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Effect of feeding mulberry multinutrient blocks on feed intake of maize stover in calves

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Key words: Mulberry multinutrient block, feed intake, maize stover, calves, rumen ammonia.

Abstract

An experiment was conducted consisting of two cattle breeds and two diets. Eight Sahiwal and eight Achai calves (6-10months age) were housed in individual pens and were offered a basal diet of maize stover ad libitum. Each of the breed groups was randomly divided in to two equal subgroups, control and treatment (4 calves/group). The control group was not given any supplement and the treatment group was given free access to mulberry multinutrient block (MMB). The control and MMB calves daily consumed 1.65 and 1.63 Kg/100Kg body weight (BWT) maize stover dry matter (DM) and 1.65 and 2.29Kg/100Kg BWT total feed DM, respectively. Statistical analysis showed that the maize stover intake was not influenced by diet ($P>0.05$) while total feed intake was higher ($P<0.001$) with MMB diet. The intake of maize stover and MMB were same in Sahiwal and Achai and did not affect by the breed ($P>0.05$). Achai calves consumed more ($P<0.05$) MMB than Sahiwal calves (9.56 vs 7.00g/Kg BWT). Mean ammonia-N in the rumen fluid of calves varied due to diet ($P<0.0001$) and breed ($P<0.05$). Rumen ammonia concentration averaged 64.12 and 148.04mg N/l on control and MMB diets, respectively and 123.59 and 94.57mg N/l in Sahiwal and Achai calves, respectively. It was concluded that MMB was effective in increasing total feed intake of maize stover based diets in the calves and was palatable also. Due to low cost of MMB (as mulberries are abundantly available in the season), feeding of MMB to ruminant livestock in Gilgit Baltistan of Pakistan is recommended.

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Introduction

Pakistan is an agricultural country and livestock significantly contribute to the economy of the country. Livestock share in national GDP is 11.8% and in agricultural GDP is 55.9% (Economic survey, 2013-14).

Geographical and climatic conditions of Pakistan have large variability. It has the benefits of both irrigated plains and range areas extended from the coastal ranges in the south to the alpine pastures in the north. Gilgit Baltistan is situated in the north of Pakistan, span over an area of 72, 496 sq km. The region is dominated by the most mountainous landscape on the earth that makes most of the area uninhabitable. Our settings are characterized by a highly fragile mountain ecosystem of the Pamir, Hindu-Kush, Karakorum and Himalayas, where pastoralism is a key source of livelihoods for majority of the people. Although the area is rich in natural resources but there is a continuous and high dependency of local communities on the natural resources. Because of the shortage of cultivable land for fodder, ruminants are mostly grazed on summer pastures and winter rangelands. The majority of the rangelands in Gilgit-Baltistan are regularly grazed beyond their carrying capacity (FAO 1987; Alvi and Sharif 1995; Beg 2010). Ruminant diets in Gilgit Baltistan are mostly based on fibrous feed including mature pastures and crop residues i.e wheat straw, stovers, stubbles etc. These feeds are imbalanced, deficient in nutrients like protein, minerals and vitamins and are highly lignified due to which their digestibility is low. Existing feed resources are limited due to high pressure on land for cereal grains, used for human consumption and it cannot be spared for additional fodder. There is diminishing and fluctuating supply of nutrients throughout the year due to extreme weather conditions. This situation demands supplementation for deficient nutrients. Nontraditional feed supplements are usually very expensive and most of our farmers cannot afford to feed required amount of these supplements. Therefore, there is a need for using alternative feed supplements, which are economical, less labor intensive and compatible to existing small farm holdings.

Due to heavy snowfall, animals are mostly stall fed with crop residues and mature grasses during winter in Gilgit Baltistan. In rare situation home grown grains, kitchen leftovers and some concentrates are offered to milking animals. Concentrates are expensive to justify their use as a supplement. The effect on ruminants of such feeding include anoestrus, low calving, low birth weight, high calf mortality, reduced growth rate and low milk production. Under nutrition reduces animal's vitality and leads to various health problems (Preston and Leng, 1984). Efficient utilization of available feed resources and improvement in nutritive value of available fodder, forages or crop residues through chemical and biological means offers a promising tool to minimize the gap between nutrient availability and demand (Sarwar *et al*., 2002).

Molasses urea block is a convenient and inexpensive method of providing a range of nutrients required by both the rumen microbes and the animals which may be deficient in the diet. The main justification for using blocks depends on their convenience for packaging, storage, transportation and easy feeding. Urea, known to farmers as a fertilizer for crop production, has been traditionally used in making multinutrient blocks for livestock for improving feed digestibility and providing protein (Makkar 2007). At least, 60 countries are now using the multinutrient technology as a strategic supplement for ruminants, mainly cows, sheep and goats raised under harsh conditions (Ben Salem *et al*., 2007).

Molasses is a major ingredient used in the preparation of multinutrient blocks but it is not available in Gilgit Baltistan of Pakistan. Being a liquid, it is difficult and expensive to be transported from other parts of the country. Gilgit Baltistan is rich in mulberry trees. Mulberry fruit as fresh or in dried form is used for human consumption. However, large quantity of fresh and dried mulberry is wasted every year. In one of my preliminary work, an attempt for

the first time was made to substitute molasses by mulberry for making multinutrient blocks that proved successful. Formulation of multinutrient blocks based on low cost and locally available feed resources that do not compete with human food has been described as very promising (Makkar, 2007). The study was planned to generate information for the first time on the nutritional aspects of MMB feeding in growing calves, fed a basal diet of low quality roughages. The overall aim of the study was to provide base line information on the use of mulberry multinutrient blocks as a strategic supplement.

Materials and methods

Experimental design and animals

The experiment was conducted in randomized complete block design (RCBD), involving two diets i.e control and mulberry multinutrient block (MMB) and two species of animals (Sahiwal and Achai). Eight growing calves of about 6 to 10 months age were selected. They were further divided according to the body weight in to two equal groups, four calves per group. Within each animal breed, the two groups were assigned to control diet and MMB supplemental diet. Maize stover was used as a basal diet for all the animals. All the animals were drenched (25cc/animal) a broad spectrum anthelmintic for treatment against gastrointestinal parasites, one week before commencement of the study. The animal experimentation part of the study lasted for four weeks, including three weeks adaptation period and one week data collection period.

Feed intake

All the animals were individually fed once a day each morning by offering known quantity of chopped maize stover, 10% in access of the previous day consumption to ensure ad lib intake throughout the experiment. The refusals were weighed every morning before offering next feed. Feed blocks were also weighed daily to estimate consumption by the calves. Clean drinking water was offered in buckets three times daily. Representative samples of the offered and refused maize stover and feed block were collected daily during the last week and stored at -10C in a freezer for chemical analysis.

Rumen ammonia concentration

On the last day of the experiment, rumen fluid was collected from each animal through a stomach tube, immediately before and four hours after offering the morning feed and strained through a double layer of muslin cloth. Aliquot 50ml was transferred to a bottle and acidified with 1cc concentrated sulfuric acid. The samples were centrifuged at 4000rpm for 5 minutes in a laboratory centrifuge. 10ml of the supernatant was transferred through pipette in to a distillation tube (capacity 250ml), added with 10ml distilled water and connected to the Labcono Rapid Still-II for distillation. The resulting ammonia was collected in a conical flask containing 10ml boric acid reagent. The distillate was titrated with 0.01N sulfuric acid.

Analytical methods

Dry matter and ash contents in feed samples and the distillation were determined with the standard procedures of AOAC (1990). In all cases analyses were performed in triplicate. The data was analyzed with the analysis of variance procedure described by Steel and Torrie (1980). The main effects were diets, breed and their interaction.

Results and discussion

Feed intake

Results on daily feed consumption are summarized in Table 1. Daily feed consumption results (g/day) were corrected for body weight (BWT) of the calves and expressed as Kg DM/100Kg BWT to get a reliable comparison of the breeds. This was important because calves of the two breeds Sahiwal and Achai were markedly different in their skeleton size and body weight. The dry matter intake (DMI) of maize stover as percent of BWT did not significantly vary due to diets ($P>0.05$) and breed ($P>0.05$). Mean DMI of maize stover was 1.65 and 1.63Kg/100Kg BWT on control and MMB diets, respectively. The daily intake of maize stover by the calves as percent of BWT did not change with MMB supplementation. This finding does not agree with the Jalal-ud-din (1991), who

reported that wheat straw consumption in buffalo steers significantly increased in response to molasses urea block supplementation. However, in line with the study, Faiza (2000) reported that the daily intake of maize stover did not increase with molasses urea block in calves. It appears that the effect of block on roughage intake is related to the quality especially N contents of basal diet. In studies such as conducted by Jalal-ud-din (1991) and Shahab-ud-din (1992), where the basal diet of wheat straw was low in N (0.4% N in DM), the intake by animals increased with block feeding. On the other hand, in the present study and that reported by Faiza (2000), the basal diet of maize stover was relatively high in N (0.8% N in DM), therefore, the intake of maize stover did not increase with block supplementation. In the present study, ammonia concentrations in the rumen fluid in control calves were above the optimum level of 50mg N/l rumen fluid (Satler and Slyter1974). This suggested that fermentable N was not limiting in calves on control diet.

Table 1. Mean feed consumption of Sahiwal and Achai calves given maize stover with or without mulberry multinutrient block (MMB).

Observations	Control Diet			MMB			Significance		
	Sahiwal	Achai	Mean	Sahiwal	Achai	Mean	Diet (D)	Breed (B)	D x B
A. Maize Stover Intake									
Dry matter intake g/d	970	707	838	1062	685	873	NS	P<0.01	NS
Dry matter intake kg/100kg BWT	1.65	1.66	1.65	1.74	1.51	1.63	NS	NS	NS
Organic matter intake g/d	903	658	780	991	639	815	NS	P<0.01	NS
Organic matter intake kg/100kg BWT	1.54	1.54	1.54	1.63	1.41	1.52	NS	NS	NS
B. Total Feed Intake									
Dry matter intake g/d	970	707	838	1391	1019	1205	P<0.01	P<0.05	NS
Dry matter intake kg/100kg BWT	1.65	1.66	1.65	2.29	2.30	2.29	P<0.001	NS	NS
Organic matter intake g/d	903	658	780	1232	853	1042	P<0.05	P<0.05	NS
Organic matter intake kg/100kg BWT	1.54	1.54	1.54	2.02	1.91	1.97	P<0.001	NS	NS

NS = Non significant (P>0.05)

The daily intake of total dry matter as percent of BWT was significantly affected by diet (P<0.001) but did not respond to difference in the breed (P>0.05). The calves having access to mulberry multinutrient blocks consumed more (P<0.001) total feed DM than the control group (2.29 vs 1.65Kg/100Kg BWT). No interaction (P>0.05) of diet and breed was found for any of the intake parameters. Results of organic matter intake of maize stover and total feed exhibited the same pattern in response to difference in diets and breed as reported above for DMI.

Total dry matter intake (DMI) by the calves remained higher (P<0.001) on block supplementation diet. This is in close agreement with the findings of Tiwari *et al.* (1990), Mehra *et al.* (1991), Badurdeen *et al.* (1994) and Faiza (2000) which consistently showed that total DMI significantly increased when multinutrient blocks were offered to the animals. No difference in Sahiwal and Achai calves was recorded with regard to daily intake (Kg DM/100Kg BWT) of maize stover (P>0.05) and total feed (P>0.05). Mean feed consumption (Kg DM/100Kg BWT) in Sahiwal and Achai calves across the two diets averaged 1.69 and 1.59 for maize stover and 1.98 and 1.97 for total feed respectively.

Daily consumption of MMB during the adaptation period gradually increased from 381g/day on day-1 to 401g/day on day-7 in Sahiwal calves and from 309g/day on day-1 to 522g/day on day-7 in Achai calves and then remained constant with little variation in both the breeds. As shown in Table 2, after the adaptation period, block consumption during the last seven days of the experiment, averaged 423 and 408g/day in Sahiwal and Achai calves, respectively but the difference was statistically non significant (P>0.05). However, when the block

consumption was calculated on BWT basis, Achai calves consumed (P<0.05) more block than Sahiwal calves (9.56 vs 7.00g/Kg BWT). The reason for high block intake in Achai than Sahiwal calves is not known and may explain difference in eating behavior of the two breeds. Sansoucy *et al.* (1987) reported that block intake by animals was related to several intrinsic factors of block and the animal.

Table 2. Mean daily consumption of mulberry multinutrient blocks (MMB) by Sahiwal and Achai calves on maize stover diets.

Observations	Sahiwal	Achai	Mean	Significance
Block Intake g/day	423	408	416	NS
Block Intake g/kg BWT	7.00	9.56	8.25	P<0.05

NS = Non Significant (P>0.05)

Rumen ammonia concentration

Mean ammonia concentration in the rumen fluid of calves before and after feeding is illustrated in Fig-1. Ammonia concentration significantly varied due to diet (P<0.0001), sampling time (P<0.05) and breed (P<0.05). Comparison of the means with LSD procedure revealed that ammonia concentrations in the rumen fluid of calves given MMB were higher (P<0.05) than those fed control diet (148.04 vs 64.12mg N/l). Ammonia concentration in the control calves remained above the optimum level of 50mg N/l suggested by Satler and Slyter (1974). The present results agree with the findings of Jalal-ud-din (1991) and Saeed (2000), who reported 2 to 3 times higher ammonia concentrations in animals receiving molasses urea block than their respective control groups. Samples of rumen fluid collected 4 hours after offering feed showed higher (P<0.05) ammonia level than those taken immediately before offering the feed (117.29 vs 98.13mg N/l). The higher ammonia concentration 4 hours after feeding was due to consumption of maize stover and MMB. In line with the findings of Van Soest (1982) reported that ammonia concentration usually reached to peak level 2 to 3 hours after feeding. Concentrations of ammonia across the two diets and two sampling times were higher (P<0.05) in Sahiwal than Achai calves (123.59 vs 94.57mg N/l). Lower ammonia concentration in the rumen fluid of Achai calves despite higher block consumption than Sahiwal calves was interesting and may be due to difference in the transaction of N in the rumen of two breeds. Van Soest (1982) discussed that absorption of ammonia across the rumen wall and utilization efficiency of ammonia by rumen microbes are the possible factors that affect net concentration of ammonia in the rumen.

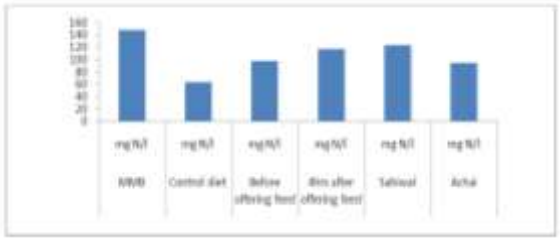

Fig. 1. Mean rumen ammonia concentrations at different time in Sahiwal and Achai calves on control and mulberry multinutrient block diets.

Conclusion

The overall conclusion drawn from the results of the present study is that as a supplementary strategy mulberry multinutrient blocks were effective in calves given a basal diet of maize stover. Sahiwal and Achai calves had the same capacity to consume maize stover diets under the conditions of the present study. On farm preparation of mulberry multinutrient blocks offer a great scope for promoting as an income generating activity especially by female farmers of Gilgit Baltistan.

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