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MIXING LESS PALATABLE GRASSES WITH UREA, MOLASSES AND EFFECTIVE MICROORGANISMS AND ITS EFFECT ON CHEMICAL COMPOSITION AND DIGESTIBILITY IN GOATS

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ABSTRACT:- A study was carried out at National Agricultural Research Centre, Islamabad to find out impacts of supplementation of low palatable grasses with urea, molasses and Effective Microorganisms (EM) on chemical composition and digestibility in goats. *Heteropogon contortus* (HC), *Chrysopogon aucheri* (CA), *Sorghum halepense* (SH) and *Desmostachya bipinnata* (DB) were used and the combinations were grass + 4% molasses, grass + 4% urea, grass + 4% urea + 4% molasses, grass + 4% urea + 1:100 EM, grass + 1:100 EM + 4% molasses, grass +1:100 EM + 4% molasses + 4% urea. Proximate analysis of samples was carried out. Crude protein content of mixtures improved as compared with sole grasses. Digestibility of HC supplemented with urea, molasses and EM in various combinations was also studied in growing goats. The highest digestibility of DM in goats was recorded in HC + 4% urea + 4% molasses treatment (85.51%) followed by HC + 4% urea (78.57%) and HC + 4% urea + 4% molasses + 1:100 EM (78.00%).

Key Words: Goats; Rangelands; Digestibility; Low Palatable Grasses; Urea; Molasses; Effective Microorganism; Pakistan.

INTRODUCTION

Low livestock productivity is caused by low genetic potential; inadequate and imbalanced nutrition, poor disease control measures, poor management and marketing problem (Rehrahie, 2001). In the past different policies preferred crops over livestock production. Good quality rangelands were transformed into crop cultivation lands and lands becoming gradually poorer with time were left for livestock production (Pratt et al., 1997). Significance of grasses and their ability to keep the soil intact from erosion and wearing away was not appreciated (Heath et al., 1985). Expansion and spread of human population has inflated the demand for livestock production. Consequently rangeland resources have come under huge pressure which has resulted in degradation and depletion of rangeland vegetation (Bano et al., 2009).The shortage of nutrients results in low nutrition and low down productivity and makes the livestock vulnerable to many diseases like breeding problems and epidemics etc. The indecent use of rangelands has led to major adjustments in ecosystem. The highly palatable grass varieties are decreasing and are occu-

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pied by low palatable species (Humphreys, 1984).In general nutritive value of less palatable species is low especially crude protein content (Kleiji and Scharer, 2006). *Heteropogon contortus*, *Sorghum halepense*, *Sachharum munja*, *Desmotachya bipinnata*, *Cymbopogon jawarancusa*, *Chrysopogon aucheri* are some of the less palatable species. Rangelands in Pakistan have good number of grasses throughout growing season of these places but only small number are desirable species (Muhammad et al., 1989). Palatability of feed is directly related with livestock production. The rangelands of the country have been occupied by unpalatable and invader species. Low palatable species may be supplemented with probiotics and mineral components or treated chemically to increase the production potential of these species as it is advantageous. Various low palatable species like *Sorghum halepense*, *Heteropogon contortus*, *Desmostachya bipinnata* and *Chrysopogon aucheri* are common in Punjab region (Muhammad, 1989).

The current study was started to ponder on using low palatable grass species as forage through value addition by making them palatable for consumption during feed deficit periods. Urea, molasses and effective microorganisms were added to low palatable grasses and their effect on nutritional improvement in terms of chemical analysis and digestibility in goats was studied.

MATERIALS AND METHOD

The range research experiments were performed at the Rangeland Research Institute, National Agricultural Research Centre, Islamabad, Pakistan. The study locations include Livestock Research Station (LRS), ASI, NARC; Animal Nutrition Laboratories (ANL), ASI, NARC and field of Rangeland Research Institute, NARC. Four low palatable grasses i.e. *Heteropogon contortus* (HC), *Sorghum halepense* (SH), *Chrysopogon aucheri* (CA) and *Desmotachya bipinnata* (DB), were harvested at mature stage and then chopped. The dried grasses were mixed with 4% urea, 4% molasses and 1: 100 EM. The solutions of urea, molasses and EM were sprinkled on the grasses 50:50 by weight. These were then kept under air tight conditions for 4 weeks to make good quality hay. HC was mixed with 4% urea, 4% molasses and 1:100 EM in following way to make different combinations. Pure HC without any addition, HC + 4% molasses, HC + 4% urea, HC + 4% molasses + 4% urea, HC + 4% urea + 1:100 EM, HC + 1:100 EM + 4% molasses, HC + 1:100 EM + 4% molasses + 4% urea. Same treat-ments were used for other grasses. For each treatment three obser-vati-ons (replications) were carried out. There were 84 observations for all treatments. Treatment samples were dried up at 80^{0}C in an oven to an even weight for 24h. These were then ground. Proximate analysis of all of the above mentioned combinations was carried out following AOAC (1990) methods. The digestibility trials were carried out for HC. Only fifteen Beetle breed goats with even size and an average body weight of 30 - 35 kg were used in the experiment. All animals were kept and fed in metabolic cages. The digestibility was calculated using following formula:

Digestibility % = Feed intake – Faeces outgo / Feed intake x 100

Data gathered were statistically analyzed using analysis of variance (ANOVA) technique under completely randomized design (CRD). Least significant differences test was used for testing means of different parameters (Steel and Torrie, 1996).

RESULTS AND DISCUSSION

Effect of Mixing of *Heteropogon contortus* with Urea, Molasses and EM

Crude protein (CP) value of the treatments showed significant variation ranging from 8.35 to 10.45% (Table 1). The significantly highest value (10.45%) was recorded in the treatment HC+EM+molasses+urea while lowest in HC (8.51%) and HC + molasses (8.35). The second highest value of CP was recorded in treatments HC+urea+EM (10.23%)and HC+molasses+urea (9.64). Treatments HC+urea and HC+molasses had 9.24%, 8.35% CP levels respectively showing statistical difference among each other.

Quality supplementation of locally existing low quality and poor palatability roughages for introduction of better feeding practices is needed to increase milk production, and it will also help in introducing sustainable farming practices that will make certain the uninterrupted supply of milk and related products (Nuwanyakpa and Butterworth, 1987). Nutritional quality of low quality roughages like straws, stoves and hays can be enhanced by diverse treatment. For example, China's knowledge and skills in using crop residues after processing for small ruminants have resulted in striking rise in beef and mutton yield. It can thus save a great amount of grains utilized for the same purpose (Gao, 2000). Consumption of poor quality roughages can be enhanced with addition of energy and supplementation of nitrogen sources, physical, biological and chemical treatment. This eventually is dependent upon the financial benefits and on the conditions that how practical and applicable these feeds will be after enhancement (Schiere and

Table 1. Chemical composition of various combinations of mix feed of *Heteropogon contortus* (HC), urea, molasses and EM

Treatment	CP %	CF %	Ash %	EE %
HC	8.51 d	35.71 a	6.12 d	1.31 e
HC+Molasses	8.35 d	32.34 b	7.65 b	1.51 c
HC+Urea	9.24 c	30.69 c	7.71 b	1.78 b
HC+Molasses+Urea	9.64 bc	30.43 c	8.15 a	1.96 a
HC+Urea+EM	10.23 ab	28.51 d	7.76 b	1.41 d
HC+EM+Molasses	9.33 bc	28.20 d	6.96 c	1.35 e
HC+EM+Molasses+Urea	10.45 a	27.96 e	6.12 d	1.31 e
LSD *P= 0.05*	0.59	1.45	0.44	0.08
CV%	2.47	3.78	6.23	8.37

Means followed by same letter do not differ significantly at $P \leq 0.05$.

Ibrahim, 1989; McDonald et al., 2002). Urea, molasses and EM are good supplements. Supplementation of low quality feeds with protein sources raises the rate and degree of absorption ensuing in better dry matter intake (Preston and Leng, 1987). Sibanda (1986) observed that molasses are palatable and promote the intake of less palatable feeds. Molasses also enhance feed intake, effectiveness, and narrowed the occurrence and frequency of laminitis particularly in high energy calorific rations. It has been found that combined effect of urea added to diets supplemented with molasses, led to optimal results than feeding with diets supplemented with urea only, molasses only, or none (Nuwanyakpa and Butterworth, 1987). Safalaoh (2006) explained that EM technology is useful in a large variety of practices. Some of the advantages from the use of EM are better meat and egg quality, enhanced animal health, decrease in stinking smells and no poisonous effects on animal farms.

Crude fiber (CF) values decreased linearly along the column. The highest CF content 35.71% was recorded in the HC treatment. The lowest was in HC + urea + molasses + EM (27.96%). The second highest value of 32.34% was recorded in HC + molasses followed by HC+molasses +urea, HC+urea producing values of 30.43%, 30.69% respectively, having no statistical difference. HC + EM + molasses, HC + EM + urea produced CF values of 28.20 and 28.51, respectively, showing no statistical difference among them.

The highly significant characteristic in the feed of ruminants is quantity of crude protein present, which facilitates milk and meat production and keeps livestock resources strong and vigorous (Afzal and Ullah, 2007). Similarly, Srivasulu et al. (1999) reported that urea treatment raised CP content of the straw from 3.35% to 7.54%, more than double of the initial CP value of straw. McKiernan (1982) study showed that sheep performance was enhanced on teff straw + molasses + urea than teff straw and urea feeds, signifying that the minerals and energy in the molasses are useful but molasses also enhance the consumption of urea by rumen microorganisms. Abd El-Aziz et al. (1997) reported that sugarcane bagasse treated with urea + 10g live yeast culture/h/day and given to Saidi rams improved CP from 3.74 to 9.90%. It becomes obvious from the results that adding molasse+urea is more effective than molasses or urea alone in the treatments. Similarly, Van Niekerk and Jacobs (1985) explained that the inadequacy of molasses to molasses + urea is due to the fact that molasses addition at limited levels as the only supplement to low quality roughages may reduce digestibility, voluntary feed intake and rate of passage. Similar effects of EM on CP were reported by Yesuf (2010). He carried study on in vitro digestibility and chemical composition of coffee pulp and coffee husk ensiled with grass, *Hyperchennia hirta* hay and EM. He reported that there was increase in the crude protein content of coffee pulp and coffee husk ensiled by its own or in combination with different levels of chopped grass hay as a result of using EM ($P<0.001$) and ($P<0.01$) respectively. The highest percentage composition of crude protein was 13-14% and 12.3 - 13%, respectively.

The ash content varied significantly among the treatments ranging from 6.12% to 8.15%. The highest amount of 8.15% ash was recorded in the treatment HC+molasses+urea. The lowest ash content of 6.12% was recorded in the treatments HC alone. The second highest ash content was recorded in the treatment HC + urea + EM producing value of 7.76% followed by HC + urea (7.71%) and HC + molasses (7.65%) with no significant difference among the column.

Significant variations were also recorded in ether extract (EE) content among various treatments. The highest value of 1.96% was recorded in HC + molasses + urea. The second highest value of 1.78% was observed in HC + urea followed by HC + molasses producing 1.51% EE. The lowest value of EE was 1.31%.

Effect of Mixing *Chrysopogon aucheri* with Urea, Molasses and EM

Various treatments of the experiment showed significant effect on CP content. The CP content ranged from 5.70% to 12.42% (Table 2). The highest value of CP 12.42% was recorded in the treatment CA + EM + molasses + urea, followed by the treatment CA + molasses + urea producing 12.06% CP. CA + urea + EM and CA + EM + molasses produced 9.91% and 9.22% CP, respectively. CP content of 7.61 and 7.03% was obtained from the treatment CA + urea and CA + molasses, respectively.

The data recorded on CF content of various treatments showed significant difference. The differences among the treatments varied from 38.79% to 26.75%. The highest CF (38.79%) content was recorded for the treatment CA alone while lowest (26.75%) in CA + EM + molasses + urea. The second higher yield of CF content was observed in the treatment CA + molasses (34.53), CA + urea (34.29%) and CA + molasses + urea (30.90%), followed by CA + urea + EM and CA + EM + molasses giving 29.91% and 26.75% CF contents respectively having significant difference. CF content decreased linearly along the column.

It is evident from Table 2 that various combinations of CA have significant variation in the ash content. The statistical highest ash content of

Table 2. Chemical composition of various combinations of mix feed of *Chrysopogon aucheri* (CA), urea, molasses and EM

Treatment	CP %	CF %	Ash %	EE %
CA	5.70 d	38.79 a	6.33 d	0.35 e
CA+Molasses	7.03 d	34.53 b	7.18 b	1.50 c
CA+Urea	7.61 c	34.29 b	7.53 b	1.00 b
CA+Molasses+Urea	12.06 a	30.90 c	8.73 a	1.41 a
CA+Urea+EM	9.91 b	29.88 d	7.13 b	1.31 d
CA+EM+Molasses	9.22 b	29.91 d	6.72 c	0.61 e
CA+EM+Molasses+Urea	12.42 a	26.75 e	6.68 c	0.56 e
LSD *P= 0.05*	2.57	2.23	0.87	0.26
CV%	2.47	3.78	6.23	8.37

Means followed by same letter do not differ significantly at P ≤0.05 .

8.73% and 7.53% was produced from treatments CA + molasses + urea and CA + urea respectively followed by CA + urea + EM (7.13%) and CA + molasses (7.18%) having no statistical difference. CA + EM + molasses + urea, CA + EM + molasses produced values of 6.68% and 6.72%, respectively with no statistical difference. The lowest ash content (6.33%) was recorded in CA. EE content varied significantly with the variation in combinations of CA. The lowest EE of 0.35% was recorded in CA, while the highest of 1.50% and 1.41% from CA + molasses and CA + molasses + urea, respectively. The treatments CA + EM + molasses + urea, CA + EM + molasses and CA + urea + EM, gave EE content which were not statistically different from each other.

Effect of Mixing *Sorghum halepense* with Urea, Molasses and EM

It is evident that the significantly highest CP content of 12.23% and 12.19% was observed in the treatment SH + EM + molasses + urea and SH + molasses + urea, respectively (Table 3). The second highest CP% was observed in treatment SH + EM + molasses and SH + urea + EM producing 10.37% and 10.24% CP. The lower values of CP were observed in the treatment SH + molasses (7.70%) and SH (7.62%).

The CF data (Table 3) showed significant variations among all the treatments. The highest CF value of 36.59% was recorded in SH while the lowest 27.02% and 27.50% were recorded in SH + EM + molasses + urea and SH + urea + EM, respectively. CF content decreased along the column. In present study addition of EM in the treatments further decreased the CF level along the column. The lowest CF was in the treatment SH + EM + molasses + urea (27.02) and the highest in SH (36.59) (Table 3). Similar trend was observed in other grasses in the study. Ali (1995) reported decreased CF content from 41.91% (3%urea treated rice straw) to 40.69% (untreated rice straw). The CF content lessened from 33.72 (5% urea ensiled rice straw) to 31.24 (untreated rice straw).

The ash content of the treatments

Table 3. Chemical composition of mix feed of *Sorghum halepense* (SH), urea, molasses and EM

Treatment	CP %	CF %	Ash %	EE %
SH	7.62 e	36.59 a	6.85 c	1.76 e
SH+Molasses	7.70 d	32.94 b	7.18 b	1.38 d
SH+Urea	8.63 c	32.61 b	7.23 b	1.55 a
SH+Molasses+Urea	12.19 a	32.64 b	8.73 a	1.52 a
SH+Urea+EM	10.24 b	27.50 c	8.13 a	1.00 a
SH+EM+Molasses	10.37 b	28.78 d	5.72 d	1.38 d
SH+EM+Molasses+Urea	12.23 a	27.02 e	6.68 c	1.79 c
LSD *P = 0.05*	2.46	2.57	0.94	0.03
CV %	3.30	4.00	7.45	0.24

Means followed by same letter do not differ significantly at $P \leq 0.05$.

varied significantly among the various combinations of SH. The highest ash content of 8.73% and 8.13 % was recorded in the treatment SH + molasses + urea and SH + urea + EM with no statistical difference among them. The lowest content (5.72%) of ash was recorded in treatment SH + EM + molasses. Various treatments of the experiment showed significant effect on the EE content. The EE content ranged from 1.76 to 1.00% among the treatments. The highest content of 1.76% and lowest of 1.00 were recorded in treatment SH and SH+urea+EM (Table 3).

Effect of Mixing *Desmostachya bipinnata* with Urea, Molasses and EM

The mean values of CP showed significant variations among the various treatments of DB. The treatments DB + EM + molasses + urea, DB + molasses + urea showed significantly highest CP yield of 12.31% and 12.91%, respectively. Treatment DB+urea+EM has 11.15% CP while the lowest 6.73% was recorded in DB followed by DB+molasses with 7.48% having statistical difference.

As evident the significantly highest CF content of 38.04% was observed in the treatment where only DB was analyzed and the lowest CF of 25.88% and 25.31% from DB + EM + molasses + urea and DB + EM + molasses, respectively (Table 4). The second highest CF % was observed in treatment DB+molasses producing 32.50%CF. DB+molasses+urea and DB+urea+EM had CF values of 28.62 and 28.75% with no statistical difference. CF content decreased linearly along the column.

The content of ash varied significantly among various combinations of DB. The DB alone showed ash content of 7.60% followed by DB + molasses and DB+urea producing 9.95 and 8.37, respectively, with significant difference. The highest ash content 10.23 was recorded in DB + molasses + urea, 7.01% and 7.92% ash were recorded in the treatments DB + urea + EM and DB + EM + molasses, respectively. Treatment DB + EM + molasses + urea showed ash value of 8.43%.

Various treatments of the

Table 4. Chemical composition of mix feed of *Desmostachya bipinnata* (DB), urea, molasses and EM

Treatment	CP %	CF %	Ash %	EE %
DB	6.73 e	38.04 a	7.60 d	1.78 e
DB+Molasses	7.48 d	32.50 b	9.95 b	2.51 b
DB+Urea	8.13 c	31.90 c	8.37 c	2.41 b
DB+Molasses+Urea	12.91 a	28.62 d	10.23 a	3.84 a
DB+Urea+EM	11.15 b	28.75 d	7.01 d	2.10 c
DB+EM+Molasses	9.00 c	25.31 e	7.92 d	1.62 d
DB+EM+Molasses+Urea	12.31 a	25.88 e	8.43 c	2.19 c
LSD $P = 0.05$	2.43	5.35	0.72	0.06
CV %	3.05	7.93	4.96	2.39

Means followed by same letter do not differ significantly at $P \leq 0.05$.

experiment showed little variation of EE content. The EE content ranged from 1.62 to 3.84% among the treatments. The highest value of EE 3.84% was recorded in treatments DB + molasses + urea. Treatment DB + molasses + EM and DB + molasses produced 1.62% and 2.51% EE, respectively, with significant statistical difference.

Average Daily Dry Matter and Nutrients Intake by Goats and their Digestibility

The dry matter intake (DMI) showed significant variation among the treatments (Table 5). The significantly highest DMI values (4.65 kg) were recorded in the treatment HC + urea + molasses followed by HC + molasses (3.79 kg) DM with statistical difference. The third higher DMI of 2.55 kg were observed in the treatments HC + urea and HC + urea + molasses + EM. The HC showed the lowest DMI value (1.60kg) than the rest of treatments. The descending trend of DMI content was 1.60, 2.55, 2.55, 3.79, 4.65 kg. The digestibility percentage of DMI varied among the treatments ranging from 41.66 to 85.51. The highest value of dry matter digestibility 85.51% was recorded in the treatment HC+urea+molasses, while the lowest 41.66% in treatment HC.

Significantly highest crude protein intake (CPI) of 0.70 kg was recorded in the treatment HC + urea + molasses + EM, while the lowest CPI of 0.12 kg from HC. The second highest CPI was recorded in treatment HC + urea + molasses by intaking 0.55 kg followed by treatment HC + molasses with 0.25 kg which were statistically different from each other. The ascending order of CPI was HC + urea + molasses + EM, HC + urea + molasses, HC + molasses, HC, respectively. The protein digestibility percentage of 83.04 was recorded in the treatments HC + urea + molasses + EM. Treatments HC + urea + molasses, HC + molasses and HC + urea showed CPI values of 73.43, 73.61 and 72.91, respectively, showing non-statistical difference among the treatments. The treatment HC had CPI digestibility % of 41.11, statistically apart from rest of the treatments, the lowest crude protein digestibility. The trend of increase in digestibility percentage for CPI was denoted as HC + urea + molasses + EM > HC + urea + molasses > HC + molasses > HC + urea > HC.

Table 5. Mean difference in digestibility (%) of DMI, CPI and CFI

Treatment	DMI (kg)	Digestibility (%) DM	CPI (kg)	Digestibility (%) CP	CFI (kg)	Digestibility (%) CF
HC	1.60 ^{d}	41.66 ^{e}	0.12 ^{e}	41.11 ^{c}	1.86 ^{a}	63.11 ^{a}
HC+Molasses	3.79 ^{b}	77.26 ^{d}	0.25 ^{d}	72.91 ^{b}	0.57 ^{d}	61.25 ^{b}
HC+Urea	2.55 ^{c}	78.57 ^{b}	0.50 ^{c}	73.61 ^{b}	0.59 ^{d}	62.31 ^{b}
HC+Urea +Molasses	4.65 ^{a}	85.51 ^{a}	0.55 ^{b}	73.43 ^{b}	0.60 ^{c}	65.22 ^{a}
HC+Urea+Molasses+EM	2.55 ^{c}	78.00 ^{c}	0.70 ^{a}	83.04 ^{a}	0.72 ^{b}	58.90 ^{d}
LSD $P = 0.05$	1.14	5.51	0.55	9.76	0.16	4.35
CV %	3.90	14.77	7.43	21.13	15.85	2.51

Means followed by same letter do not differ significantly at $P \leq 0.05$.

Various treatments of the experiment showed significant effect. The CFI content ranged from 0.57 to 1.86 kg among the treatments. The highest value of 1.86 kg was recorded in treatments HC, followed by treatment HC + urea + molasses + EM (0.72 kg) HC + urea + molasses (0.60 kg) with statistical difference. The highest value of 65.22% digestibility of fiber was recorded in the treatment HC + urea + molasses, followed by HC, HC + urea, and HC + molasses with 63.11, 62.31% and 61.25 %, respectively. The statistical lowest digestibility value of 58.90 was recorded in the treatments HC +urea + molasses + EM.

Nutrient Digestibility

Goats fed HC, HC + urea, HC + molasses, HC + urea + molasses, HC + urea + molasses + EM had similar DM, CP and CF consumption among all the treatments (Table 5). The highest digestibility of DM (85.51%) in animals was recorded in treatment HC+urea+molasses followed by 78.57% in HC+urea. The treatments HC+molasses and HC + urea + molasses + EM produced 77.26 and 78.00 digestibility of DM, differences were significant among the treatments. The lowest digestibility of dry matter (41.66 %) was observed in HC. Similarly, differences in the digestibility of CP and CF among all the treatments were small.

Preston and Leng (1987) reported that supplementation of low quality feeds with protein sources raises the rate and degree of absorption ensuing in better dry matter intake. Nuwanyakpa and Butterworth (1987) reported that molasses+urea notably ($P<0.05$) enhanced N and DM digestibilities, and N retention than urea sole or molasses sole, even though the feed ratio of molasses (14.8%) and molasses+urea (14.7%) were alike. On every stage of noug cake or Trifolium hay, the results of molasses - urea on teff straw, nutrient digestibilities and total feed intake, were appreciably larger than molasses, signifying that the minute quantity of urea considerably enhanced the worth of molasses as a supplement, possibly through making N available in more quantity for growth and protein synthesis of rumen bacteria. Similarly in the present study DMI results of molasses + urea on grass were appreciably larger than those with urea alone or molasses alone. For example the DMI of HC + urea was 2.55kg but for treatment HC + urea + molasses it was 4.65kg (Table 5). Improvement of dry matter intake by urea treatment has also been explained for wheat straw in sheep by Doulberg et al. (1981). El-Badawi et al. (1990) reported that CP digestibility of 3% urea treated rice straw was 80.10% in adult Baladi goats appreciably larger than those Baladi goats given untreated rice straw (67.30%). Similary in present study CP digestibility of treatment HC+urea was 72.91% compared with untreated pure HC (41.11%).The high digestibilities of the CP obtained in treatment HC+4% urea i.e.73.61 (Table 5) were in agreement with Nour (1986), due to the supplement molasses and urea.

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