COBISS: 1.01
Agris category code: L02

EFFECT OF FEEDING SYSTEM ON GROWTH AND CARCASS CHARACTERISTICS OF IMPROVED JEZERSKO-SOLČAVA LAMBS

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Received February 10, 2012; accepted May 23, 2012.
Delo je prispelo 10. februarja 2012, sprejeto 23. maja 2012.

Effect of feeding system on growth and carcass characteristics of Improved Jezersko-Solčava lambs

The objective of this study was to evaluate the effect of feeding system on growth and carcass characteristics of Improved Jezersko-Solčava (JSR) weaned lambs. Thirty-five lambs (25.48 kg) housed in group pens were divided into four groups and offered different diets which consisted of hay and second harvest in the ratio of 40:60 and a supplement of 650 g concentrate (Diet 1), hay and second harvest in the ratio of 40:60 (Diet 2), hay and 650 g of concentrate (Diet 3), and just hay (Diet 4) for 50 days. Daily intake was calculated by weighting the offered amount and leftovers of concentrate and forage. Daily intake per lamb contained 15.56 MJ, 14.38 MJ, 16.57 MJ, and 12.23 MJ ME for the Diet 1, 2, 3, and 4, respectively. Lambs were slaughtered at 30.77 kg of live weight. Lambs fed Diet 1 reached the highest DG (165.5 g/day), followed by Diet 3 (146.89 g/day), Diet 2 (123.55 g/day) and Diet 4 (75.51 g/day). HCW and CCW were higher in Diet 1 and 3, compared to Diet 2 and 4. Lambs fed Diet 3 had the highest DP (45.35%), followed by Diet 1, 2, and 4 with 44.33, 41.10 and 39.51%, respectively. The lowest kidney-pelvic fat was observed in lambs fed Diet 4 (5.64) and the highest in Diet 3 (7.66). These results demonstrate that fattening of weaned JSR lambs fed by forage-concentrate diets produced heavier carcasses than those only fed by forage, without significant effects on carcass fatness or carcass conformation.

Key words: sheep / breeds / Improved Jezersko-Solčava sheep / growth / carcass characteristics / feeding system / animal nutrition / diet

Vpliv načina krmljenja na rast in značilnosti klavnih trupov jagnjet oplemenjene solčavske pasme

Ugotavljali smo vpliv različnega krmljenja na rast in klavne lastnosti odstavljenih jagnjet oplemenjene jezersko-solčavske pasme (JSR). Petintrideset jagnjet (25,48 kg) je bilo uhlevljenih v 4 skupine po 8–9 jagnjet in krmljenih z različnimi krmnimi obroki v intervalu 50 dni. Skupina 1 je dobivala seno in otavo (40:60) ter 650 g koncentrata, skupina 2 seno in otavo (40:60), skupina 3 seno in 650 g koncentrata ter skupina 4 samo seno. Dnevno zauživanje krme smo izračunali na podlagi dnevnih tehtanj koncentrata in voluminozne krme ter njihovih ostankov. Jagnjeta so dnevno zaužila v povprečju 15,56 MJ, 14,38 MJ, 16,57 MJ in 12,23 MJ ME v skupini 1, 2, 3 in 4. Jagnjeta smo zaklali pri povprečni telesni masi 30,77 kg. Jagnjeta iz skupine 1 so dosegla največji dnevni prirast (165,5 g/dan), sledila je skupina 3 (146,89 g/dan), nato skupina 2 (123,55 g/dan) in skupina 4 (75,51 g/dan). Masa toplih in hladnih trupov je bila večja pri jagnjetih iz skupin 1 in 2 v primerjavi s skupinama 2 in 4. Jagnjeta iz skupine 3 so dosegla najboljšo klavnost (45,35 %), sledila so jagnjeta iz skupin 1, 2 in 4 (44,33, 41,10 in 39,51 %). Notranja zamaščenost je bila najnižje ocenjena pri trupih jagnjet iz skupine 4 (5,64), najvišje pa pri trupih jagnjet iz skupine 3 (7,66). Zaključimo lahko, da je pitanje odstavljenih JSR jagnjet z obroki na osnovi voluminozne krme in dokrmljevanjem s koncentratom prispevalo k hitrejši rasti in kot rezultat dajalo težje trupe, pri čemer se zamaščenost in mesnatost klavnih trupov ni statistično značilno spremenila.

Ključne besede: ovce / pasme / oplemenjena jezersko-solčavska ovca / rast / klavne lastnosti / režim krmljenja / prehrana živali / krmni obroki

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1 INTRODUCTION

In recent years, sheep breeding is becoming our important agricultural branch regarding the prevention of overgrowing and preservation of cultivated landscape in Slovenia. In general, sheep farming plays an important role from the cultural, ecological and environmental point of view. For this reason, the use of traditional rearing system of local sheep breeds is very important. Among the most spread sheep breeds in Slovenia are the local Jezersko-Solčava sheep breed (JS) and Improved Jezersko-Solčava with Romanov (JSR). Over the last 30 years the JSR breed has been developed under the local conditions as the result of crossbreeding the autochthonous Jezersko-Solčava breed to improve its fertility. JSR is a meat breed spread throughout Slovenia and is also suited for lamb production in pre-alpine regions where it stays on mountain pastures during the summer. It is fertile all year round and mates soon after lambing. The main production system used by Slovenian breeders of JS and JSR sheep is grazing lambs with their dams on the pasture till they reach 25 to 30 kg of slaughter weight. Pasture lambs are highly valued by consumers for their good meat quality, especially lower carcass fatness and higher percentage of linoleic (C18:2n-6), α-linolenic (C18:3n-3), arachidonic (ARA) (C20:4n-6), and eicosapentaenoic (EPA) (C20:5n-3) fatty acids (Cividini *et al.*, 2007; Cividini *et al.*, 2008). However, the production and the economical value of pasture lambs are seasonal. In fact, JSR sheep breeders are increasingly fattening their lambs by allowing access to hay or second harvest and concentrate or grain. In winter, breeders wean lambs at around 50 to 60 days old and fatten them with hay and concentrate or grain-based diets till they reach 30 to 35 kg. Especially in winter, breeders use many different feeding systems, which depend on a diet and time of weaning. The diet mostly consists of hay and second harvest. The hilly relief of agricultural land in pre-alpine areas does not allow the required production of hay and second harvest. Consequently, the quality of hay and second harvest may vary between seasons and breeders. Because of different feeding systems carcass characteristic and meat quality have some specificity attributed to a particular region and to different feeding system. There is a lack of information on fattening lambs with various diets, and scarce characteristics of their growth and carcass composition. The aim of this study was to analyze the growth rate and carcass characteristics of weaned JSR lambs fattened with different diets through the winter season.

2 MATERIAL AND METHODS

2.1 ANIMALS AND DIETS

The experiment was conducted at the Educational and Research Animal Husbandry Centre, University of Ljubljana, Biotechnical Faculty, Department of Animal Science located in Logatec. Thirty-five weaned JSR lambs aged on average 113 days were housed in group pens and randomly assigned to four experimental fattening diets (8–9 lambs/diet) differing in hay and second harvest level and supplemented with or without concentrate. Each group was assigned also by sex. Experimental fattening diets were constructed from the highest to the lowest concentrations of crude proteins (CP) and metabolizable energy (ME) as shown in Table 2. The highest quantity of CP was offered to the lambs fed Diet 1 (224.62 g/day), followed by Diet 3 (193.37 g/day), Diet 2 (142.53 g/day), and the lowest with Diet 4 (92.40 g/day). Lambs fed Diet 1 and 3 (concentrates groups) were offered also the high-

Table 1: *Chemical composition of hay, second harvest, and concentrate*
Preglednica 1: *Kemijska sestava sena, otave in koncentrata*

	Hay I	Hay II	Second harvest	Concentrate
Dry matter (DM) (g/kg)	877.3	878.1	847.4	880.1
Crude proteins (CP) (g/kg DM)	76.5	61.9	124.4	205.0
Crude fat (CFat) (g/kg DM)	15.0	13.0	25.4	
Crude fiber (CF) (g/kg DM)	326.0	338.5	271.7	
Ash (g/kg DM)	63.7	95.3	83.3	
Nitrogen free abstract (Nfree) (g/kg DM)	518.8	491.3	495.2	
Metabolizable energy (ME) (MJ/kg DM)*	8.36*	8.19*	9.09*	11.36**

Metabolizable energy for hay and second harvest was estimated using equations 1 and 2
* Metabolna energija za seno in otavo je ocenjena s pomočjo enačb 1 in 2
** Metabolizable energy for concentrate was declared by producer (Catalogue, 2008).
** Metabolna energija koncentrata je povzeta iz deklaracije proizvajalca (Katalog, 2008)

Table 2: *Composition and daily intake of the experimental diets*
Preglednica 2: *Sestava in dnevna koncumacija obrokov*

	Diet			
Feed (g/lamb)	1	2	3	4
Hay I	500	700	0	0
Hay II	0	0	1400	1700
Second harvest	700	1200	0	0
Concentrate	650	0	650	0
Daily intake per lamb				
Dry matter (DM) (g/day)	1603.90	1630.99	1801.41	1492.77
Crude proteins (CP) (g/day)	224.62	173.48	193.37	92.40
Metabolizable energy (ME) (MJ/day)*	15.56	14.38	16.57	12.23

est amount of ME, 16.57 MJ/day and 15.56 MJ/day, respectively. The lowest amount of ME was offered to the lambs fed Diet 4 (12.23 MJ/day). Diet 1 consisted of hay I and second harvest in the ratio of 40 to 60, and 650 g of concentrate per lamb per day. Diet 2 contained hay I and second harvest in the ratio of 40 to 60, without concentrate. Diet 3 consisted of hay II and 650 g of concentrate per lamb per day, and Diet 4 contained only hay II, without concentrate. Concentrate was fed individually, while second harvest and hay were fed per group. Mineral-vitamin mixture and water were available *ad libitum*. Each diet was calculated using the average live weight of the lambs and nutrient requirements for fattening lambs (NRC, 1985). For this purpose the chemical composition of hay and second harvest was determined (Table 1). ME in hay and second harvest was estimated using the equations 1 and 2, by Babnik *et al.* (2001). The amount of hay and second harvest were adjusted daily on the basis of the previous daily intake. The amount of concentrate stayed the same during fattening period.

The initial body weight of weaned lambs was on average 25 kg. The experiment lasted 48, 50, 49, and 49 days for Diet 1, 2, 3, and 4, respectively. Prior to the beginning of the experiment, a 7-day adaptation period was allowed, when lambs were shared and treated against parasites. Lambs were also adapting to the new diet and environment in this period. In the experimental period, lambs were fed once a day, in the morning. Lambs receiving Diet 1 and Diet 3 got the adherent amount of concentrate. Lambs from these two groups were blocked into hayrack to eat its own concentrate, and they were left out afterwards. Leftover concentrate was then removed from the hayrack and weighted. Hay and second harvest were weighted and put into hayrack, according to the group. Prior to feeding the next morning, the leftovers hay and second harvest in hayracks were removed and weighted. Lambs were weighted approximately every 10 days, prior to feeding. The target slaughter weight of experimental animals was 30 kg on average.

Estimation of metabolizable energy (ME, MJ/kg DM): Hay – first harvest (Babnik *et al.*, 2001):

$$ME\ (MJ / kg^{-1}\ DM) = 13.00 - 0.01415 \times CF + 0.02256 \times CFat - 0.00482 \times CP \quad (1)$$

Second harvest (Babnik *et al.*, 2001):

$$ME\ (MJ / kg^{-1}\ DM) = 11.73 - 0.01129 \times CF + 0.04526 \times CFat - 0.00577 \times CP \quad (2)$$

2.2 SLAUGHTERING AND CARCASS CHARACTERISTICS

On slaughter day, lambs were weighted at the Educational and Research Animal Husbandry Centre, before transportation to the abattoir at the Department of Animal Science, Biotechnical Faculty in Domžale (45 km). All lambs were slaughtered in three consecutive dates by the same procedure. Lambs were electrically stunned and slaughtered according to the standard commercial procedure. After slaughter, hot carcass weight (HCW) was determined and expressed as a percentage of slaughter weight. HCW was defined as weight of the whole carcass of each animal after bleeding, removing entrails, head, pelt, forefeet, hindfeet, tail and udder. Carcass conformation and fatness classes were subjectively scored according to the Slovenian regulation for grading and classifying carcasses of sheep and lambs (Rules, 2001), which is in agreement with the EUROP classification (Council Regulation, 1994). Kidney with knob channel fat belongs to the carcass. The pH of the *Musculus longissimus dorsi*

(LD) on the carcass right side was recorded at 45 min and 24 h *post-mortem* behind last rib using a pH-meter equipped with a penetrating electrode. Carcasses were kept at 17°C for 2 h, and were then chilled at 4°C for 24 h in conventional chiller. After chilling, cold carcass weight (CCW) was measured. Daily gain during the experimental period was calculated from live weights and age. Dressing percentage was calculated from hot carcass weight and slaughter weight.

2.3 STATISTICAL ANALYSIS

Data were subjected to the analysis of variance, using the GLM procedure of the SAS Statistical Software (1990). The effects of feeding system (Diet 1, 2, 3, and 4) and sex (male and female) were included in the model as fixed. The potential interaction between diet and sex was considered but was not statistically significant for the analyzed traits. Therefore, it was excluded from the model. Least square means were compared at the 5% probability level.

3 RESULTS

The average values of daily feed intake are shown in Table 3. The average forage intake was lower in lambs fed Diet 1 and Diet 3, which added concentrate, than in lambs fed Diet 2 and Diet 4, fed by forage only. The average concentrate intake was higher in lambs fed Diet 1 than in lambs fed Diet 3. The lowest average total intake was found in lambs fed only with hay (Diet 4) and the highest total intake was found in lambs fed with hay II and concentrate (Diet 3). Lambs fed Diet 2 had almost the same average total intake as lambs fed Diet 3. The average total intake in our case was higher in all tree diet groups compared to the literature (Haddad and Husein, 2004). Haddad and Husein (2004) fed Awassi lambs during the 60 days experimental period with 15:85 (high concentrate) and 60:40 (high forage) forage to concentrate ratio diet until 30 kg of slaughter weight. The average total DM intake for Awassi lambs from high concentrate diet was 978 g/day and was lower than average total DM intake for lambs in Diet 4 fed only with hay (1182.8 g/day). When the ME intake was compared to the literature, the ME intake of Improved Jezersko-Solčava lambs was higher (Haddad and Husein, 2004; National, 1985). The average ME intake per lamb per day in our experiment was 11.74 MJ. Regarding nutrient requirements lambs from 25 to 30 kg of body weight should require 8.0 to 8.8 MJ ME/day to gain 150 g/day in average (Verbič and Babnik, 1999). However, the average forage and the average total intake in our experiment were probably overestimated.

The average live weights according to the diet are shown in Fig. 1. At the beginning of the trial the average live weight of lambs in Diet 1, 2, 3, and 4 were 24.37 kg, 24.88 kg, 24.78 kg and 23.90 kg, respectively. In the adaptation period, lambs were losing their live weight, but after the adaptation period, lambs began to increase their live weight. The initial average live weight of all lambs was 25 kg.

Table 4 shows the effect of feeding system on the main growth and carcass characteristics. There were no significant differences among feeding systems in age at slaughter and weight at slaughter. The target slaughter weight was 30 kg when JSR lambs are traditionally slaughtered. Differences among feeding systems in terms of average daily gain were highly significant. Lambs fed Diet 1 reached the highest daily gain (165.5 g/day). Daily gain of the lambs during the trial was significantly lower in lambs fed Diet 4 (75.51 g/day) then lambs fed Diet 3

Table 3: *The average feed intake of lambs receiving different diets during the fattening period*
Preglednica 3: *Povprečna dnevna konzumacija jagnjet krmljenih z različnimi obroki v času poskusa*

	Diet			
Intake (g/lamb/day):	1	2	3	4
Forage intake	940	1561	1042	1347
Concentrate intake	562		526	
Total intake	1502	1561	1568	1347
DM Intake (g DM/lamb/day):				
From forage	808.27	1339.99	914.98	1182.80
From concentrate	494.62	/	462.93	/
Total DM intake	1302.88	1339.99	1377.91	1182.80
Total crude protein intake (g/lamb/day)	185.49	142.53	151.54	73.22
Total ME intake (MJ/lamb/day)	12.72	11.81	12.75	9.69

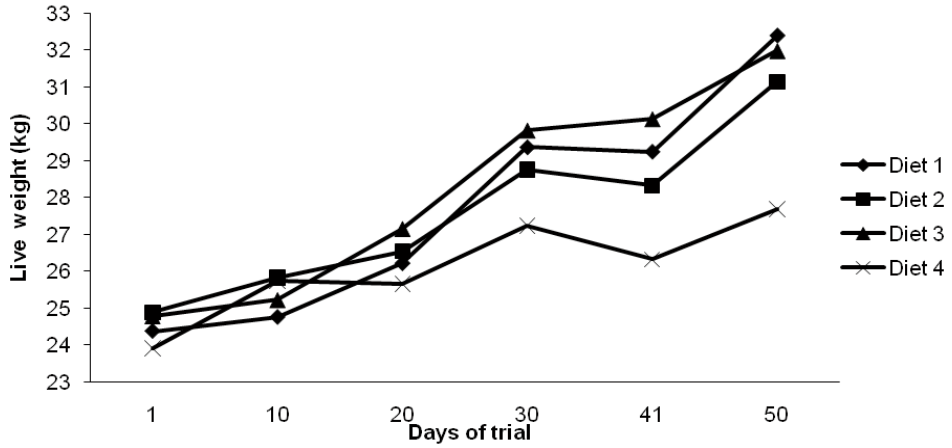

Figure 1: *Average live weights according to the Diet*
Slika 1: *Povprečne telesne mase v času poskusa glede na krmni obrok*

(146.89 g/day) and lambs fed Diet 1. The differences in daily gain of lambs between Diet 2 (123.55 g/day) and Diet 4 were not significant. Hot carcass weight (HCW) and cold carcass weight (CCW) were the highest in lambs fed Diet 3 and differed significantly when compared to lambs fed Diet 4. The differences in HCW and CCW between Diet 2 and Diet 4 were not statistically significant. Significant differences were seen in dressing percentage (DP) due to the feeding systems. The highest DP had lambs fed Diet 3 (45.35%), followed by Diet 1, Diet 2, and Diet 4; 44.33%, 41.10%, and 39.51%, respectively. The differences among feeding systems in kidney-pelvic fat were statistically significant with the lowest value in lambs fed Diet 4 (5.64) followed by Diet 1, Diet 2, and Diet 3; 7.66, 7.69 and 7.73, respectively.

4 DISCUSSION

High-energy diets have been shown to improve growth rates in different sheep breeds. Beauchemin *et al.* (1995) studied the effect of dietary energy density on growth performance of Rambouiller, Dorset, Finn, Suffolk, and Romanov breeds and observed that reduced dietary digestible energy lowers growth rate and decreases growth efficiency. Similar results reported Haddad and Husein (2004) when compared Awassi lambs fed high

Table 4: *Carcass characteristics of the Improved Jezersko-Solčava (JSR) lambs fattened with four different diets (LSM ± SE)*
Preglednica 4: *Klavne lastnosti jagnjet oplemenjene jezersko-solčavske pasme glede na krmni obrok*

	Diet 1 N = 9	Diet 2 N = 9	Diet 3 N = 8	Diet 4 N = 9	P
DG (g/day)	165.54 ± 12.08^{a}	123.55 ± 12.08^{ab}	146.89 ± 12.80^{a}	75.51 ± 12.08^{b}	***
AS (days)	159.77 ± 13.94	193.99 ± 13.94	176.75 ± 14.76	153.66 ± 13.94	ns
SW (kg)	32.22 ± 1.28	30.97 ± 1.28	31.99 ± 1.35	27.51 ± 1.28	ns
HCW (kg)	14.18 ± 0.59^{a}	12.75 ± 0.59^{ab}	14.54 ± 0.63^{a}	10.88 ± 0.59^{b}	**
CCW (kg)	13.74 ± 0.59^{a}	12.28 ± 0.59^{ab}	14.10 ± 0.62^{a}	10.48 ± 0.58^{b}	**
DP (%)	44.33 ± 0.79^{a}	41.10 ± 0.77^{b}	45.35 ± 0.83^{a}	39.51 ± 0.85^{b}	***
EUROP	8.16 ± 0.30	8.02 ± 0.29	8.81 ± 0.32	7.55 ± 0.32	ns
Kidney-pelvic FAT	7.66 ± 0.41^{a}	7.69 ± 0.41^{a}	7.73 ± 0.44^{a}	5.64 ± 0.45^{b}	**
FAT	8.80 ± 0.34	8.64 ± 0.33	8.45 ± 0.36	7.68 ± 0.36	ns

DG = daily gain from the first to the last day of the trial; AS = age at slaughter; SW = slaughter weight; HCW = hot carcass weight; CCW = cold carcass weight; DP = dressing proportion; EUROP = EUROP conformation (score): E+ = 15, E_0 = 14, E– = 13, U+ = 12, U_0 = 11, U– =1 0, R+ = 9, R_0 = 8, R– = 7, O+ = 6, O_0 = 5, O– = 4, P+ = 3, P_0 = 2, P– = 1; Kidney-pelvic FAT = kidney-pelvic fatness; FAT = carcass fatness (score) 5+ = 15, 5_0 = 14, 5– = 13, 4+ = 12, 4_0 = 11, 4– = 10, 3+ = 9, 3_0 = 8, 3– = 7, 2+ = 6, 2_0 = 5, 2– = 4, 1+ = 3, 1_0 = 2, 1– = 1; a, b, c = Means in the same row, within group effect, heaving different superscripts are different (P < 0.05); ns = not significant; * = P < 0.05; ** = P < 0.01; *** = P < 0.001.

concentrate diet (12.26 MJ/kg ME) and lambs fed high forage diet (10.08 MJ/kg ME) through 60 days fattening period and slaughtered at 30 kg. Awassi lambs fed a high concentrate diet maintained higher weights throughout the entire experimental period. The average daily gain of lambs fed high concentrate diet was greater compared to lambs fed high forage diet (258 g/day *vs.* 178 g/day). In the present experiment, lambs fed forage-concentrate diet (Diet 1 and 3) with the highest metabolizable energy intake (12.72 *vs.* 12.75 MJ/day) maintained higher average daily gain throughout the experimental period (165.54 *vs.* 146.89 g/day) compared to lambs fed just forage diet (Diet 2 and 4) with low metabolizable energy intake (11.81 *vs.* 9.69 MJ/day ME) (123.55 *vs.* 75.51 g/day). The highest daily gain of lambs fed Diet 1 in our experiment was probably the result of the highest protein intake in this group of lambs. In addition, Haddad *et al.* (2001) fattened Awassi lambs with high concentrate diets differing in CP levels and observed that higher intake of digestible CP improved growth rate.

Despite better quality of second harvest added in Diet 1 (hay I : second harvest = 40:60 plus concentrate) compared to hay II added in Diet 3 (hay II plus concentrate), a total DM intake for lambs fed Diet 3 (1377.91 g/day) was the highest. Lambs fed Diet 3 had higher average forage intake and lower average concentrate intake than lambs fed Diet 1, what indicates that lambs preferred to consume hay II than a mixture of hay I and second harvest. The lowest total DM intake had lambs fed Diet 4 (forage diet; 1182.80 g/day). Consequently, total ME was the highest in lambs fed Diet 3 and the lowest in lambs fed Diet 4. Similar results found Haddad and Husein (2004) for Awassi lambs, where lambs fed high concentrate diet had higher ME intake compared to lambs fed high forage diet. They concluded that this increase in ME intake for lambs fed high concentrate diet resulted in a greater average daily gain and final body weights for lambs fed high concentrate diet. Nevertheless, some authors reported that sheep consume more energy when fed diets containing relatively large amounts of alfalfa compared with concentrates (Grovum, 1988). Hatfield *et al.* (1997) found that DM intake decreased linearly with increasing barley level in the diet from 50%, 70% to 90% and maintained 1.47, 1.43 and 1.26 kg/day/lamb, respectively. The average intake of DM (1.4 kg/day) for lambs observed by Hatfield *et al.* (1997) was similar as DM intake for lambs fed Diet 3 in our experiment (1.37 kg/day). However, net energy for gain observed by Hatfield *et al.* (1997) did not increase with decreasing level of barley in the diet. Santos-Silva *et al.* (2002) reported similar results for average daily gain in Merino Branco and Ile de France × Merino Branco lambs with a linear increase of daily gain when lambs were only on pasture, pasture plus supplement, or receiving concentrate.

Although the final slaughter weight did not differ significantly between diets ($P = 0.0528$) a slight differences were observed. Lambs fed Diet 1 and Diet 3 (concentrate plus forage) maintained higher final body weight (32.22 and 31.99 kg) at the end of experimental period when compared to lambs fed Diet 2 and Diet 4 based on forage (30.97 and 27.51 kg). Despite no statistical differences in slaughter weight among diets, there were differences in hot and cold carcass weight. Both, HCW and CCW were the greatest for Diet 3, intermediate for Diet 1 and Diet 2, and the smallest for Diet 4. Feeding system influenced dressing percentage with better values for lambs fed diets based on forage and supplemented with concentrate compared to lambs fed just forage diets. Lambs fed Diet 3 had the highest dressing percentage (45.35%) and differed significantly from lambs fed Diet 2 (41.10%) and Diet 4 (39.51%). Lambs fed Diet 1 (44.33%) had similar dressing percentage compared to lambs fed Diet 3, but differed significantly from lambs fed Diet 2 and Diet 4. Our findings in terms of dressing percentage were similar to the findings of Haddad and Husein (2004), where dressing percentage of lambs fed high concentrate diet was higher compared to lambs fed high forage diet (48.5% *vs.* 43.5%).

Feeding system did not significantly affect carcass conformation and carcass fatness. Similar results found Santos-Silva *et al.* (2002) among lambs of two genotypes grazing on the pasture, grazing and receiving a supplement or feeding in the stable with concentrate. Moreover, Hatfield *et al.* (1997) reported no influence in the level of whole barley in the diet on backfat, bodywall thickness, and quality grade. However, in the present experiment feeding system did affect kidney pelvic fat with the highest score for lambs fed Diet 3 (7.73), followed by Diet 2 (7.69), Diet 1 (7.66), and Diet 4 (5.64). Hatfield *et al.* (1997) found a tendency for quadratic response among the levels of whole barley. Lambs receiving 70% of whole barley in a diet had greater kidney-pelvic fat than lambs fed 50 and 90% of whole barley in diets. However, Improved Jezersko-Solčava lambs fed higher energy diets produced more kidney-pelvic fat at the same carcass fatness compared to lambs fed lower energy diets. Moreover, when calculated the cost for kilogram of gain considering market prices and quality of hay I, hay II, second harvest and concentrate (0.11; 0.16; 0.1855 and 0.33 €/kg), average intake per day of each feed and average daily gain for lambs in each group (Diet 1, …Diet 4), the feed cost for kg of gain in group Diet 1, Diet 2, Diet 3 and Diet 4 was 2.33, 2.42, 3.04 and 3.67 €/kg, respectively (Model calculations, 2011).

5 CONCLUSION

Feeding forage-concentrate diets like Diet 1 and Diet 3 improved hot and cold carcass weight of Improved Jezersko-Solčava lambs which occurred also due to the higher dressing percentage observed for lambs fed Diet 1 and Diet 3. Improved Jezersko-Solčava lambs which were finished on high-energy diet had a greater daily gain compared to those that were finished on lower-energy diet. Feeding system did not affect carcass fatness and carcass conformation. Thus, lambs kept in a stable and fed with good quality hay or second harvest *ad libitum* supplemented with 650 g concentrate per day per lamb (Diet 1) grew faster and produced heavier carcasses than those fed only with forage, without significant effects on carcass fatness or carcass conformation. Additional, feed cost for kilogram of gain was the lowest in Diet 1.

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