ECONOMIC BENEFITS OF SUPPLEMENTING LAMBS WITH UREA MOLASSES BLOCKS ON RANGES OF PAKISTAN

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Summary

Effects on feed intake, liveweight gain and economic benefits of supplementing lambs with urea molasses blocks, were studied. Forty eight crossbred lambs were divided into 6 groups and assigned randomly to grazing on native pasture (CONT) or along with supplements of Commercial ration (COM) and urea molasses blocks (UMBs) containing two levels of cement and calcium oxide as a binding agent. Analysis of variance revealed highly significant ($p < 0.01$) differences in dry matter (DMI, g/day), crude protein (CPI, g/day) and metabolizable energy (MEI, MJ/day) intakes. Differences in liveweight gain (LWG, g/day), feed conversion ratio (FCR) and net econmic benefit of supplementation were also highly variable. The intake of DM, CP and ME varied from 974 to 1002, 66-70 and 7.6-8.4 in lambs supplemented with UMBs, significantly ($p < 0.01$) greater than 848, 52.5 and 5.6 in lambs supplemented with COM or than 633, 34.2 and 4.1 in lambs grazing on CONT pasture. In spite of differences in feed intake, the values of LWG, FCR and net economic benefits (54.3; 57.8; 17.1 and 1.96; 2.4) in lambs supplemented with COM and UMB-2, were similar but significantly ($p < 0.01$) higher than 10.6; 0.55, 31.7; 1.04, 33.7; 1.21 and 28.3; 0.9 in lambs maintained on CONT or supplemented with UMB-1, UMB-3 and UMB-4 respectively. Factors responsible for differences in feed intake, liveweight gain and economic benefits, are discussed.

(**Key Words** : Ranges, UMBs, Feed Intake, Liveweight Gain and Economic Benefits)

Introduction

In addition to prolonged dry season, mismanagement of rangelands in the country, has also contributed to the problem of malnutrition being faced by small ruminants (Khan and Mohammed, 1987). This period of malnutrition coincides with late gestation, early lactation and post weaning growth when ewes and lambs demand more energy and nitrogen for essential physiological functions (Rafiq et al., 1990 and ARC, 1990). On the other hand, vegetation during this period is mainly composed of cell wall contents (CWCs), deficient in energy and nitrogen (Hasan, 1979) and affect the productivity of grazing stock through poor synthesis of microbial protein (Kempton et al., 1979; Birrell, 1981 and Kemption, 1982). Without supplementation of the deficient nutrients required by ruminal microbes within host animal, pastures during dry season support to only maintenance level. For meeting an increasing demands of mutton and other animal products in the country, it becomes imperative to find out means of supplementation which are not only cheaper, easily available but also satisfy the requirements of microbes as well as host animals under grazing conditions, Umunna (1982) reported that non-protein nitrogenous substances (NPN) like urea offer the solution of this problem if used with readily available sources of energy (e.g. molasses). On account of problems faced during logestic and feeding of animals, workers like Sudana and Leng (1986) suggested that urea molasses block licks provided a safer, regulated source of N supplementation for ruminants.

The objective of this experiment was to measure the changes in feed intake, liveweight gain and economic benefits of supplementing lambs with urea molasses blocks, on ranges in Kaghan valley of Pakistan.

Materials and Methods

Location

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Study was conducted at Livestock Experimental Station at Jaba in Kaghan Valley, 20 km north of Mansehra in NWFP province of Pakistan. The station is located at an altitude of 1500-2000 meters and receives 350-600 mm/annum precipitation mainly during winter. Annual temperature ranges between $-3^{\circ}C$ to $35^{\circ}C$. Flat and plain areas in the valley are suitable for the cultivation of wheat, maize and lucerne crops. The species composing the grassland cover include Dactylis geomerata, Agropyron detatum, Phacelurus speciosus, Rottboelia exalatata, Bromus inermis and Chrysopogon echineulatus. Depending upon the precipitation, dry matter production varies between 600-850 kg/ha.

Animals and Supplemental diets/licks

Forty eight crossbred (Kaghani × Rambouillet) lambs of an an average 26 kg liveweight, were divided into 6 groups and assigned to grazing (CONT) only or grazing plus supplementation with a commercial ration (COM) or with four different levels of urea molasses block licks (UMB-1, UMB-2, UMB-3 and UMB-4) at random. Each group of lambs without (CONT) or with respective supplements grazed on separate pasture. Stocking rate and duration of study was adjusted in such a way that lambs under each regime, get dry matter intake at a rate of 3-4 percent of liveweight.

Sampling procedures

Before the start and at the end of experimental grazing, 20 samples of vegetation were taken from an area of 1 square meter of each paddock, with a quadrate method. Samples were weighed, dried till a constant weight and kept for further analysis. Similar samples of COM, UMB-1, UMB-2, UMB-3 and UMB-4 supplemental diets were taken for the estimation of composition and consumption of dry matter (DMI, g/day), crude protein (CPI, g/day) and metabolizable energy (MEI, MJ/day).

Analytical methods

Dry matter contents of vegetation and supplemental feeds were estimated using methods described by AOAC (1984). Kjeldahl method (AOAC, 1984) was used for the estimation of N contents of vegetation and supplemental feeds before as well as after the end of grazing. Metabolizable energy in vegetation and supplementary feeds were determined using automatic adiabatic bomb calorimeter.

Measurement

Intake of dry matter, crude protein and metabolizable energy were measured by difference in plant biomass before the start and at the end of experiment. Changes in liveweight were measured through weighing at the start, at fortnightly intervals and at the end of experiment.

Management

During the whole experiment of 98 days, lambs had an easy access to drinking water and common salt for licking.

Statistical Design

Data collected on feed intake and changes in liveweight of lambs were subjected to an analysis of variance using Complete Randomized Design (CRD). Differences among means were identified using least significant differences (LSD) as per Steel and Torrie (1981).

Economic analysis

Economic analysis of liveweight gained by lambs was performed using techniques of Perrin et al. (1979).

Results and Discussion

Chemical composition of plants composing vegetation cover and supplements of COM, UMB-1, UMB-2, UMB-3 and UMB-4 is given in table 1.

Table 2 shows the intakes of dry matter (DMI, g/day), crude protein (CPI, g/day) and metabolizable energy (MEI, MJ/day) by lambs given supplements of CONT, COM, UMB-1, UMB-2, UMB-3 and UMB-4 respectively.

Changes in liveweight of lambs and subsequent economic benefits of supplementation are presented in table 3.

Analysis of variance revealed highly significant ($p < 0.01$) differences in DMI, CPI and MEI in lambs given diets of CONT alone or CONT along with COM, UMB-1, UMB-2, UMB-3 and UMB-4 supplements. LSD test showed that intake of DM, CP and ME was significantly greater ($p < 0.01$) in lambs supplemented with UMBs than in lambs given diets of COM and CONT respectively. The values of DMI, CPI and MEI among lambs given supplements of UMB-1, UMB-2, UMB-3 and UMB-4 were almost similar ($p < 0.05$). Lambs grazing on native pasture (CONT) had the lowest rate of intake of DM, CP and ME.

The rate of gain in liveweight (LWG) of lambs maintained on native pasture (CONT) or supplemented with COM, UMB-1, UMB-2, UMB-3 and UMB-4 was highly ($p < 0.01$) variable. As per LSD test, liveweight gain (LWG, g/day) was lowest in lambs grazing on

TABLE 1. COMPOSITION (%) OF GRASSES (CONT) AND SUPPLEMENTS OF COMMERCIAL RATION (COM) AND UREA MOLASSES BLOCKS (UMBs)

Ingredients	Grasses	COM	UMBs				STD DEV
			UMB-1	UMB-2	UMB-3	UMB-4	
Molasses	–	–	65	65	65	65	4.0
Urea	–	–	6	6	6	6	1.2
Cao	–	–	5	–	7	–	1.7
Cement	–	–	–	5	–	7	1.7
Wheat bran	–	–	14	14	12	12	3.6
Corn gluten (20%)	–	–	10	10	10	10	1.6
Dry matter (g/kg DM)	275	860	700	670	715	687	10.4
Metabolizable energy (ME. MJ/kg DM)	6.5	7.4	11.5	11.0	10.8	11.2	1.3
Crude protein (g/kg DM)	54	85	95.4	96.2	92.7	94.6	3.8

TABLE 2. FEED INTAKE IN LAMBS GRAZING ON NATIVE PASTURE (CONT) OR ALONG WITH COM AND UMBs SUPPLEMENTS

Parameters	CONT	COM	UMBs				STD DEV
			UMB-1	UMB-2	UMB-3	UMB-4	
Dry matter (DMI, g/day)	633^{f}	848^{e}	$1{,}002^{a}$	993^{ab}	974^{cd}	978^{bc}	12.3
Metabolizable energy (MEI, MJ/day)	4.1^{de}	5.6^{d}	8.4^{a}	8.2^{ab}	7.6^{bc}	7.6^{bc}	1.0
Crude protein (CPI, g/day)	34.2^{f}	52.5^{e}	70.7^{a}	69.6^{ab}	67.5^{bc}	66.2^{cd}	3.2

Means with different superscripts differ significantly ($p < 0.01$).

TABLE 3. FEED CONVERSION RATIO (FCR) AND ECONOMICS OF LIVEWEIGHT GAIN (LWG) IN LAMBS GIVEN CONT OR ALONG WITH SUPPLEMENTS OF COM AND UMBs

Parameters	Grasses	COM	UMBs				STD DEV
			UMB-1	UMB-2	UMB-3	UMB-4	
Supplemental feed intake (g/day)	–	216^{e}	390^{a}	372^{ab}	341^{cd}	344^{c}	8.2
LWG (g/day)	10.6^{f}	54.3^{ab}	31.7^{cd}	57.8^{a}	33.7^{c}	28.3^{de}	2.4
FCR	1:60	1:2	1:3	1:2	1:3	1:3	5.6
Cost of supplemental feed (Rs)	–	0.86^{a}	0.61^{b}	0.60^{bc}	0.53^{de}	0.55^{cd}	0.4
Total benefit of LWG	0.55^{f}	2.82^{ab}	1.65^{cd}	3.0^{a}	1.75^{c}	1.46^{de}	0.6
Net benefit of Supplementation	0.55^{f}	1.96^{ab}	1.04^{cd}	2.4^{a}	1.21^{c}	0.80^{de}	0.5

1. Rs.22 = 1 US $.
2. Field price of COM = Rs 160/40kg, UMB-1 & 3 Rs 63/40kg and UMB-2 & 4 Rs 64/40 kg.
3. Means with different superscripts differ significantly ($p < 0.01$).

CONT. Lambs given supplementary diets of UMB-2 and COM had similar LWG but significantly ($p < 0.01$) higher than lambs on UMB-1, UMB-3 and UMB-4 gained liveweight at a similar rate ($p < 0.01$).

As shown in table 3, feed conversion ratio (FCR) and net benefit of supplementation were highest in lambs under supplemental regime of UMB-2.

Least significant difference test also revealed that kind or level of cement and calcium oxide as a binding agent, did not affect the intake of feed or liveweight gain in lambs supplemented with urea molasses blocks.

A number of biological and chemical factors have affected the voluntary feed intake and subsequently performance of lambs. As mentioned early, post weaning growth in lambs and kids in the region coincides with summer season when plants start maturing. Most of cell contents are converted into grains and remaining parts of plant, are mainly composed of CWCs, deficient in energy and N with poor synthesis of microbial protein. Significantly ($p < 0.01$) lower DMI and LWG in lambs under feeding regime of CONT as given in table 2 and 3, clearly support this hypothesis and are consistent with an early finding of Hassan (1979). Significantly poor performance of lambs grazing on native pasture (CONT) in the opinion of Birrell (1981) is due to quality of diet which is one of the factors responsible for low intake and liveweight of animals. An addition of nutrients through supplements of COM or UMB-1, UMB-2, UMB-3 and UMB-4, significantly ($p < 0.01$) raised intake of DM, CP and ME. This increase in feed intake is associated with an enhanced rate of ruminal fermentation. As observed by Umunna (1982), added nitrogen and energy might have improved the nutritional environment in the rumen which in turn stimulated the microbial proliferation and activity leading to increased dry matter intake, digestibility and weight gain. Similar increases in feed intake were recorded by Egan and Doyle (1985). However, this effect was speculated to be due to additional microbial protein for digestion in small intestine rather than enhanced rate of fermentation. These increases in feed intake and liveweights are in close agreement with those recorded by Sudana (1985), Sharma (1986) and Henderson (1986).

The significantly higher feed intake and liveweight gain in supplemented than in unsupplemented lambs has also been observed by Sudana and Leng (1986). These workers recorded an increase in feed intake and liveweight gain of sheep given basal diet of wheat straw along with cotton seed meal or urea molasses blocks alone or in combined form. This increase in feed intake and LWG, was attributed to a closer balancing of the protein: energy ratio required for tissue growth with that of nutrients absorbed. These workers concluded that urea molasses block licks were an effective method of providing urea and of overcoming a number of potential mineral deficiencies and perhaps providing other microbial factors such as amino acids and peptides. Woo and Kang (1987) found an improvement in performance of lambs supplemented with ground nut cakes, soybean meal and cotton seed meal. These supplements were found to improve microbial protein synthesis, hence improved animal productivity.

Uneven ranges and subsequent distribution of moisture also contributed variablity in quality of vegetation and affected the response of lambs to dietary supplements at a greater rate under regimes of UMB-1, UMB-3 and UMB-4 than 35 under UMB-2 with low production of ammonia and microbial protein systhesis. Breakdown of urea at a higher rate than consumption by microbes, further limited the response of lambs supplemented with UMB-1, UMB-3 and UMB-4 (Kempton, 1982). Hoover (1986) reported that proteins were superior to urea for the maintenance of fiber digestion, indicating a requirement for amino acids and peptides. This theory supports to higher responses of lambs supplemented with COM ration. Form of energy yielding nutrients is an other factor affecting the efficient use of N, capturing of ammonia N in the rumen and synthesis of microbial proteins. Availability of carbohydrates in COM may have contributed in an efficient utilization of ammonia and synthesis of microbial protein at a higher rate than molasses in UMBs-an observation coinciding with early finding of Oldham et al. (1977). Data collected by these workers revealed that molasses did not prove better than barley grain or fishmeal for promoting an efficient use of urea N which led to a significant variability in liveweight gains of lambs given supplements of UMB-1, UMB-3 and UMB-4. Rafiq (1991) also reported that vegetation during summer season contained higher CWCs than CCs, with limiting effects on the performance of lambs. When lambs were supplemented with barley and cotton seed cake, rate of gain was better than supplemented ones as confirmed by Warly et al. (1994). Their findings revealed that an inadequate supply of energy also limited the response of lambs to dietary supplements. Data collected by Robert et al. (1987) revealed that sometime individual variations in rate of maturing or weight gaining were also associated with differences in productive efficiency. Otherwise feed intake in lambs under all UMB regimes, was almost similar ($p < 0.05$).

Variations in feed conversion ratio (FCR), total benefit and net benefit of supplementing lambs with COM or UMB-1, UMB-2, UMB-3 and UMB-4, have been due to differences in chemical composition of vegetation, dietary supplements and subsequent efficiency of utilization by lambs. The commercially available compound rations are mainly composed of natural ingredients containing easily digestible carbohydrates, soluble proteins, peptides and amino acids leading to an adequate synthesis of microbial proteins. On the other hand, due to higher solubility of urea, ammonia might have escaped and gone wasted through ruminal walls, leading to an inadequate production of microbial protein, low liveweight and poor economic benefits in lambs supplemented with UMBs. Bhattachary and Pervez (1973) also observed that urea sometimes resulted losses or no change in liveweight without declining feed intake. The poor FCR and benefits in lambs supplemented with UMB-1, UMB-3 and UMB-4, are also related to higher breakdown of dietary N under pasture conditions where vegetation was more coarse and succulent. As mentioned above, higher rates of protein and peptide breakdown than rate of assimilation of products of hydrolysis into microbial protein leads to wasteful ammonia production and N excretion with a limiting effect on animal performance as shown by lambs supplemented with UMB-1, UMB-3 and UMB-4 and consistent with recent findings of Wallace (1993). This pattern of differences in FCR and net benefit are similar to those recorded by Assadi-Moghaddam and Nik-Khah (1988) and Mirza et al. (1988; 1990). In a similar study Gihade et al. (1989) recorded a weight gain of 64.8 and a FCR of 6.8 in Ossimi lambs. When lambs were supplemented with urea molasses blocks, weight gain and FCR rose to 95.9 and 99.6 g/day and FCR to 4.58 and 4.37 respectively.

All these findings clearly indicate that urea molasses blocks offer an easy and economical method of supplementing lambs under rangeland conditions. To avoid wastage of ammonia due to higher solubility of urea, partial replacement with lowly degraded N supplements like fishmeal (FM), would be more beneficial in supplemental rations for lambs production. Use of supplements like FM as reported by Hassan and Bryant (1986) and Hussein and Jordan (1991) will not only help the host lambs but also the ruminal microbes for an efficient utilization of poor quality feed, higher liveweight gain and economic benefits.

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