Research Article

Effect of Nutrition During the Last Stages of Pregnancy on Lamb Birth Weight and Growth Performance in Balkhi Ewes

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Abstract | The present study was designed to examine the weight gain and growth performance of Balkhi lambs and pregnant Balkhi ewes at The University of Agriculture, Peshawar Dairy Farm Malakandair. Balkhi sheeps (n=30) were purchased from the market. They were kept for ninety days including 10 days for adaptation. Animals were divided into three groups such that each group contain ten animals i.e. group A (NRC recommended diet), group B (4% more CP and 2% more TDN), and group C (conventional grazing). Weekly body weight changes were recorded on digital balance and body condition score was calculated (1-5) on weekly basis. Bodily changes of ewes were significantly higher in group B (1.73±0.13 kg/week) followed by group A (1.22±0.07 kg/week) and group C (0.85±0.03 kg/week). The similar pattern was found for birth weight of lambs (group B > group A > group C). Least growth rate of lambs was observed in group C (0.46±0.02) followed by group A (0.75±0.042) and B (0.94±0.06). The effect of different level of diets was significant (P<0.05) on body condition score (BCS) of pregnant ewe before and after lambing. It was concluded that higher Crude Protein (CP) and Total Digestible Nutrients (TDN) supplementation to pregnant ewes improves the birth weight, growth rate of lambs and body condition scoring of ewes.

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Introduction

Pakistan is an agricultural country. Livestock is sub-sector of agriculture. Livestock having share of 60.54 percent in agriculture and 11.22 percent in GDP, recorded the growth at 4.0 percent against the target of 3.8 percent during the Financial Year 2018-19. About 59759 thousand tons of meat was produced, of which 40 thousand tones was contributed from sheep meat (Economic Survey of Pakistan, 2018-19).

Sheep and goats are mostly owned by rural subsistence smallholder producers and are used for milk, meat and wool production. They are mostly landless and graze their flocks on communal ranges. Usually they live in sedentary or transhumant system of living; however, nomads are also found (Ahmed, S. 2007). Nomadic herders native to the tribal belt of Pakistan and Afghanistan, solely depend for livelihood upon their flocks, are responsible for conservation and development (breed improvement) of the present day Balkhi sheep. There are more than 30 sheep breeds in

Pakistan (Khan et al., 2007). The annual population of goat and sheep is increasing at the rate of 4.5% and 1.2% respectively (Davendra, 2000). The population of sheep is 30.9 millions. (Economic Survey of Pakistan, 2018-19). Balkhi is a heavy muttonous fat-tailed sheep breed, originated in the continental climate of Balkh area in Afghanistan and are found in the adjacent areas of central valley of Khyber Pakhtunkhwa (KP) province of Pakistan and primarily raised for mutton production (Ibrahim et al., 2017). Small ruminants can play important role in fulfillment of daily protein requirement of humans (Khan, 2007).

Nutrition has a direct effect on reproductive performance (Vinoles et al., 2008). Nourishment affect total life span yield of sheep by influencing body size. The last six weeks of gestation is the most crucial phase in ewe food. 70 per cent of fetal growth occurs at this time (Gardner, 2007). If protein level is low in feed of pregnant ewes, it will result in low birth rates and underweight lambs (Wu et al., 2006).

Keeping in view the above facts the current study was carried out in order to investigate the effect of feeding regimes on pregnant Balkhi Sheeps and birth weight, survival rate and growth performance of lambs in order to facilitate the farmers of the area.

Materials and Methods

This study was carried out at The University of Agriculture Peshawar Dairy Farm Malakandair. Total 30 advance pregnant Balkhi sheep were selected for this study. Experiment lasted for 90 days including 10 days for adaptation period.

Housing and feeding

Ewes were kept under closed housing system. The ewes were dewormed and vaccinated as per standard protocol. Before feeding the experimental animals, either conventional or with treatments the composition (nutritional value) of the diets were determined by proximate analysis according to Association of Official Analytical Chemists, (AOAC, 1990). Experiment was started 30 days before lambing and continued till 50 days after postnatal period (Munoz et al., 2009).

Experimental animals and dietary treatments

All the sheep were divided into three groups randomly (each group consist of 3 animals) named A, B and C. The sheep were assigned three different dietary treatments in which one group was NRC recommended level, other group had 4%more CP and 2% TDN and third group was given conventional nomads people feeding and that was grazing. The design of the experiment was completely randomized design. The Design used for this experiment was Completely Randomized Design (CRD). Concentrate ration were formulated from available concentrates ingredients in dairy farm. While formulating the ration changes were made in concentrate ingredients and their level.

Table 1: *Proximate composition of the concentrate ration.*

Components	Concentrates	
	A (NRC level)	B (above NRC)
Dry matter(%)	91.65	91.42
Crude protein (%)	12	16
Ether extract (%)	5.32	5.78
Crude fiber (%)	14.26	11.81
Ash (%)	5.21	4.99
Nitrogen free extract (%)	46.1	47.3
Metabolizable energy (KJ/kg)	2.32	2.38

Table 2: *Mean weight gain in ewes for 3 weeks before lambing treated with different diets.*

	Weight gain (Kg) Mean± SE			
Group	Week 3	Week2	Week1	Mean
1	0.97^{b}±0.07	$1.20^{a,b}$±0.21	1.45^{b}±0.03	1.21^{c}±0.06
2	1.66^{a}±0.26	1.59^{a}±0.10	1.92^{a}±0.00	1.72^{a}±0.13
3	0.72^{b}±0.15	0.81^{b}±0.09	0.94^{c}±0.16	0.85^{c}±0.03

Mean with different superscripts in the same column are significantly different at α=0.05.

Weighing of the animals: Weight of the animals was recorded at morning with empty gut using electrical balance. Weekly data were collected before and after parturition and weight change during nursing and lactation were recorded till the last week of experiment.

Body Condition Scoring (BCS): Scoring was performed by feeling the fat deposition i.e. the level of muscling over and around vertebrae in the loin region. Spinous and transverse process of loin vertebrae were felt along with central spinal column and used to assess an individual body condition score (1-5) as described by Kenyon et al., 2014.

Statistical analysis: Data was arranged in Microsoft excel 2007 and were analyzed by using the general

Table 3: *Effect of diets on weekly body weight (Kg) gain of lambs.*

Group	Weight gain (Kg) Mean± SE							Mean
	Week1	Week2	Week3	Week4	Week5	Week6	Week7	
1	0.95^{a}±.0	1.02^{a}±.01	0.95^{a}±.01	0.90^{a}±.02	0.93^{a}±.02	0.93^{a}±.01	0.92^{a}±.02	0.94^{a}±.04
2	1.18^{a}±0.01	1.19^{a}±0.11	1.17^{b}±0.02	1.16^{b}±0.02	1.15^{b}±0.03	1.11^{b}±0.02	1.11^{b}±0.01	1.1^{b}±0.06
3	0.44^{b}±.02	0.48^{b}±.02	0.45^{c}±0.02	0.50^{c}±0.01	0.45^{c}±0.02	0.49^{c}±0.02	0.44^{c}±0.03	0.45^{c}±0.02

Mean with different superscript in the same column are significantly different at α=0.05

linear model (GLM) SAS-2000 ANOVA Jason Roy (2007). Significant level was considered at $P<0.05$.

Results and Discussion

The study was performed to evaluate the performance of pregnant ewes and their new born lambs when subjected to three different types of feeding. The results obtained are elaborated in the following sub-headings.

Effect of diets on ewe weight before lambing

There was no significant difference between group-1 and group-3 in the start of week (Table 2). Overall the weight gain is increasing in all groups but group-2 mean value (1.72±0.13) is greater followed by group 1(0.94±0.16) and group 3(0.85±0.03). Highest mean weight gain in 3rd week before lambing was in group 2(1.6633±0.26) followed by group 1(0.9767±0.07) and group 3(0.7233±0.15).

As animal entered in the 2nd week their weight gain values shows marked increase. In week 1 before lambing group B shows statistically significant difference (1.9200±0.00) kg/week in body weight gain followed by treatment A (1.4567±0.03) and C (0.9433±0.16).

Lamb birth weight

NRC recommended group get more weight (3.6^{b}±.158) than keeping just on grazing. Mean values of birth weights for all three groups shows that there is difference in conventional and NRC recommended group but significant difference is present in (4.20a±.113) above NRC recommended group. Analysis of variance shows significant effect of different feeding on lamb birth weight (P value =0.004).

Lamb weekly growth

There is no significant difference (P>0.05) on growth of lamb in group-1 and group-2 in the first week as shown in Table 3. However, significant difference was present among all the groups after 1st week. In week 2 and 3, average mean values of weight gain is numerically increasing in all groups but higher significance (<0.05) is present in group 2 compared to group 1 and group 3. In week 4, group B shows statistically significant difference (1.160±0.02) kg/week in body weight gain followed by group 1 (0.900±.020) and 3(0.5000±0.0173). For week 5 group B shows statistically significant difference (1.156 ±0.035) in body weight gain followed by group1 (0.933±.020) and 3 (0.4500^{c}±0.0231) and this group was continued for week 6 and 7.

Overall group 2 weight gain (1.1±0.0612) is significantly higher (P<0.05) followed by group1 (0.9448±.0426) and then group 3 (0.4578±0.0250). ANOVA shows significant difference among three different types of diets.

Body condition scoring (BCS) of ewes

BCS before lambing: No significant difference was found in group 1 and 3 at beginning of experiment as shown in Table 4, but difference is significant for group 2 (3.35±.0.0473). Highest body condition scoring (3.38±.0593) was observed in group 2 followed by group 1(3.14a±.0593) and then group 3 (2.95±.034). Significant difference (P<0.05) is present in BCS of pregnant ewe before lambing.

Table 4: *Body condition scoring of ewes before lambing.*

Group	Beginnings BCS	Lambing BCS	Mean
1	3.11^{b}±.05	3.18^{a}±.06	3.14^{a}±.05
2	3.35^{a}±.0.04	3.42^{b}±.06	3.38^{b}±.05
3	2.93^{b}±.02	2.97^{c}±.01	2.95^{c}±.03

Mean with different alphabetic superscript in the same column are significantly different at<0.05

BCS after lambing: Huge reduction in body condition scoring was observed in the ewes that were just on conventional grazing and no supplementary ration was allowed (1.4700^{b}±.000) (Table 5). Highest

lost in body condition scoring (1.4700[b]±.000) was observed in treatment 3 followed by treatment 1 (2.6567[a]±0.0395) and then treatment 2 (2.745[a]). Analysis of variance showed significant effect (P<0.05) of different level of diets on BCS of pregnant ewe after lambing.

Table 5: *Body condition score of ewes before and after lambing.*

Group	Week 1	Week2	Week3	Mean
1	2.72[a]±0.04	2.65 [a] ±0.04	2.64[a]±0.04	2.65[a]±0.03
2	3.01[b]±0.03	2.99 [b]±0.04	2.96[b]±0.06	2.7[a]±.04
3	1.68[c]±0.04	1.55 [c]±0.09	1.45[c]±0-14	1.47[b]±.00

Mean with different superscript in the same column are significantly different at α=0.05

The findings of the study are discussed in this chapter. Significant difference in weight gain was observed in NRC recommended feed group (P<0.05). Radunz et al. (2011) found that sheep given (25.3% on DM basis CP) had greater BW gain (P < 0.001) than (14.3% on DM basis CP) group. In late gestation when increase protein diet and same energy diet is given ewes increased their live body weight (Ocak et al., 2005; Engel et al., 2008). These studies coincides with our results that greater the gain in BW of that pregnant ewes which had been fed more protein diet.

In agreement with our studies Dawson et al. (2005) found positive relationship of increase herbage and concentrate allowance with live weight gain. Kerslake et al. (2008) found no satisfactory result of weight gain by protein supplementation when enough roughage was provided.

Present study revealed that different level of feeding regime has their effect on birth weight of lambs. Ewes that had been given above than NRC requirement diet had more birth weight (4.200a±.113) than that just kept on conventional grazing (3.200b±.104). Previous studies demonstrate that low nutrition in pregnancy negatively effects on growth of the foetus (Husted et al., 2007, 2008).

Furthermore low nutrition in late gestation badly affects the lambs metabolic control postpartum, up to 18 weeks of age (Husted et al., 2007) and the ewes live weight during late pregnancy (Husted et al., 2008).

Meyer (2010) found that different nutritional plane of pregnant ewes and their effect was studied on offspring BW. He found positive relationship of good nutrition with live body weights of lambs. Sormunen-Cristiana and Jauhiainen (2001) studied that there is positive effect of more protein and energy levels in late pregnancy on growth rate of lambs during the first six weeks of their life. The findings of Thomson et al. (2004) suggested that heavier lambs at birth are heavier till 12 weeks of age. Results of Kerslake (2008) revealed that concentrate supplementation within the height of 6 cm increased birth weight of lambs from 4.8 to 5.3 kg and concentrate addition increased lamb growth by 30 g/day. Nørgaard et al. (2008) identified decrease in colostrum output with feed restriction.

Study showed that ewes maintain body condition with adequate or supplemental CP in late gestation ewe diets. Similar to our results, Munozn et al. (2009) found an increase in BW and BCS in ewes before parturition and his result showed that ewes supplemented with CP during late gestation gain more weight. Late pregnancy supplementation directly effects on Ewe weight and BCS, (Ocak et al., 2005). Ewes lose their body weight before than body condition if controlled feed is given. (Nørgaard et al., 2008).

Present study revealed that different level of feeding regime has their effect on birth weight of lambs. Ewes that had been given supplemented protein ration (group B) than NRC requirement diet had significantly higher birth weight (4.2±.113) than those just kept on conventional grazing (3.2±.1). Previous studies showed effect of insufficient nutrition in pregnancy on growth of the fetus (Husted et al., 2008; Husted et al., 2007). Both ewe weight and BCS can be affected by supplementation of the ewe in late pregnancy (Ocak et al., 2005).

Conclusions and Recommendations

Findings of the study revealed that daily feeding supplementary concentrates having high energy and protein concentration to pregnant ewes along with grazing improve birth weight and growth rate in terms of live body weight gain and body condition scoring.

Authors Contribution

SM conceived the idea of this study. SM and SA executed the research trial and data collection. MS and

MN analyzed the data and wrote the manuscript. All authors contributed and coordinated in finalization of this manuscript.

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