.069	24.3 ± 1.243	ns
Total for the two periods:			
LW at the 25 days age (kg)	11.775 ± 0.580	11.115 ± 0.601	ns
LW at the end of the experiment (kg)	22.5 ± 0.768	22.9 ± 0.929	ns
ADG (kg)	0.233 ± 0.013	0.268 ± 0.015	ns
Duration of the period (day)	45.8 ± 1.070	44.3 ± 1.243	ns

* Means differ at $P<0.05$; ns: non significant. LW: live weight; ADG: average daily gain.

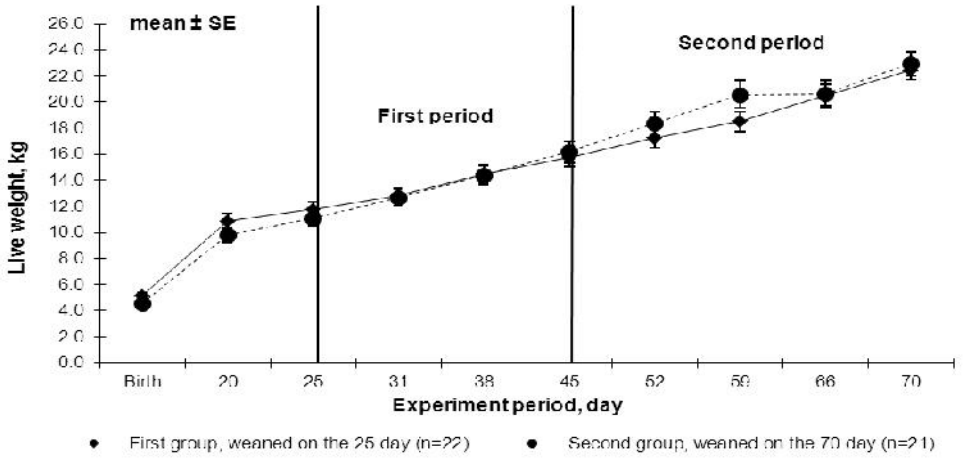

Figure 1. Comparison of the growth of lambs weaned at 25 and 70 days (mean ± SE).

Table 3. Intake of feed and milk during experimental period.

Indicators	First period *		Second period *		For the two periods	
	Weaning at 25 days	Weaning at 70 days #	Weaning at 25 days	Weaning at 70 days #	Weaning at 25 days	Weaning at 70 days #
Intake of feed and milk by animal (kg/day):						
Alfalfa hay	0.044	-	0.189	-	0.129	-
DDGSc	0.163	0.021	0.239	0.106	0.208	0.066
Maize	0.240	0.036	0.363	0.147	0.313	0.095
Soybean meal	0.100	-	-	-	0.044	-
Sunflower meal	-	0.037	-	0.122	-	0.082
Suckled milk	-	1.338	-	1.392	-	1.374
Total	0.547	1.432	0.791	1.767	0.694	1.617
Total dry matter	0.477	0.336	0.689	0.591	0.605	0.473
Mineral vitamin mixture	0.018	-	0.016	-	0.017	-
Intake of energy and nutrients by animal per day:						
Feed units for growth**	0.698	0.755	0.935	1.126	0.842	0.956
Crude protein (g)	113.2	100.3	113.3	163.9	114.7	134.4
Crude fiber (g)	42.0	9.4	98.6	35.2	75.3	23.1
Calcium (g)	4.82	2.93	6.31	3.65	5.91	3.32
Phosphorus (g)	2.64	4.10	3.07	4.75	2.92	3.76
Expense of dry mater, milk and protein per kg gain:						
Dry matter (kg)	2.397	1.333	2.650	2.126	2.597	1.765
Feed units for growth	3.51	2.99	3.60	4.05	3.61	3.58
Crude protein (g)	569	398	436	590	492	502

* The first period from 25 days of age up to 16 kg LW, and the second from 16 to 22 kg LW
# Feed intake by the lambs is registered in the creep accessible to the lambs.
** 1 FUG (Feed units for growth) = 6 MJ NE

Table 4. Slaughter traits and weight of internal organs and rumen volume of the lambs weaned at 25 and 70 days (mean ± SE).

Indicators	Weaned at 25 days	Weaned at 70 days	Significance
Slaughter data:			
Pre-slaughter weight (kg)**	28.4 ± 0.65	28.0 ± 0.83	ns
Carcass weight (kg)	13.5 ± 0.46	12.8 ± 0.30	ns
Carcass yield (%)	47.40	45.70	ns
Separable internal fat (kg)	0.398 ± 0.042	0.255 ± 0.009	ns
Fattiness	3.0	2.7	ns
Organs weight (kg):			
Heart	0.158	0.150	ns
Lung	0.603	0.472	*
Liver	0.790	0.568	*
Small intestine	0.948	0.672	*
Large intestine	0.515	0.387	*
Rumen	0.745	0.510	*
Omasum	0.110	0.088	ns
Reticulum	0.138	0.137	ns
Abomasum	0.212	0.177	ns
Volume of the rumen (L)	9.593	7.937	ns

* Means difference at P<0.05; ns: non significant. **Determined after 12 h of water and 24 h of food deprivation. LW: live weight; ADG: average daily gain.

Rumen histology

The histological analysis showed that the papillae in the rumen of the lambs weaned at 25 days of age were significantly (P<0.05) longer and wider, compared to those weaned at 70 days of age (Table 5). The thickness of the rumen wall was significantly (P<0.05) higher in the lambs weaned at 25 days compared to the animals weaned at 70 days of age (Table 5).

Meat chemical composition

The chemical composition of Muscle *Longissimus dorsi* did not show any significant differences between the two groups of lambs (Table 6).

No significant differences in the fatty acid composition were found between the two groups (Table 7). The contents of C14:0, C15:0, C16:0, C18:0 and the total amount of the saturated fatty acids tended to be higher in the lambs weaned at 70 days of age, whereas the rest of the fatty acids had higher contents in the lambs weaned at 25 days (Table 7).

Table 5. Histological data for rumen of the lambs weaned at 25 and 70 days (mean ± SE).

Indicators	Weaned at 25 days	Weaned at 70 days	Significance
Length of the papillae (µm)	404.470 ± 1.707	359.609 ± 1.273	*
Thickness of the papillae (µm)	59.861 ± 1.947	38.533 ± 1.293	*
Thickness of the rumen wall (µm)	205.311 ± 3.312	160.901 ± 3.820	*

* Means differ at P<0.05; ns: non significant.

Table 6. Chemical composition of Muscle Longissimus dorsi of the lambs weaned at 25 and 70 days (mean ± SE).

Components (%)	Weaned at 25 days	Weaned at 70 days	Significance
Water	76.877 ± 0.077	76.980 ± 0.457	ns
Dry mater	23.123 ± 0.077	23.020 ± 0.457	ns
Protein	18.980 ± 0.167	19.213 ± 0.487	ns
Fat	3.277 ± 0.093	3.283 ± 0.230	ns
Ash	0.867 ± 0.099	0.857 ± 0.090	ns

ns: non significant

Table 7. Fatty acids composition of perirenal fat of the lambs weaned at 25 and 70 days (mean ± SE).

Fatty acids (%)	Weaned at 25 days	Weaned at 70 days	Significance
C14:0	6.20 ± 2.511	7.43 ± 1.699	ns
C15:0	0.65 ± 0.216	0.70 ± 0.137	ns
C16:0	19.15 ± 4.023	20.80 ± 1.224	ns
C16:1	0.82 ± 0.056	0.77 ± 0.060	ns
C17:0	1.97 ± 0.263	1.45 ± 0.137	ns
C18:0	19.42 ± 0.789	20.66 ± 1.448	ns
Trans C18:1	0.12 ± 0.120	-	ns
C18:1	44.78 ± 4.820	42.72 ± 0.734	ns
C18:2	5.69 ± 1.171	4.44 ± 1.486	ns
C18:3n-6	0.21 ± 0.029	0.16 ± 0.009	ns
C18:3n-3	0.28 ± 0.017	0.25 ± 0.023	ns
CLA (conjugated linoleic acids)	0.71 ± 0.084	0.61 ± 0.082	ns
SFA (saturated fatty acids)	47.38 ± 6.030	51.05 ± 1.713	ns
UFA (unsaturated fatty acids)	52.62 ± 6.030	48.95 ± 1.713	ns
MUFA (monounsaturated fatty acids)	45.73 ± 4.950	43.49 ± 0.708	ns
PUFA (polyunsaturated fatty acids)	6.89 ± 1.085	5.21 ± 1.341	ns

ns: non significant.

Economical evaluation

In this study the weaning at 25 days of age allowed the expense of feed/kg gain to be reduced, but also to decrease the expense per kg meat in comparison with the lambs weaned at the age of 70 days (Table 8).

The additionally milked milk from the period of partial suckling of the lambs until 22 kg is 47.2 kg/ewe for a period of 51 days when the lambs were weaned at 25 days and average LW 11.8 kg (Table 9). The lambs from the second group have consumed at average 60.1 kg milk. This quantity is 21.5 % higher than the amount of milk from the ewes whose lambs were weaned after 25 days.

Discussion

One of the reasons for the lower growth rate of the lambs from the first group during the first period of the experiment until 16 kg is the stress caused by the partial suckling and the early weaning as well. During this period the lambs of the second group had 7.5% higher energy intake and the quantity of the crude protein was higher compared to the lambs of the first group (Table 3) and this led to the significantly higher gain during this period.

The higher gain in the lambs of the second group was observed during the second period as well but the difference of 6.5% was not significant. In line with our results when comparing the growth between early weaned and lambs suckling till 60 days of age, Radzik-Rant et al. (2012) reported insignificantly 4.1% higher gain in the suckling lambs.

During the second period the two groups of lambs displayed increased feed consumption (Table 3). In the lambs of the second group this indicates that the milk consumed (1.392 kg/d) is insufficient to satisfy the nutritional needs of the lambs. The growth of the suckling lambs is connected to the milk productivity of the ewes (Burris and Baugus, 1955). Snowder and Glimp (1991) found positive correlation between the milk productivity of the ewes and the growth of the lambs until the age of 56 days. In a previous research (Simeonov et al., 2012) the lambs had no access to creep and ate only the feed of their mothers which might be the reason for the lower gain. Wilson et al. (1970) pointed significantly higher weight gain in suckling lambs with access to creep, comparing to lambs ho received only milk. The slaughter analysis showed that the lambs weaned at the age of 25 days had better fatness (Table 4) and higher dressing percentage which is important from economical point of view when finishing lambs. The higher fat content in the carcasses of the lambs of the first group is related to the higher grain and energy intake of the lambs.

Table 8. Price of feedstuffs consumed by one lamb per day of experiment.

Feed / Indicators	Price/ton, Euro	Weaned at 25 days	Weaned at 70 days
Alfalfa hay	128.0	0.017	-
DDGSc	189.0	0.039	0.012
Maize	210.0	0.066	0.020
Soybean meal	358.0	0.016	-
Sunflower meal	179.0	-	0.015
Milk	613.0	-	0.842
Mineral vitamin mixture	222.0	0.004	-
Total per lamb		0.141	0.889
Per kg gain		0.605	3.317
Per kg carcass		1.048	6.951

Table 9. Milked milk of a ewe when lamb is weaned at 25 days of age and suckling milk if weaning is at 70 days of age.

Live weight of lambs (kg)	Duration (day)		Daily milk yield (kg)		Milk for period (kg/ewe)	
	Weaning at 25 days	Weaning at 70 days	Weaning at 25 days	Weaning at 70 days	Weaning at 25 days	Weaning at 70 days
To 11.775*	5	-	**	-	3.4	-
First period to 16 kg	20	20	1.02	1.338	20.4	26.7
Second period to 22 kg	26	24	0.90	1.392	23.4	33.4
Milk accumulation (kg)	51	44	-	-	47.2	60.1

* During the period of partial suckling of lambs; ** Milked milk does not correspond to 24 hours.

The higher dry feed intake in the lambs of the first group affected significantly the higher weight of the internal organs (Table 4). According to Fluharty et al. (1999) the feeding system may influence the weight of the visceral organs. The authors stated that lambs receiving alfalfa had heavier liver, compared to lambs fed concentrate. The weaning at 25 days of age and feeding dry feed have influenced the significant higher weight of the lung and liver large and small intestine (Table 4). The higher roughage and concentrate intake at early age stimulates the better development of the rumen in the lambs weaned at 25 days of age. When taking samples of the rumen the darker color and the longer papillae in the lambs weaned at the 25th day were clearly visible. The higher length of the papillae in the early weaned lambs corresponds to the results of Le Roux (2011). Abou Ward (2008) also pointed the higher length of the papillae in lambs receiving dry feed at the age of 7 days, in comparison to sucking lambs without feed. Warner et al. (1956) described increased rumen volume and better papillae development and rumen walls in lambs inured to dry feed at early age. In their experiments Morand-Fehr et al. (1982) reported that the early feeding with dry forages not only stimulated the rumen development but accelerated the development of the muscles of the rumen wall which allowed the more effective digestion of the contents. The fermentation in the rumen of the ruminants leads to volatile fatty acids formation, stimulating the development of the papillae (Anderson et al., 1987; Van Soest, 1994). Baldwin and McLeod (2000) pointed that butyric and propionic acids influence the development of the papillae in the rumen. Warner et al. (1956) reported that grains were more important than the roughages for the papillae development. According to Žitnan et al. (1998) the roughage intake stimulates the rumen muscles development because of the volume, which accelerates the movements of the rumen (McGillard et al., 1965). The poor development of the rumen in the suckling lambs is due to the direct transition of milk in the abomasum caused by the reflex closing of the esophagus (Ørskov et al., 1970). In this case the milk does not contribute to the fermentation in the rumen (Baldwin et al., 2004). The higher roughage intake led to the higher volume of the rumen (Table 5). According to Rikard and Ternouth (1965) the higher concentrate intake alters the muscles in the rumen increases the density of the papillae, which confirms our results.

The two feeding regimens applied had no influence on the chemical composition of the muscle tissue (Table 6). The water content of Muscle *Longissimus dorsi* was 76.9%, which according to Gökdal et al. (2012) is in the normal range (70-80%).

No significant difference in the fatty acid composition of the perirenal fat was found between the groups (Table 7). The lambs of the second group tended to have higher contents of C14:0 and C16:0 and lower C18:3, which is reported by Beriain et al. (2000). According to Bas and Morand-Fehr (2000) and Okeudo et al. (2004) the lipid profile in suckling lambs is influenced by the composition of the milk they receive. The fermentation of the rumen also affects the fatty acid composition of the lipids (Ørskov et al., 1975).

Conclusions

The results of the experiment show that approximately equal growth in the live weight and carcass could be reached in lambs, weaned at 25 days of age, when properly fed, and lambs suckling until 70 days of age. A tendency toward higher weight gain in the late weaned lambs existed.

The development of the digestive system is better in the lambs weaned at the age of 25 days compared to the sucking lambs. At early weaning the carcass displayd a tendency toward better fatness and more internal fat than. No significant differences in the meat chemical composition and the fatty acid profile of the perirenal fat were found, although higher saturated fatty acids content was observed in the suckling lambs. Early weaning at the age of 25 days led to higher amount of milked milk and the expenses per kilogram of weight gain are several times lower.

Author contributions

M. S. carried out the experiment, calculated the results and wrote the article. N. T. and K. N. carried out the experiment and wrote the article. S. R. studied the meat (chemical composition). T. P. checked contents of the fat. D. Y. did the histological analysis of the rumen. A. K. and I. S. carried out the experiment.

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