Journal of Animal and Veterinary Advances 13 (3): 152-158, 2014
ISSN: 1680-5593

Study the Use of Urea Molasses Mltinutrient Block on Pica Symptom of Cattle

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Abstract: This study discuses the effect use of feeding Urea Molasses Multinutrient Block (UMMB) as an alternative supplements on the pica symptom of Limousin cattle. Thirty indigenous pica cattle were chosen from Ningnan mountainous district Guyuan City on the basis of similar bodyweight. The Ningnan mountainous district cattle produce was limited by harsh environments and nutritional factors. Especially the forage quality and availability are affecting nutrient intake. Forage was reduced during winter and early spring of the year. A background of these blocks manufacturing process and their effect on pica symptom of cattle are reported. Sixty cattle were randomly divided equally into control and UMMB treatment supplemental groups. Both groups have the same forage except the treatment group was free access to supplement with UMMB. The experiment lasted for 30 days. The content of mineral elements (Se, Zn, Cu, Co, I, Ca, P) in blood in the experiment group were significantly increased contrast with control group ($p<0.05$) after feeding the UMMB. The activity of Ceruloplasmin (CP), Superoxide Dismutase (SOD) and Lactate Dehydrogenate (LDH) in the serum of experimental group were significantly increased contrast with control group ($p<0.05$). The content of mineral elements (Se, Zn, Cu, Co) on feather in the experiment group were significantly increased contrast with control group ($p<0.05$). According to the field observation and stock owner reflect, the pica symptom was disappeared in the treatment group after feeding UMMB 3 days and the intake and drinking have significantly increased. Cattle have the symptom of pica and the hair was coarseness and lackluster before experiment in the experiment group. The symptom of pica was gradually disappeared and the appearances of cattle were dramatically changed with feeding the UMMB. Furthermore, the color of hair was brightness and bushy and the cattle was in good condition in the treatment group after feeding UMMB. But the hair of the cattle in the control group was sparseness and dirty. The symptom of pica was all disappeared which means the UMMB was an effectively in treated cattle pica. So, the UMMB can be as an effective way mineral supplement and treatment in cattle pica.

Key words: Urea molasses mltinutrient block, pica, cattle, ningnan mountainous, mineral element

INTRODUCTION

Nutrient deficiency is a commonly problem in the world, especially the mineral deficiencies and imbalances for cattle (Garg *et al*., 2013). In arid and semi-arid regions, feed shortage is the main constraint to their productivity. During the hot and dry seasons, the available feed resources are not enough in energy and digestion proteins which are insufficient to ensure maintenance requirements and reducing productivity throughout the year. In drought conditions, ruminants need enough nutritious to improve animal performance. Earlier studies have assessed the nutritional quality in Ningnan mountainous district forage. The nutrition consent in this mountain was deficiencies and required to supplement the desired level of production. In the past decades, UMMB was chosen as a supplementation to deficient diets in cattle (Garg and Gupta, 1992; Schiere *et al*., 1989; Toppo *et al*., 1997), sheep (Owen *et al*., 2012; Mirza *et al*., 1988; Sudana and Leng, 1986) and baffaloes (Hosmani *et al*., 1995; Mehra *et al*., 1991, 1993; Tiwari *et al*., 1990). However, there are many kinds of UMMB in the market. Since, these UMMB are too soft or hygroscopic due to humidity resulted in gobbled rapidly by the animals which lead to extensive supplement to animals. In order to study the UMMB of local cattle in

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Guyuan, the present study was carried out on UMMB formulas, raw material, technical parameter and feeding effect.

MATERIALS AND METHODS

Ingredient composition of UMMB: The UMMB prepared in this study using the process as described by Li *et al.* (2008). Different ingredient of UMMB licks were chosen from local place with the objective of supplying minerals nutrition. The UMMB consisted of mineral mixture, common salt, urea, sodium bentonite, molasses, wheat bran, calx and calcium hydrogen phosphate at the level of 8.5, 20, 10, 20, 20, 4, 5 and 12.5%, respectively.

Animals feeding and management: The study was done at the Ningnan mountainous district, Guyan City, Ningxia Province, China. Sixty indigenous cattle with symptom of pica were chosen from Ningnan mountainous district Guyuan city on the basis of similar bodyweight, divided randomly into two groups of thirty animals in each group. Two groups have the same formula except the treatment group supplemented with UMMB to meet their mineral requirement. The ingredient composition of UMMB was mineral mixture, common salt, urea, sodium bentonite, molasses, wheat bran, calx and calcium hydrogen phosphate at the level of 8.5, 20, 10, 20, 20, 4, 5 and 12.5%, respectively.

The cattle animals were kept in sheds during the experimental conduction. Clean and fresh drinking water provided in the morning and afternoon. During the 30 days of study, hematology index, serum enzymology index, the mineral concentration of the blood, the mineral content of the hair, the consumption of UMMB and the pica animal clinical manifestation and disease development were tested at the beginning and end of the experiment.

Sample preparing: Take blood sample 30 mL in the neck venous before the experiment and at the end of the experiment with 1% heparin anticoagulation and stored at -25°C. The 10 mL used for the test mineral element, 10 mL used for the determination hematology index and 10 mL used for the biochemical index test. Take 1 g clothing hair before and at the end of the experiment for mineral test.

Routine hematological examination: Routine hematological was examined by automatic animal blood analyzer. The routine hematological test indexes including: Red Blood Cell (RBC), White Blood Cell (WBC), Hematocrit (HCT), Hemoglobin (HGB), neutrophils (GR), Lymphocyte (LY), Median cells (MO), Platelet (PLT), Lymphocyte ratio (LY%), mid-value cell ratio (MO%), neutrophils ratio (GR%), Mean Corpuscular Volume (MCV), Mean Content of Hemoglobin (MCH), Mean Corpuscular Hemoglobin Concentration (MCHC), Mean Platelet Volume (MPV) and Platelet Cubic Thrombocytocrit (PCT).

Blood biochemical index examination: Blood biochemical index was examined by chemical colorimetric method (Test kit). The evaluation indexes including Ceruloplasmin (CP), Glutathione Peroxidase (GSHPX), Superoxide Dismutase (SOD), Lactate Dehydrogenase (LDH) and Alkaline Phosphatase (AKP).

Blood element analysis: The blood element analysis: Selenium determination. Instruments: AFS-930 double ways for atomic fluorescence photometric (Beijing auspicious day Instrument Company.). Methods: blood 2.0 g, add 15 mL nitric acid and 1 mL strong high chlorine acid in cook stove digestion 15-16 h (130°C temperature), cooling the sample and then added to 10 mL. Hydride Generation Atomic Fluorescence spectrometric determination (HGAFC), 200~290 nm wavelength, standard curve equation (fluorescence intensity value) = 40.4049×C (density)-3.9259. The calcium, phosphorus, copper, zinc, cobalt, selenium and iodine element determination. Instruments: plasma atomic emission spectrometer (American varian company VISTA-AES). Methods: the former dealing similar with selenium determination, determination conditions temperature was -35°C, water temperature 22°C, power 1.2 kW; gas flow for argon was 2.25 L min^{-1}, nitrogen 1.5 L min^{-1}. Determine wavelength was: 396.847, 213.618, 327.395, 213.857, 238.892, 257.610, 238.204 nm, respectively. Element fluorine, chlorine determination. Instruments: ion chromatography (Dianne Company). Methods: the former dealing similar with selenium determination, according to GB/T14924.12 2001, the eluent and leacheate were 12% of chromatographic pure NaOH; temperature 30°C and the sample volume 20 μL, the volume was leacheate 250 μL/time each sample elution time was 20 min.

Data statistics and processing: The SPSS 13.00 Software on One-Way ANOVA analysis of variance and Duncan's multiple comparison, the result in average±standard deviation.

RESULTS AND DISCUSSION

Routine blood index: Routine blood test results shown in Table 1. The results showed that the number of Red Blood

Table 1: Results of blood routine in sickness cattle

	At the beginning of the experiment		At the end of the experiment	
Blood routine items	Experiment group	Control group	Experiment group	Control group
RBC (10^{12} L^{-1})	4.64±0.99	4.56±0.92	9.18±0.99*	4.74±0.94*
WBC (10^{9} L^{-1})	7.88±2.39	7.93±2.32	8.46±2.33*	7.55±2.03*
HCT (%)	22.72±5.54	21.46±5.23	26.08±6.14*	23.21±5.52*
HGB (g L^{-1})	109.4±12.86	108.64±12.41	113.53±11.58	112.13±12.45
NP (10^{9} L^{-1})	2.98±0.8	2.76±0.73	3.17±0.92	3.15±0.86
LY (10^{9} L^{-1})	4.13±1.76	3.94±1.48	3.75±1.38*	4.44±1.72*
MC (10^{9} L^{-1})	0.77±0.41	0.71±0.34	0.59±0.17*	0.78±0.36*
PLT (10^{9} L^{-1})	413.5±216.37	415.57±217.3	346.6±146.09*	417.8±193.17*
LY (%)	51.05±8.4	50.83±7.48	50.01±8.34*	52.34±8.86*
MC (%)	9.49±2.94	9.13±2.51	7.69±1.09*	8.99±2.61*
NP (%)	39.46±8.08	40.12±8.53	42.74±8.03*	38.67±8.32*
MCV (fL)	48.67±2.52	47.86±2.17	49.94±3.18	48.73±2.61
MCH (Pg)	24.66±7.32	25.67±7.85	22.4±2.51*	24.54±6.16*
MCHC (g L^{-1})	515.9±185.81	513.1±183.65	455.8±102.56*	511.8±158.01*
MPV (fL)	9±1.78	9.56±1.92	10.19±1.86	9.33±1.67
PCT (%)	0.38±0.26	0.35±0.17	0.36±0.21	0.4±0.24

Table 2: Result of enzymatic activity in blood serum

	At the beginning of the experiment		At the end of the experiment	
Items	Experiment group	Control group	Experiment group	Control group
CP (10^{12} L^{-1})	1.38±0.9900	1.29±0.9100	8.45±2.560*	1.41±0.7700*
GSHPX (10^{9} L^{-1})	208.71±8.9800	205.97±8.5300	246.15±75.63*	211.16±15.090*
SOD (%)	105.98±6.0200	104.56±5.8700	130.81±2.550*	106.89±6.3200*
LDH (g L^{-1})	2653.29±171.67	2651.11±169.88	4544.51±347.7*	2643.99±137.37*
AKP (10^{9}/L)	20.69±8.0800	21.51±8.1100	28.08±11.68*	19.13±6.8200*

Table 3: The mineral content in blood (mg L^{-1})

	At the beginning of the experiment		At the end of the experiment		
Items	Experiment group	Control group	Experiment group	Control group	Referance
Se	0.011±0.005	0.012±0.005	0.084±0.015*	0.026±0.011*	0.13
Zn	1.47±0.4100	1.35±0.4000	8.2±0.28000*	3.15±0.2600*	9.00
Cu	1.66±0.1600	1.67±0.1480	5.09±0.2500*	2.41±0.1600*	5.00
Co	0.025±0.004	0.027±0.004	0.08±0.0020*	0.03±0.0030*	0.10
I	0.01±0.0030	0.013±0.004	0.03±0.0020*	0.011±0.002*	-
Ca	81.99±1.1600*	83.44±0.7200*	97.91±3.4600*	84.33±0.3800*	102.00
P	150.13±0.4800	150.16±0.5300	250.8±7.52000*	153.36±1.3000*	260.15

Experiment group compared with control group; *notice $p<0.05$; significant difference

Cells (RBC), Hematocrit (HCT), Hemoglobin (HGB) and the number of White Blood Cells (WBC) of pica cattle were below normal index. The number of RBC, WBC, HCT, HGB, Neutrophils (NP), Mean Corpuscular Volume (MCV), Medial Plaque Volume (MPV) in the experiment group were increased by 49% ($p>0.05$), 4.19% ($p>0.05$), 12.88% ($p<0.05$), 3.64% ($p>0.05$), 6% ($p>0.05$), 7.67% ($p<0.05$), 2.54% ($p<0.05$), 11.68% ($p>0.05$) compared with control group. Lymphocytes (LY), Median Cells (MC), Platelets (PLT), Lymphocyte rate (LY%), Median Cells rate (MC%), Mean Content of Hemoglobin (MCH), Mean Corpuscular Hemoglobin Concentration (MCHC), Platelet Cubic Thrombocytocrit (PCT) in the experiment group were reduced by 9.2% ($p>0.05$), 23.38% ($p>0.05$), 16.18% ($p<0.05$), 2.04% ($p>0.05$), 18.97% ($p>0.05$), 9.16% ($p>0.05$), 11.65% ($p<0.05$) and 5.26% ($p<0.05$) compared with control group.

Serum enzyme activity test results: Result of enzymatic activity in blood serum shown in Table 2. From Table 2, the results showed that the enzyme activity are not significant difference ($p>0.05$) in the experiment group and control group at the beginning of the experiment. But at the end of the experiment, the CP, GSHPX, SOD, AKP and LDH activities were higher (significant difference, $p<0.05$) than the control group.

The mineral element content in blood: It can be seen from the Table 3, the concentration of calcium was significant difference ($p<0.05$), the other index were not significant ($p>0.05$) at the beginning of the experiment. At the end of the trial, experiment group and control group were all significant difference ($p<0.05$) and the concentration of the index were close or higher than the normal index.

Table 4: The mineral elements content in hairs (mg kg^{-1})

Elements	At the beginning of the experiment		At the end of the experiment		
	Experiment group	Control group	Experiment group	Control group	Referance
Cu	6.19±0.170*	6.33±0.1400*	9.35±0.130*	6.42±0.09*	10
Zn	92.44±0.990	92.51±1.3200	208.15±0.780*	105.75±0.88*	-
Co	0.21±0.026	0.21±0.0300	0.42±0.036*	0.24±0.02*	-
Se	0.173±0.02	0.161±0.014	1.3±0.1500*	0.18±0.01*	1~5

Experiment group compared with control group; *notice p<0.05; significant difference

Table 5: The consumption of the block (g day^{-1})

Days	1-5 day	6-15 day	16-30 day
Consumption	126.41±8.43	76.2±5.14	76±6.73

Experiment group compared with control group. *Notice p<0.05, Significant difference

The mineral elements content in hairs: It can be seen from the Table 4, the concentration of copper were significant difference (p<0.05), the other index were not significant (p>0.05) at the beginning of the experiment. At the end of the trial, experiment group and control group were all significant difference (p<0.05) and the concentration of the index were close or higher than the normal index.

The block consumption: Table 5 showed the consumption of the block. Total 1-5 days was about 126.41, 6-15 g day^{-1} was 76.20 g day^{-1} and 16-30 day was 76.00 g day^{-1}.

The consumption of the block: The pica cattle were very like lick block and the block palatability is better, especially in the first stage, some cattle not only suck block but also bite it. It means that the mineral deficiencies of cattle are pretty serious in the countryside. In the first days of the test, the time of lick was control in order to prevent the excessive suck. After 4 or 5 days, the average intake was normal (76.2 g $days^{-1}$). According to the lick intake each day, each block can available for every cattle suck 20~30 days or so. In this study, cattle feed intake block are differences among the individual but did not appear urea poisoning.

The effect of the block on the hairs and treatment the symptom of pica: Every cattle has the symptom of pica before experiment. The pica cattle gradually reduced symptoms since entering the experiment period in the experiment group. According to observe and reflect from the client, the cattle with pica symptoms cattle in the experiment group were gradually disappeared after licking the block 3 days, the feed and water intake were increased. The pica symptom was disappeared after 15 days but the control group still have pica symptom.

The hair was harsh and lusterless etc. before the experiment, the hair was improved greatly and hair removal in advance, hair removal time neatly and with shining fur after the experiment. The results showed that UMMB has a good curative effect on cattle pica. It can improve hair nutrition; promote the hair take off and growth as early as possible.

The appetite, spirit and different body status: All the cattle feed and excrement was normal during the experiment. The feed and water intake were increased according to the field observation and reflect from the client. The feed intake still could not measure although a lot of effort on feed intake because this experiment was conduct in production conditions. The body status and fur condition in experiment group were better than control group. The above statement showed that UMMB can improve the cattle nutrition and health conditions and can improve the dry matter of feed intake, especially straw feed intake.

Routine blood index is a comprehensive index which reflects the cattle nutrition condition, metabolism condition, the environmental balance in the body, body health, growth speed and production performance (Azizi-Shotorkhoft *et al*., 2013). The present study results showed that the index of RBC, WBC and HGB were below normal index in pica cattle. The blood routine index was normal after feeding UMMB. It means that the physiological and biochemical indexes had relatively comprehensive improvement when feeding UMMB.

The most important function of mineral elements is the composition of enzyme and maintain of the enzyme activity. The corresponding enzyme in the blood and tissue of the active can make corresponding reaction when certain mineral elements lacking which can be used to diagnose certain mineral elements. The study results showed that the enzyme activity was significantly higher in the experiment group than the control group. AKP is a kind of metal enzymes containing zinc, the AKP activity dropped significantly when animals lack zinc or vice versa, the activity of AKP increasing significantly since supplementary zinc (Roth and Kirchgessner, 1979). A lack of mineral element selenium will resulted in the GSHPX activity change. The relationship between blood GSHPX activity and food selenium levels was confirmed in mouse, chicken, lamb, calves and pig. The activity of GSHPX can be used as an index in the early diagnosis of selenium deficiency (Chavez and Kratzer, 1979). Siddons and Mills (1981) reported that GSHPX changes provide an objective evidences for the ruminant animals and clinical diagnosis of selenium deficiency index of this diseases. The RBC GSHPX can well reflect the ox of selenium condition (Rombo *et al*., 1982). The advantages of evaluation minerals nutrition through enzyme activity not only can early monitoring minerals nutrition but also can avoid sample pollution of the elements but this approach also has some shortcomings that the activity of GSHPX may reduced, especially the activity of GSHPX (Levander, 1985).

Hair is part of the animals' organization. Many microvascular grow in to hair roots during the hair growth. Hair roots cells, blood, lymphatic and extracellular fluid close contact to get fully nutrition and the mineral elements deposit on the base of the hair in the short term. So, the concentration of element in hair can reflect the body metabolism. Combs reported that animal hair plays a tape which reflects the elements intake and metabolism in different periods. Use hair monitoring animal nutritional status with the advantages of sampling take easily without any damage to the animal, long-term preservation, analysis convenience etc. The element concentration of hair is changed with the breed of livestock and poultry, age, body parts, body color, hair period and the different parts of the season and change.

Table 3 showed that the levels of Se, Zn, Cu, Co, I, Ca and P in the experiment group have reached or exceeded the reference requirements. The mainly biological functions of elements were regulated the body's physiological activities through proteins and enzymes involved in metabolism of the body or form hormones (Yang, 1996). The lack of trace element will lead to metabolism disorder which affects livestock production performance (Gandra *et al*., 2011; Xin *et al*., 2011; Romero-Huelva *et al*., 2012). Mineral nutrition imbalance has become recognized as one of the main factors that restrict livestock production, it seriously affect the growth of livestock and cause more serious consequences than infectious diseases (Schiere *et al*., 1989). There are more reports about adding trace elements to improve ruminant livestock production performance (weight and lactation). It's mainly concentrated in weight gain effects after add a single element Selenium (Se) and Iodine (I) and filling zinc nutritional status (Garg and Gupta, 1992; Owen *et al*., 2012; Mirza *et al*., 1988; Sudana and Lang, 1986; Tiwari *et al*., 1990; Toppo *et al*., 1997).

There are also a large number of literature reported on zinc supplementation promotes the growth of cattle and sheep and increased feed intake of the stress of calf, promote weight on cattle and treatment effect of thin cattle (Mirza *et al*., 1988). For the bulls, zinc deficiency will resulted in seminiferous tubule degeneration, abnormal mesenchymal cells, sperm dysplasia, reduce testosterone production, impact shape of testis and delay the onset of estrus (Mehra *et al*., 1991). Zinc is also associated with Animals taste and appetite, its deficiency may result in corneal cornification and cover or block the taste buds small, lead to taste loss (Mehra *et al*., 1993). Adding Co can increase the hemoglobin and weight gain in the process of production (Hosmani *et al*., 1995). The influence of Co deficiency on cattle immune will lead to lowered immunity (Paterson and MacPherson, 1990). Cu, Zn, Co, Se, Fe and I are necessary mineral nutrition elements for livestock. Co and Fe are mainly involved in hematopoietic; Co can also boost ruminants rumen digestion. Se involved in antioxidant effect and regulation of thyroid function by forming glutathione peroxidase and iodine enzyme, respectively (Berry *et al*., 1991). Se deficiency (white myopathy) and anemia is a Worldwide widespread disease.

Urea molasses mltinutrient block can treatment and prevention of many diseases. The parasite was significantly reduced by giving male lamb Urea molasses mltinutrient block (Anindo *et al*., 1998; Molina-Alcaide *et al*., 2010). The incidence of intestinal parasitic diseases were effectively reduced by adding licking block (drug urea molasses lick block, molasses lick block 7% urea and 21% urea molasses lick block) (Rafiq *et al*., 2000). Urea molasses mltinutrient block can also treatment the water buffalo's lack of mood disorder which is the most common Summer buffalo reproductive disorders (Atta *et al*., 2012; Kang *et al*., 2005). Supplementary feeding urea molasses to 5 months East African goat not only improve the body weight gain but also significantly reduced gastrointestinal nematode parasites (Waruiru *et al*., 2003).

CONCLUSION

It could be concluded that UMMB could treatment the Ningna mountains cattle pica. Supply of UMMB in experiment increased the intake and the performance of cattle. The results showed that UMMB supplementation is an effective strategy to increase the production while maintaining animal performance and feed efficiency.

ACKNOWLEDGEMENTS

Researchers are grateful to Xishan Li, Guanglin He, Guoping Zhang, Yaofa Du, Xiaomei Yang, Lizhen Yan, Yafeng Zhao who participated in this experiment. This study was financed by Henan Academy of Agricultural sciences outstanding youth fund of science and technology (Project No.: 2013YQ22) and Henan Academy of Agricultural Sciences Dr. Start-up fund of Scientific research.

REFERENCES

Anindo, D., F. Toe, S. Tembely, E. Mukasa-Mugerwa, A. Lahlou-Kassi and S. Sovani, 1998. Effect of Molasses-Urea-Block (MUB) on dry matter intake, growth, reproductive performance and control of gastrointestinal nematode infection of grazing Menz ram lambs. Small Rumin. Res., 27: 63-71.

Atta, M., W.B. Zeinelabdeen, O.A. El Khidir and A.A. Adam, 2012. Reproductive performance of Sudan Nilotic does fed pelleted molasses and mash sorghum based diets. Small Rumin. Res., 104: 99-103.

Azizi-Shotorkhoft, A., J. Rezaei and H. Fazaeli, 2013. The effect of different levels of molasses on the digestibility, rumen parameters and blood metabolites in sheep fed processed broiler litter. Anim. Feed Sci. Technol., 179: 69-76.

Berry, M.J., L. Banu and P.R. Larsen, 1991. Type I iodothyronine deiodinase is a selenocysteine-containing enzyme. Nature, 349: 438-440.

Chavez, E. and F.H. Kratzer, 1979. Potassium deficiency in the adult male chicken. Poult. Sci., 58: 652-658.

Gandra, J.R., J.E. Freitas, R.V. Barletta, M.M. Filho and L.U. Gimenes *et al*., 2011. Productive performance, nutrient digestion and metabolism of Holstein (Bos taurus) and Nellore (Bos taurus indicus) cattle and Mediterranean Buffaloes (Bubalis bubalis) fed with corn-silage based diets. Livest. Sci., 140: 283-291.

Garg, M.R. and B.N. Gupta, 1992. Effect of supplementing urea molasses mineral block lick to straw based diet on DM intake and nutrient utilization. Asian-Aust. J. Anim. Sci., 5: 39-44.

Garg, M.R., P.L. Sherasia, B.M. Bhanderi, B.T. Phondba, S.K. Shelke and H.P.S. Makkar, 2013. Effects of feeding nutritionally balanced rations on animal productivity, feed conversion efficiency, feed nitrogen use efficiency, rumen microbial protein supply, parasitic load, immunity and enteric methane emissions of milking animals under field conditions. Anim. Feed Sci. Technol., 179: 24-35.

Hosmani, S.V., U.R. Mehra and R.S. Dass, 1995. Effect of dietary urea levels on intake of Urea Molasses Mineral Block (UMMB) and utilization of nutrients in adult buffaloes. Indian J. Anim. Nutr., 12: 67-72.

Kang, R.S., A.S. Nanda and P.S. Brar, 2005. Effect of Urea Molasses Multinutrient Blocks (UMMB) supplementary feeding on therapeutic efficacy of hormonal treatment in anoestrus buffaloes. Indian J. Anim. Sci., 75: 1261-1265.

Levander, O.A., 1985. Considerations on the assessment of selenium status. Fed Proc., 44: 2579-2583.

Li, H., Q. Yang, Q. Li, G. Zhang and X. Yang *et al*., 2008. Research on formula processing technology of beef cattle complex nutrition block. Heilongjiang Anim. Husbandry Vet. Medic., 7: 56-59.

Mehra, U.R., J. Challa and U.B. Singh, 1991. Effect of supplementation of urea molasses mineral block and wheat bran in a wheat bhoosa based diet on growth performance and nutrient utilization in buffalo calves. Indian J. Dairy Sci., 44: 522-525.

Mehra, U.R., J. Challa and U.B. Singh, 1993. Nutrient utilisation and rumen fermentation pattern in buffaloes fed rations supplemented with formaldehyde treated urea molasses mineral blocks. J. Applied Anim. Res., 4: 67-72.

Mirza, I.H., J.K. Jadoon, M.A. Naqvi and A. Ali, 1988. Performance of lambs fed urea molasses block vs concentrate. Asian-Aust. J. Anim. Sci., 1: 27-31.

Molina-Alcaide, E., E.Y. Morales-Garcia, A.I. Martin-Garcia, H. Ben Salem, A. Nefzaoui and M.R. Sanz-Sampelayo, 2010. Effects of partial replacement of concentrate with feed blocks on nutrient utilization, microbial N flow and milk yield and composition in goats. J. Dairy Sci., 93: 2076-2087.

Owen, E., T. Smith and H. Makkar, 2012. Successes and failures with animal nutrition practices and technologies in developing countries: A synthesis of an FAO e-conference. Anim. Feed Sci. Technol., 174: 211-226.

Paterson, J.E. and A. MacPherson, 1990. A comparison of serum vitamin B12 and serum methylmalonic acid as diagnostic measures of cobalt status in cattle. Vet. Rec., 126: 329-332.

Rafiq, K., M. Mostofa, M.A. Awal and M.M. Hossain, 2000. Efect of medicated block licks on the performance of indigenous dairy cows of Bangladesh. Asian-Aust. J. Anim. Sci., 3: 774-780.

Rombo, L., A. Bjorkman, J. Brohult, P. Hedman, P.O. Pehrson and E. Bengtsson, 1982. Serum and erythrocyte concentrations of chloroquine in patients with acute diarrhoea. Ann. Trop. Med. Parasitol., 76: 253-256.

Romero-Huelva, M., E. Ramos-Morales and E. Molina-Alcaide, 2012. Nutrient utilization, ruminal fermentation, microbial abundances, and milk yield and composition in dairy goats fed diets including tomato and cucumber waste fruits. J. Dairy Sci., 95: 6015-6026.

Roth, H.P. and M. Kirchgessner, 1979. [*In vitro* activation of serum alkaline phosphatase in rats given various amounts of zinc]. Zentralbl Veterinarmed A, 26: 835-840 (In German).

Schiere, J.B., M.N.M. Ibrahim, V.J.H. Sewalt and G. Zemmelink, 1989. Response of growing cattle given rice straw to lickblocks containing urea and molasses. Anim. Feed Sci. Technol., 26: 179-189.

Siddons, R.S. and C.F. Mills, 1981. Glutathione peroxidase activity and erythrocyte stability in calves differing in selenium and vitamin E status. Br. J. Nutr., 46: 345-355.

Sudana, I.B. and R.A. Leng, 1986. Effect of supplementing wheat straw diet with urea or urea molasses block and/or cotton seed meal on intake and live weight changes of lambs. Anim. Feed Sci. Technol., 16: 25-35.

Tiwari, S.P., U.B. Singh and U.R. Mehra, 1990. Urea molasses mineral blocks as a feed supplement: Effect on growth and nutrient utilization in buffalo calves. Anim. Feed Sci. Technol., 29: 333-341.

Toppo, S., A.K. Verma, R.S. Dass and U.R. Mehra, 1997. Nutrient utilization and rumen fermentation pattern in crossbred cattel fed dhfferent planes of nutrition supplemented with urea molasses mineral block. Anim. Feed Sci. Technol., 64: 101-112.

Waruiru, R.M., C.O. Onyando and R.O. Machuka, 2003. Effect of feeding urea-molasses blocks with incorporated fenbendazole on grazing dairy heifers naturally infected with gastrointestinal nematodes. J. S. Afr. Vet. Assoc., 74: 49-52.

Xin, G.S., R.J. Long, X.S. Guo, J. Irvine, L.M. Ding, L.L. Ding and Z.H. Shang, 2011. Blood mineral status of grazing Tibetan sheep in the Northeast of the Qinghai-Tibetan Plateau. Livest. Sci., 136: 102-107.

Yang, W., 1996. Current status and prospect of transnasal pituitary tumor operation and cranial base surgery. Zhonghua Er Bi Yan Hou Ke Za Zhi, 31: 259-260 (In Chinese).