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Studies on the Anti-Nematodal Effects of Medicated Urea-Molasses-Mineral Blocks Against Gastrointestinal Nematodiasis in Indigenous Dairy Cows of Bangladesh

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Abstract: The objectives of this studies was to select an ideal anthelmintic which was incorporated in blocks, to know the efficacy of medicated urea molasses mineral block (MUMMB) against gastrointestinal nematode parasites in naturally infested indigenous dairy cows and its cost benefit analysis. To fulfill these objectives naturally infested 72 indigenous dairy cows with gastrointestinal nematode parasites were selected for this study. The cows were offered normal diet added with 250 gm differents block/ cow/ day. Comparative stability trials were carried out with three anthelmintic (albendazole, fenbendazole and thiophanate) on 48 dairy cows. After comparative anthelmintic efficacy trails all three anthelmintic separately mixed with molasses-mixture and kept in laboratory under normal environmental conditions up to 4 months. After 4 months comparative efficacy trails of those anthelmintic incorporated in molasses mixture were done against naturally infested gastrointestinal nematodes parasites in dairy cows. Efficacy of medicated blocks against gastrointestinal nematodiasis was evaluated by examining faecal EPG reduction throughout the licking period, which was compared with pre-treatment EPG value. In this study three types of blocks such as medicated urea-molasses-mineral block($MUMMB_a$, 0.3gm fenbendazole/kg block), medicated-urea-molasses-mineral blocks ($MUMMB_b$, 0.4gm fenbendazole/kg block) and urea-molasses blocks(UMMB) were prepared. cost benefit analysis of the medicated blocks licks was calculated based on the present cost of ratio components and milk sale value. Fenbendazole was found to be stable in blocks and was selected for the preparation of medicated blocks. Medicated blocks $MUMMB_a$ offered to lick by naturally infested dairy cows with gastrointestinal nematode parasites showed EPG reduction from 976.26±98.04 to 70.88±20.99 and when medicated blocks $MUMMB_b$, offered to lick by naturally infested dairy cows with gastrointestinal nematodes parasites, showed EPG reduction from 958.33±102.06 to zero within seven days. The same result still remained during the experiment. Whereas UMMB also reduced EPG about 13.44%. The cost benefit analysis showed that marginally there was increase in the feed cost in medicated block licks group but it was profitable under consideration to milk sale. Prolonged low level administration of fenbendazole through medicated-urea-molasses-mineral blocks were found to have therapeutic and prophylactic effect against naturally infested gastrointestinal nematode parasites of dairy cows. Use of MUMMB instead of UMMB was proved to be better for parasites of dairy cows under the village condition of Bangladesh where balanced ration for dairy cows also was a major scarcity and was found to be cost effective.

Key words: MUMMB, UMMB, G.I. nematodiasis, dairy cows

INTRODUCTION

Parasitic diseases are most common in tropical and sub-tropical countries of the world especially in Bangladesh. The geo-ecological condition (average rainfall 100 mm, relative humidity 80% and temperature 26°c) together with the water lodged and low lying areas in Bangladesh, poor husbandry methods and chronic shortages of nutrients provide suitable ecological condition for rapid multiplication and dissemination of parasites. Among the parasites internal parasites are causing serious problems of livestock in the form of production, performance and mortality. Gastrointestinal nematode parasites are causing severe anemia, weakness, loss of body weight, decreased meat and milk production, diarrhoea, hypoproteineamia and finally death (Faiz, 1972). Annual loss from parasitic diseases among ruminants in Bangladesh was estimated around $1,000 million (Tk.58,000 million), about 20% reduction in weight gain up to sexual maturity, about 15% reduction in milk production (Rahman,1998).

At present, livestock in Bangladesh mainly depends upon low quality roughage and agricultural by-products like straw, wheat bran, rice polish etc. which provide mostly carbohydrate to cattle. Fibrous residues were generally low in nitrogen content with low digestibility.

But there is hardly any source of protein for cattle available in the country to nourish and to increase animal production and performance. The farmers of Bangladesh have become disinterested to grow nutritious grains like pulse, oil cakes etc. and high yielding varieties of green fodder which provide protein to cattle. On the other hand the demand for agricultural products like rice, wheat, pulse etc. are increasing day by day with the increasing growth of population. As a result the price of feed and fodder for livestock in going beyond the reach of the farmers, resulting in protein deficiency and hence there are also minerals and vitamins deficiencies in the animal ration and are causing deteriorating condition of the health of the animal production.

For the control of gastrointestinal nematodiasis generally anthelmintic are used sporadically and indiscriminately and still in this country there is no report available for sustainable control of gastrointestinal nematode parasites as well as improvement of the nutritional status in cow for better production. There are reports that benzimidazloes are more effective in prolonged low level dietary administration than single dosing (Anderson *et al*., 1980) to the present time, control of gastrointestinal nematode parasites has either relied on frequent anthelmintic treatment or has not been undertaken due to the high cost or unavailability of anthelmintic. Where nutritional deficiencies were likely to exacerbate the detrimental effects of parasitic infestation, then use of low cost supplements such as urea-molasses block (UMB) can enhance the animals ability to utilize the available diet and assist the animals to withstand infestation. Such supplements should therefore be considered an integral part of husbandry practice, in order to reduce the debilitation effects of parasitism and minimize the requirement for anthelmintic chemotherapy. In this country UMB is used for beef fattening but still there is no approach to use medicated blocks for cattle. In this study attempt has made to prepare UMMB and a suitable modern anthelmintic was incorporated to prepare MUMMB for dairy cattle. Substitution of medicated-urea-molasses block (MUMMB) for UMB can then occur for short periods during times when parasite challenge is high or during period of low host immune competence caused by physiological stresses such as high milk production and reproduction. If this type of prophylactic measure will be taken which saves labour of drug administration, avoids spillage of drug and eliminates the risk of under dosing and pasture contamination by faecal parasitic eggs will also be reduced. The present investigation was conducted with the following objectives: to select an ideal anthelmintic which will be incorporated in blocks, to know the efficacy of MUMMB against gastrointestinal nematodes in naturally infested cattle and its cost benefit analysis.

MATERIALS AND METHODS

Selection and management of experimental animals: The research work was carried out in the surrounding villages of Bangladesh Agricultural University(BAU), viz. Chakchatrapur, Boyra, Sutiakhali and Babukhali and also the Department of Pharmacology and of Physiology, Faculty of Veterinary Science, BAU, Mymensingh. The experiment was done from July '97 to June '98 on 72 indigenous lactating cows naturally infested with gastrointestinal nematode parasites. The farmers used all the selected animals only for dairy purposes during the study period. The animals were 4-6 year old and on an average 121 to 190 kg body weight. During the entire experimental period the cows were maintained under normal village condition of Bangladesh. All the animals were kept under the same managemental conditions. Rice straw was the staple feed for the cows. Green grasses were available depending on the season. The calves were tied or tethered at the night and allowed to free access or suckling to their dam during the whole day. The cows were milked once a day and only in the morning.

Grouping of experimental animals: A total of 24 dairy cows naturally infested with gastrointestinal nematode parasites were selected form the study area for comparative stability trials of anthelmintic. Cows were divided into equally 4 groups of six in each. All the cows of group-II were treated with albendazole (Helmex^{R}, Renata Ltd., Bangladesh) @ of 7.5 mg kg^{-1} body weight at a single dose orally. Group-III were with fenbendazole (Paraclear^{R},Techno drugs Ltd., Bangladesh) @ of 7.5 mg kg^{-1} body weight orally at single dose. Group-IV were with thiophanate (Nemafax^{R}, Rhoun poulenc Agrovet, Bangladesh Ltd.) @ of 50 mg kg^{-1} body weight and group-I remained as untreated infected control. All these three anthelmintic were separately mixed with 250gm molasses mixture and remain in the laboratory at normal room temperature up to 4 months. After 4 months again 24 dairy cows naturally infested with gastrointestinal nematode parasites were selected for the further study of the efficacy of anthelmintic-molasses-mixture against gastrointestinal nematodes. All the 24 cows were divided into 4 groups containing 6 cows in each group. All the cows of group-W were treated with albendazole in molasses-mixture @ 7.5 mg kg^{-1} body weight orally at a single dose. Group-X were with fenbendazole in molasses-mixture @ of 7.5 mg kg^{-1} body weight orally at a single dose. Group- Y were with thiophanate in molasses-mixture

@ of 50 mg kg^{-1} body weight orally at a single dose and group-Z remained as infected control which was treated with molasses-mixture only @ of 250 gm/ cow orally at a single dose. Finally after the preparation of different types of block again 24 indigenous dairy cows naturally infested with gastrointestinal nematode parasites were selected for the study of the efficacy of different types of blocks against gastrointestinal nematode parasites. All the cows of group-A were treated with medicated-urea-molasses-mineral blocks ($MUMMB_a$, 0.3 g albendazole/kg block), group-B with $MUMMB_b$ (0.4 g fenbendazole/kg block), group-C with UMMB @ 250 gm/cow/day and group-D remained as infected control (no block condition).

Selection of anthelmintic: For the preparation of MUMMB, an ideal anthelmintic was selected on the basis of following criteria: (a) stability in the blocks, (b) Broad spectrum of activity, © lack of milk residues, (d) high safety index, (e) cost effectiveness and availability in the local market, (f) lack of adverse effects during pregnancy. Of all the various ideal qualities of anthelmintic only the stability in blocks were studied. For this purpose, comparative stability trials were done with the following three anthelmintic. Albendazole (Helmex^R, Renata Ltd., Bangladesh), Fenbendazole (Paraclear^R,Techno drugs Ltd., Bangladesh), Thiophanate (Nemafax^R, Rhoun poulenc Agrovet, Bangladesh Ltd.).

Preparation of Blocks: Cold method was used for the preparation of Blocks as described by Mazed (1997). The molasses was placed in a disk and then mixed with salt, urea, vitamin-mineral mixture (Calfostonic^R) and anthelmintic (Fenbendazole). After 12 h later wheat bran lime powder were added in above molasses-mixture and mixed vigorously by an electrical concrete mixture machine to give a thick paste with sticky consistency. The mixture was then transferred to a disk from mixture machine. After then the mixture was transferred to a dice of ball press then compressed with weight of suitable size to make it more compact. Blocks were removed from the dice and were placed on the floor for about 13 hours for more compactness. After solidification of the blocks they were cut at the rate of 250 gm block size for distribution. For the present study the composition of MUMMB and UMMB are given in Table 1.

The size and weight of each block was 21 x 16 x 7 cm and 1.50 kg, respectively. $MUMMB_a$ was allowed to lick by the experimental dairy cows of group-A once a day at the dose rate of 250 g/cow during morning after milking. $MUMMB_b$ for the animals of group-B and UMMB for group-C. Blocks were placed in a wooden box for proper licking. The daily intake of fenbendazole of each cow of group-A was 75 mg to achieve the dose rate of 0.4 mg kg^{-1} body weight and daily intake of fenbendazole of each cow of group-B was 100 mg to achieve the dose rate of 0.6 mg kg^{-1} body weight. All cows of both controlled and treated groups had free access to normal feed and clean drinking water.

Table 1: Composition of blocks

	Amount (%)		
Ingredients	$MUMMB_a$	$MUMMB_b$	UMMB
Molasses	48	48	48
Urea	7	7	7
Wheat bran	29	29	29
Lime (CaO)	6	6	6
Salt	5	5	5
Vitamins and mineral mixture (Calfostonic^R)	5	5	5
Fenbendazole	0.3g kg^{-1}	o.4g kg^{-1}	-

Collection and examination of samples: Faecal samples were collected directly from the rectum of each experimental cows. Samples were collected in the morning for the evaluation of pre and post-treatment egg load. Firstly the samples were examined for qualitative purpose by direct smear method and if the samples were positive then quantitative determination of helminths egg was made by McMaster method as described by Rahman *et al.* (1996).

The efficacy of $MUMM_b$ against gastrointestinal nematodiasis in dairy cows was based on the faecal egg count reduction test (FECRT). The faecal samples were collected and examined before and during block licking at 7th, 15th, 30th, 45th, 60th, 75th, 90th day and EPG of faeces of each cow was recorded.

Cost benefit analysis: Cost benefit analysis was calculated based on the basis of present cost of block used per day and return on milk sale per day. The cost of 250gm UMMB and 250gm MUMMB were 2.40 Taka and 3.50 Taka, respectively. The cost of four months interval routine deworming was 80.00 Taka (o.66 Taka daily). The rate of per kg milk was 15.00 Taka only.

Statistical analysis: Statistical analysis of the experimental data was carried out according to the method described by Steel and Torrie(1980) to analysis of variance in Completely Randomized Design(CRD). The results were assayed by the Least Significant Difference Test "MSTAT" computer programme.

RESULTS

Comparative stability trail and selection of anthelmintic: The cows of group-II which were naturally infested with gastrointestinal nematode parasites treated with

Table 2 : Efficacy of anthelmintic against gastrointestinal nematodiasis in dairy cows on the basis FECRT

Group No. of cow	Drugs with dose	Pre-treatment EPG (Mean±SD) '0' day	Post-treatment EPG (Mean±SD) 7th day	14th day	21st day	28th day	% of EPG reduction on 28th day
I (n=6)	Control(untreated infected)	916.66±121.10	1008.33±135.70	1033.33±103.27	1108.33±80.10	1191.66*±58.45	-30.00
II (n=6)	Albendazole (Helmex^{R}) 7.5 mg kg^{-1} bwt.	941.66±153.02	91.66±37.63	108.33±49.15	108.33±37.63	125.00**±41.83	86.72
III (n=6)	Fenbendazole (Paraclear^{R}) 7.5 mg kg^{-1} bwt.	908.33±124.16	108.33±58.45	91.66±49.15	100.00±31.62	83.33**±40.82	90.82
IV (n=6)	Thiophanate (Nemafax^{R}) 50 mg kg^{-1} bwt.	933.33±112.54	158.33±58.45	116.66±60.55	141.66±58.45	150.00**±54.77	83.92

*P<0.05; **P<0.01 when pre-treatment value is compared with post-treatment 28th day value

Table 3: Efficacy of anthelmintic molasses-mixture against gastrointestinal nematodiasis in cows after 4 months

Group No. of cow	Drugs molasses mixture with dose	Pre-treatment EPG (Mean±SD) '0' day	Post-treatment EPG (Mean±SD) 7th day	14th day	21st day	28th day	% of EPG reduction on 28th day
Z (n=6)	Control (only molasses mixture) 250 gm/ cow	933±186	891±153	1000±134	1008±111	1150*±100	-23.21
W (n=6)	Albendazole mixture (Helmex^{R}) 7.5 mg kg^{-1} bwt.	1075±129	241±73	158±80	158±58	250**±31	76.74
X (n=6)	Fenbendazole mixture (Paraclear^{R}) 7.5 mg kg^{-1} bwt.	1000±167	100±63	91±37	108±37	108**±37	89.16
Y (n=6)	Thiophanate mixture (Nemafax^{R}) 50 mg kg^{-1} bwt.	1016±154	383±100	358±114	358±130	375**±97	63.11

*P<0.05; **P<0.01 when pre-treatment value is compared with post-treatment 28th day value

Table 4: Efficacy of MUMMB against gastrointestinal nematodiasis in naturally infested indigenous dairy cows

Group No. of cows	Type of block licks	EPG before block licks (Mean±SD) '0' day	EPG during block licks (Mean±SD) 7th day	15th day	30th day	45th day	60th day	75th day	90th day	% of EPG reduction on 90th day
D (n=6)	No block (Control)	941±97	983±143	1025±68	1041±106	1125±121	1175±133	1233±140	1283±93	-36.28*
A (n=6)	MUMMB$_a$	976±98	200±59	150±44	100±46	80±48	71±31	70±36	70±20	92.73**
B (n=6)	MUMMB$_b$	958±102	0	0	0	0	0	0	0	100**
C (n=6)	UMMB	991±124	958±115	925±103	941±124	958±159	941±131	916±140	858±102	13.44^{NS}

^{NS} Non significant; *P< 0.05; **P<0.01 within the column and within the row when pre-treatment value is compared with post-treatment 90th day value

albendazole @ 7.5 mg kg^{-1} body weight orally at a single dose, showed 86.72% EPG reduction on 28th day of post-treatment i.e. efficacy of albendazole was 86.72%. The cows of group-III were treated with fenbendazole @ 7.5 mg kg^{-1} body weight, showed 90.82% EPG reduction on 28th day of post treatment i.e. efficacy of fenbendazole was 90.82%. The cows of group-IV were treated with thiophanate @ 50 mg kg^{-1} body weight orally at a single dose, showed 83.92% EPG reduction on 28th day of post treatment i.e. efficacy of thiophanate was 83.92%. Where as cows of group-I (infected untreated control group), showed increased EPG from 916.66±121.10 to 1191.66±58.45 i.e on 28th day of post-treatment increased EPG was 30.00%. This result is shown in Table 2. For the stability trials all these three anthelmintic were mixed separately with molasses mixture and kept in laboratory up to 4 months. After 4 months albendazle in molasses mixture, showed 76.74% EPG reduction of nematode parasite infested dairy cows. Fenbendazole in molasses mixture showed 89.16% EPG reduction and thiophanate in molasses mixture also showed 63.11% EPG reduction. In molasses mixture fenbendazole showed highest percentage of nematode eggs reduction i.e. fenbendazole was highly stable in molasses mixture. This result is shown in Table 3. On the basis of highest stability in molasses mixture and some basic criteria which were described in methodology section, fenbendazole was selected for the preparation of medicated blocks (MUMMB).

Efficacy of MUMMB against gastrointestinal nematodiasis in naturally infested indigenous dairy cows: *Haemonchus, Trichostrongylus, Strongylus, Mecistocirus, Oesophagastomum spp* of gastrointestinal nematodes were found during faecal examination by direct smear method. Naturally infested dairy cows with gastrointestinal nematode parasites of group-A offered to licks MUMMB$_a$ @ 250gm/day for each cow, showed EPG reduction from 976.26±98.04 to 70.88±20.99 with in 90 days of experimental trials and the EPG reduction percentage was 92.73%. Group-B offered to lick MUMMB$_b$ @ 250 gm/day for each cow, showed EPG reduction from 958.33±102.06 to zero within 7 days i.e. the efficacy was 100%. The same result were found during the whole experimental period of medicated block licks. Urea-molasses-mineral block(UMMB) also reduced EPG from 991.66±124.16 to 858.33±102.06 and the eggs reduction percentage was 13.44%. Where as the cows of control group (No block), showed increased EPG from 941.66±97.03 to 1283.33±93.04 and the increased percentage was 36.28%. This result is shown in Table 4.

Table 5: Cost benefit analysis

Parameter	R_1	R_2	R_3
Cost of UMMB licks	-	2.40	-
Cost of routine deworming	-	0.66	-
Cost of MUMMB licks	-	-	3.50
Total cost of feed (Taka)	-	3.06	3.50
Return on milk sale (Taka)	20.50	27.30	35.80
Profit (Taka/day)	-	6.80*	15.30*

Group-R_1 remained as control (NO block), R_2 UMMB licks with routin deworming and R_3 MUMMB licks Exchange rate one US $ = 58.00 Taka
* P<o.o1

Cost benefit analysis: The daily total cost for UMMB licks with routine deworming in group-R_2 was 3.06 Taka/cow, for MUMMB licks in group-R_3 was 3.50 Taka/cow. Where as return on milk sale from control group-R_1 was 22.50 Taka/cow, from group-R_2 was 27.30 Taka/cow and from group-R_3 was 35.80 Taka/cow. The cost benefit analysis are presented in Table 5.

DISCUSSION

In this study on the basis of faecal EPG reduction albendazole, fenbendazole and thiophanate showed 86.72, 90.82 and 83.82% efficacy against gastrointestinal nematodiasis in naturally infested dairy cows and this is agreement with the earlier reports (Ratnaparki *et al*., 1992; Bauer *et al*., 1997; Karim *et al*., 1998; Pandit, 1981) Within molasses mixture albendazole, fenbendazole and thiophanate were separately kept in the laboratory up to 4 months for comparative stability test. After 4 months within molasses mixture albendazole, fenbendazole and thiophanate showed 76.74, 89.16 and 63.11% EPG reduction, respectively. Due to lack of earlier report the efficacy of anthelmintic incorporated in molasses mixture were not compared, but Sanyal and Singh reported that fenbendazole showed highest efficacy in MUMMB which was closely related to this present work (Sanyal, 1995; Sanyal and Singh, 1993a,b). In this study within molasses mixture fenbendazole showed the highest EPG reduction (89.10); followed by albendazole (76.74) and the lowest was with thiophanate(63.11). Most probably the differences in effectiveness were due to spectrum of activity and biodegradation of anthelmintic in the environment. Fenbendazole fulfilled all the criteria as described by Sanyal (1995) which were shown in methodology section. There are also some reports that multiple doses of fenbendazole is more effective than single recommended dose (Anderson *et al*., 1980 and Prichard *et al*., 1978) repeated multiple therapeutic doses of fenbendazole in pregnant ewes, cows have not shown ill effects (Charles *et al*., 1995). Based on the comparative stability trials in molasses mixture and also the basic criteria, fenbendazole was selected for the preparation of medicated blocks (MUMMB), i.e. fenbendazole was selected as a suitable ideal anthelmintic for incorporation in urea-molasses-mineral block (UMMB) to make medicated block(UMMB).

In medicated block licks group-A showed 92.73% EPG reduction during block licking period. The results of medicated block licks group-B indicate that the output of eggs in the faeces become zero within seven days and the same result was still remained through out the experimental period. Faecal egg counts during the experiment were highest in the control group (No block), while the UMMB group was intermediate which coincides with the earlier reports (Sanyal, 1995; Knox, 1996; Sanyal and Singh, 1993a, b). From this efficacy trial, it is suggested that the medicated blocks containing 0.4 gm fenbendazole per kg block are highly effective for the treatment as well as prevention of parasitic re-infestation in dairy cows.

Total cost of MUMMB licks group-R_3 was higher (3.50 Taka) than UMMB licks with routine deworming group-R_2 (3.06 Taka). Simultaneously net return on milk sale was also higher (35.80 Taka) in group R3 than group-R_2 (27.30 Taka).

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