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EFFECT OF FEEDING FREQUENCY ON DRY MATTER INTAKE WEIGHT GAIN FEED CONVERSION EFFICIENCY AND ITS RELATION WITH BODY MEASUREMENTS IN LOHI LAMBS

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Due to high basal metabolic rate, the small ruminants need more frequent feeding than large ruminants. Lohi is one of potential mutton breed of Pakistan. A study was conducted to evaluate the growth performance correspond to feeding frequency in Lohi lambs, keeping in view the prevailing feeding pattern i.e. once per day during intensive feeding as opted by the livestock farmers. Lohi lambs were raised on more than one feeding frequencies regarding least cost basis. It was noted that with the increase in feeding frequencies, dry matter intake/kg/day was increased. Statistically, results of weekly weight gain showed significant ($P<0.05$) difference among various treatments (A, B and C). Similarly, feed conversion efficiency for all the groups of lambs also showed a significant ($P<0.05$) difference. The data collected on the morphometric measurements (heart girth, HG; body length, BL) of Lohi lambs for all treatment groups showed a significant ($P<0.05$) difference. The range lands which were easily available for grazing by small ruminants are reducing at the rate of 2% per decade. There is immense need to explore intensive rearing of small ruminants by adopting different strategies of offering feed to their animals best suited in tropical environment. The study proved that farmers should adopt three times feeding strategy to their small ruminants to get maximum growth performance.
Keywords: Sheep, wool production, growth performance, animal nutrition, weight gain

INTRODUCTION

Pakistan ranks 11th in the world having **30.1** million heads of sheep. Pakistani sheep are primarily raised for mutton and wool production. These animals contribute 54278 thousand skins and 701 thousand tonnes of mutton meat annually in the national economy (Anonymous, 2017). The weight of local sheep indicates the scope of improvement which can be exploited with proper feeding and adopting better management practices. There are 28 recognized breeds of sheep (Alvi, 1991) spread all over the country.

The prevailing production systems for small ruminants in Pakistan are described as nomadic, transhumance, household sedentary and commercial (Qurashi *et al*., 2004). It is estimated that five million farmers and 0.5 million landless families own sheep in Pakistan. It has also been estimated that about 3.4% of the holdings are upto 5 sheep, 9.1% have from 6to 15, 13.8% have from 16 to 30, 14.2% have from 31 to 50, 8.7% have from 51 to 75, 7.1% have from 76 to 100, 8.7% have from 101 to 150, and 6.7% between 151 to 200, 14.4% between 201 to 350 and 14.1% has more than 350 sheep (Khan, 2003).

Lohi represents the predominant breed of irrigated areas of central Punjab. It is one of the important sheep breed for mutton production in Pakistan. Optimum growth and development of a healthy animal depend upon adequate nutrition and management. Increased weight gain and dry matter intake are well known factors that influence financial returns in sheep enterprise. Balanced ration with correct feeding schedule is necessary for optimum growth response and greater economic returns. Due to high basal metabolic rate, the small ruminants need more frequent feeding than large ruminants. Therefore, increase in feeding frequencies may improve growth performance of Lohi lambs, thereby increasing the mutton production in Pakistan.

MATERIALS AND METHODS

The experiment was conducted at Small Ruminant Training and Research Center (SRT & RC) Pattoki to investigate the effect of different feeding frequencies on the growth performance of Lohi lambs. Weaned Lohi lambs (n=27) of nearly same age (170-180 days) and nearly same weight (20-22 Kg) were selected from the available flock.

The Lohi lambs were ear tagged for identification. The animals were randomly divided into three groups (A, B and C), with nine animals in each group, which were further subdivided into three replicates with three lambs/ sub group. The lambs were randomly allotted to different treatment groups whereas, Group A was treated as control. The lambs of group A, B, and C were offered barseem (*Trifolium alexandrium*) as green fodder *ad libitum* and concentrate @

1% of their body weight twice (7am and 7pm), thrice (7am, 1pm, and 1 am) and four times daily (7am, 1pm, 7pm and 1am), respectively.

Table 1. Composition of concentrate ration mixture.

Sr. No	Ingredients	Percent
1	Cotton seed meal	10.00
2	Maize grains	35.00
3	Canola meal	10.00
4	Wheat bran	13.00
5	Rice Polish	15.00
6	Burga fat	1.00
7	Molasses	13.00
8	Mineral mixture	2.00
9	Sodium bicarbonate	0.85
10	Premix	0.15
	Total	100.00%
	C.P	15.57%
	ME/kg	2.87

The orts were recorded daily up to twelve weeks. Weighing of the lambs was done at the start of the experiment and thereafter at weekly intervals.

The studied parameters were; dry matter intake (daily), body weight (weekly), feed efficiency (FE) by the formula

$$\text{F. E.} = \frac{\text{Weight gain}}{\text{Feed consumed (DM basis)}}$$

Morphometric measurements (cm's; fortnightly) were taken as Height at withers (HAW; from the highest point at withers upto the feet touching ground at leveled area), Heart girth (HG; circumference around the chest) and body length (BL; point of shoulder to point of hip). Economics against variable feeding frequency was also calculated. The data thus collected was analyzed by using analysis of variance technique (ANOVA) under Completely Randomized Design (CRD) as described by Steel *et al*. (1997). Least significant differences were calculated to compare means, when the difference was significant.

RESULTS

The highest (P<0.05) dry matter intake DMI in case of green fodder was recorded in group C and the lowest (P<0.05) in group A (Table 2). So, a considerable difference was observed in the dry matter intake from green fodder among all the treatment while no difference (P>0.05) was observed in the DMI form concentrate ration. The average daily total dry matter intake was also different (P<0.05) among all the treatment and it was higher (P<0.05) in group C.

The average daily gain was different (P<0.05) among all the groups and highest (P<0.05) average daily gain was observed in group C. Weekly trend of weight gain is shown in Figure 1.

Table 2. Productive performance and Mean body measurements of Lohi sheep at different feeding frequencies.

Parameters	A (Mean±S.E)	B (Mean±S.E)	C (Mean±S.E)
Green fodder DMI (kg)	0.51±0.007a	0.52±0.008b	0.54±0.008c
Concentrate DMI (kg)	0.26±0.004	0.26±0.0045	0.26±0.004
Total DMI (Kg)	0.78±0.011a	0.79±0.012b	0.81±0.012c
Avg. daily wt gain (gm)	0.13±0.005a	0.16±0.004b	0.18±0.008c
Feed Efficiency	0.49±0.017a	0.62±0.015b	0.67±0.024c
Rearing cost (PkR)	31.75±0.33c	34.03±0.34b	37.56±0.33a
Withers Height (cm)	60.15±1.06a	61.37±0.81a	62.13±0.61a
Change in withers height (cm)	3.82±0.36b	4.76±0.61ab	5.99±0.76a
Heart Girth (cm)	70.81±1.01c	75.14±0.85b	82.27±1.11a
Change in Heart Girth (cm)	3.55±0.21c	5.75±0.27b	8.75±0.34a
Body Length (cm)	59.95±1.25b	64.79±0.68a	65.77±0.58a
Change in Body Length (cm)	4.17±0.17b	7.74±0.55a	8.67±0.22a

The means bearing the different alphabets in a row are significantly different (P<0.05)

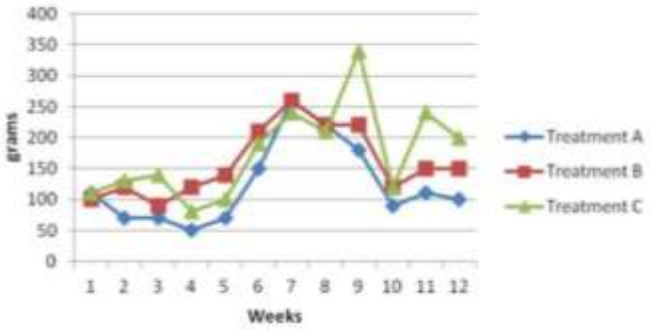

Figure 1. Average daily gain (ADG) on weekly basis.

The feed efficiency had shown statistically significant (P<0.05) difference among all the three groups A, B and C, respectively.

***Feed Efficiency*:** The feed efficiency had shown statistically significant (P<0.05) difference among all the three groups A, B and C, respectively as depicted in Figure 2.

Figure 2. Feed efficiency on weekly basis.

The data regarding production cost comprise of (green fodder, concentrate, and labor cost). The cost of production

was different among all the groups and was higher in group C. Feeding frequency had no impact on mean wither height so, it was remained same among all the groups (P>0.05) but it has strong positive impact on heart girth because it was different among all the treatments and had low impact on body length because it remained same (P>0.05) in group B and C and lower (P<0.05) in group A is shown in Table 2.

DISCUSSION

The findings of Keskin *et al*. (2007) are in line with the results of present study. They studied the effects of feed frequency on growth performance of Awassi lambs and found the increase (P<0.05) in dry matter intake as the feeding frequency was increased. Ahmad *et al*. (2014) also reported the same trend of increase of dry matter intake with increase in feeding frequencies in kids. Similarly, the findings of Assoumaya *et al*. (2009) are also closely in line with our results as they studied the effect of feeding frequency on dry matter intake form meal and Pangola grass on eight black belly rams. The tendency of feed intake was positively correlated (P<0.05) with increase in feeding frequency.

Likewise, our findings also match with the results of Prior (1976) who studied the effect of twelve times feeding frequency and found that it was better (P<0.05) than twice daily. Many scientists (Krehbiel *et al*., 1998; Castro *et al*., 2002; Kozloski *et al*., 2009) have studied the effect of feeding frequency on dry matter intake and found the feeding frequencies are directly (P<0.05) related to dry matter intake. Direkvandi *et al*. (2016) found that by increasing the feeding frequency, intake of fodder was decreased but duration of forage intake was increased in the treatment of eight meals per day. It may be obvious that more frequent feeding than one time per day might have increased the mucosal in contact time for the absorption of nutrients from the ingesta.

The findings of Keskin *et al*. (2007) are in line with our results as they studied the effects of feed refreshing (FR) on the growth performance of Awassi lambs over a period of 65 days at 2 (FR2), 4 (FR4), 8 (FR8), 12 (FR12), 24 h (FR24) intervals. They concluded that frequency of feeding linearly increase the average daily gain. The increase in feeding intervals increases the average daily gain (Rakes *et al*., 1962; Faichney, 1968; Prior, 1976; Kromann *et al*., 1966). This might be attributed to a stimulation of gastrointestinal system, which enhances the salivary glands and ruminal secretions (Ozen,1995).

The lambs which received four times feed per day showed better feed efficiency as these animals converted the feed more efficiently. These results have close resemblance with Keskin *et al*. (2007) who studied the effects of feed refreshing frequency on growth and carcass characteristics of Awassi lambs and concluded that feed conversion efficiency was increased (P<0.05) with frequent feedings.

The findings of present study slightly demonstrate the findings of Jabbar and Anjum (2008) who reported similar results in Lohi sheep. The results of our research do not match with the findings of Anadana *et al*. (1996) and Gregoirea *et al*. (1996). This may be due to that increased feeding frequency which has enhanced the dry matter intake and had become more labor intensive.

The body measurements in group C have increased at higher rate which might be due to better intake, digestibility and absorption of nutrients. The findings of Bunnel (1980) has resembled to our results as he studied a relationship between weight and linear body measurements of Dall's sheep and concluded that heart girth and body length was increased as the body weight was increased. Similarly, the findings of Iqbal *et al*. (2010) and Younas *et al*. (2010) are closely in line with our results as they worked on Kajli sheep and Hissardale sheep and reported that with the increase of body weight morphometric measurements (body length and heart girth) also increases.

This experiment was performed to evaluate the pertinence of working in tropical conditions of Pakistan. It was found that increased frequency of meals tended to increase feed intake and consequently increase in weight gain. These results underline the need to conduct studies with other species of animals fed according to a pattern closely related to intensive, semi intensive and field conditions.

REFERENCES

Ahmad, N., A. Ali, M. Abdullah, A. Khalique, K. Javed, J.A. Bhatti, S. Ahmad, Saima, Z. Iqbal, M.O. Omer, U. Younas, Z. M. Iqbal, K. M. Anjum, T. Hussain, and F. Shahzad. 2014. Effect of feeding frequency on the growth performance of Beetal goat kids during winter season. J. Anim. Plant Sci. 24:73-76.

Alvi, S.A. 1991. Meat production and technology in Pakistan. Pakistan Agricultural Research Council, Islamabad, Pakistan; pp.12-13.

Anandana, S., V.R.B. Sastry, L.M. Musalia and D.K. Agrawal. 1996. Growth rate and nutrient efficiency of growing goats fed urea ammoniated neem (*Azadirachta indica*) seed kernel meal as protein supplement. Sml. Rumin. Res. 22:205-212.

Annonymous. 2016. Economic Survey of Pakistan. Ministry of Food and Agriculture, Govt. of Pakistan, Islamabad, Pakistan.

Assoumaya, C., D. Sauvant, F. Pommier, M. Boval, B. Calif and H. Archimède. 2009. Effect of frequency of meals on intake and digestion of tropical grass consumed by Rams. Asian Aus. J. Anim. Sci. 22:72- 81.

Bunnel, F.L. 1980. Weight estimation of Dall's sheep and mountain goats. Wildlife Soci. Bull. 8:291-297.

Castro, T., T. Manso, A.R. Mantecon and M.D. Carro. 2002. Effect of either once or twice daily concentrate supplementation of wheat straw on voluntary intake and digestion in sheep. Sml. Rumin. Res. 46:43-50.

Direkvandi, E., Y. Rouzbehn and H. Fazaeli. 2016. Effect of feeding frequency on nutrient digestibility and feeding behaviour in Turkmen horse. J. Agri. Sci. Tech. 18:937-948.

Faichney, G.F. 1968. The effect of frequency of feeding on the utilization of roughage diets by sheep. Aust. J. Agric. Res. 19:813-819.

Gregoirea, R.J., M.H. Fahmyb, J.M. Bouchera, A. Tremblayc and J. Merciera. 1996. Effect of four protein supplements on growth, feed conversion, mohair production, fiber characteristics and blood parameters of Angora goats. Sml. Rumin. Res. 19:121-130.

Iqbal, M.Z. 2010. Relationship between live body weight and body measurements in Kajli sheep. M.Phil. Thesis Department of Livestock Production, University of Veterinary and Animal Sciences, Lahore, Pakistan.

Jabbar, M.A. and M.I. Anjum. 2008. Effects of diets with different forage to concentrate ratio for fattening of Lohi lambs. Pak. Vet. J. 28:150-152.

Keskin, M., S. Gul, A. Şahin, S. Kaya, M. Duru, O. Gorgulu, S. Sahinler and O. Bicer. 2007. Effects of feed refreshing frequency on growth and carcass characteristics of Awassi ewes. South Afr. J. Anim. Sci. 37:248-255.

Khan, M.S. 2003. Country Report on State of Animal Genetic Resources of Pakistan. FAO, Rome, Italy.

Kozloski, G.V., R.L. Cadorin, C.J. Härter, L. Oliveira, T.P. Alves, F.R. Mesquita and D.S. Castagnino. 2009. Effect of supplemental nitrogen source and feeding frequency on nutrient supply to ewes fed a kikuyu grass (*Pennisetum clandestinum*) hay-based diet. Sml. Rumin. Res. 81:112-118.

Krehbiel, C.R., C.L. Ferrell and H. C. Freetly. 1998. Effects of frequency of supplementation on dry matter intake and net portal and hepatic flux of nutrients in mature ewes that consume low-quality forage. J. Anim. Sci. 76:2464-2473.

Kromann, R.P., E.E. Ray and A.B. Nelson. 1966. Influence of frequency and source of protein supplementation on energy metabolism in feeder ewes. J. Anim. Sci. 25:1040-1044.

Ministry of Finance. 2006. Economic Survey of Pakistan. Ministry of Food and Agriculture, Govt. of Pakistan, Islamabad, Pakistan.

Ministry of Finance. 2013. Economic Survey of Pakistan. Ministry of Food and Agriculture, Govt. of Pakistan, Islamabad. Pakistan.

Ozen, N. 1995. Animal nutritional physiology and metabolism. Adeniz University Agriculture Faculty Notes, Antalya, Turkey; pp.343.

Prior, R.L. 1976. Effects of dietary soy or urea nitrogen and feeding frequency on nitrogen metabolism, glucose metabolism and urinary metabolite excretion in sheep. J. Anim. Sci. 42:160-167.

Qureshi, R.H., A. A. Tarar, Z. Ahmed, M. Younus and T. Ali. 2004. Livestock management, feeding and health in the Punjab, Pakistan. Livestock Action Plan; FAO, UNDP Building, Islamabad, Pakistan.

Rakes, A.H., E.E. Lister and J.T. Reid. 1962. Some effects of feeding frequency on the utilization of isocaloric diets by young and adult sheep. J. Anim. Nutr. 75:86-92.

Robert, W., Rhodes and W. Walter. 1962. Influence of frequent feeding on the performance of growing and fattening ewes. J. Anim. Sci. 21:108-111.

Steel, R.G.D., J.H. Torrie and D.A. Dickey. 1997. Principles and Procedures of Statistics: A biometrical approach, 3rd Ed. McGraw-Hill, New York, USA.

Younas, U. 2010. Relationship between live body weight and body measurements in Hissardale sheep. M.Phil Thesis, Department of Livestock Production, University of Veterinary and Animal Sciences, Lahore, Pakistan.