

Effect of neem leaves extract and ivermectin against tick infestation in calves

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Abstract

Context: Tick infestation is a serious challenge to farmers in both developed and developing countries.

Objective: The present study was designed to compare the therapeutic value of neem leaves extract and ivermectin against tick infestation in calves.

Materials and Methods: A total of 15 calves infested with ticks were selected and divided into three groups, Group A (n=5) kept as control group, Group B (n=5) treated with neem extract and Group C (n=5) treated with ivermectin. After spray of neem leaves extract and injection of ivermectin the treated and control groups were kept for 28 days and clinical and hematological parameters were investigated at 7 days intervals. On the basis of tick count, the efficacy of ivermectin was found 100% on day7, 14, 21 and 28 after the treatment whereas neem leaves extract (spray) was 68.8% effective at day 28 against tick infestation in calves. The results showed that the body weight of calves increased after treatment in groups B and C respectively, comparative to control group. The hemoglobin concentration (Hb), packed cell volume (PCV %), and total erythrocyte count (TEC) was increase significantly ($P < 0.05$) whereas the erythrocyte sedimentation rate (ESR) in the neem and ivermectin treated group was decreased. All the calves after neem spray and ivermectin injection remained healthy and no adverse effect were observed. The change of growth rate and coat color brightness was mentionable.

Conclusion: It is concluded that neem leaves extract may be used as an alternative approach against tick infestation in calf.

Keywords: Ivermectin, Neem leaves, Tick infestation and Calves.

Introduction

Cattle among other livestock species available are the most versatile component in relation to existing integrated agricultural farming system in Bangladesh. Cattle rearing in Bangladesh is hindered by various problem among them malnutrition and parasitic infestation are the major limiting factors (Jabbar and Green, 1983). Bangladesh is a moderately hot and humid country with short winter and prolonged rainy season and the geo-climatic condition of Bangladesh is suitable for the development and survival of various parasites as well as ticks (Islam *et al.* 2006). Tick infestation is a serious challenge to farmers in both developed and developing countries (Jongejan, 1999).

Commonly available insecticides are effective against ticks, these are expensive and fears of contamination of the environment and potential toxic effects on humans and other non-target organisms. Therefore, it essential to explore the alternative tick control measures that are effective, safe and economic with environmental safety. Natural plant products would be suitable candidates. *Azadirachta indica* has proven to be effective against many insect pests and disease vectors of agricultural products (Schmutterer, 1990) and is widely distributed in many parts of Bangladesh, especially in the dry areas where livestock farming is common. A number of compounds have been isolated from various parts of the tree, viz. meliantriol, salannin, azadirachtin and the triterpenoids, nimocinolide and isonimocinolide (Sharma *et al.* 2011). Neem extract seems to disrupt the mating and oviposition of insects and inhibits the hatchability of their eggs and moulting of their nymphs (Sazena, 1993). Additionally, in Bangladesh many drugs are being used for a long time to combat tick infestation in livestock. Due to indiscriminate use, ticks became resistant against the drugs.

Ivermectin is a member of the macrocyclic lactone class of endectocides, commonly referred to as avermectins. It is used for the treatment of internal and external parasites in dogs,

cats, horses, pigs, sheep and cattle. It is effective against number of parasites such as nematodes, acarins and insects, and it also improves the skin coat of animal (Negrea 1997). Subcutaneous (SC) and topical (TOP) formulations are available for use in cattle, at a dose of 0.2 and 0.5 mg/kg bodyweight (BW), respectively. Ivermectin is safe and effective against both ecto and endo parasite of animals but it is expensive. In contrast, the alternative cheapest and available source of drug is herbal therapy. Experimental investigations, therefore, is imperative to assess the therapeutic value of indigenous herbal plants and leaves. In vivo research work in this field is yet very limited in our country. Therefore, the present research work was undertaken.

Materials and Methods

Selection of animals

Fifteen calves of both sexes aged between 5 to 6 months were primarily selected from the HSTU dairy farm, Dinajpur. All the calves were examined for the presence of ticks by parting of hair.

Collection of neem leaves and drug

Neem leaves were selected for its effectiveness against tick infestation in calves. Mature and disease free neem leaves were collected from HSTU campus and Injectable ivermectin from local market.

Neem leaves extract preparation

The leaves were dried and grind. For the preparation of 15% neem leaves extract, 15 g of leaf powder was mixed with 100 ml distilled water and stirred for 30 minutes at 6000 rpm. It was kept overnight at 4°C and the supernatant was collected. This was used as the crude leaf extract to study.

Experimental design

Calves, naturally infested with ticks, were randomly divided into 3 equal groups namely A, B and C for assessing the efficacy of neem leaves extract and ivermectin against tick infestation.

Group A: was kept as infected control without any treatment.

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Group B: was treated with 15% neem leaves extract (spray) (the dose should be mentioned. What as the spray volume / spray time / actual amount of extract drops / surface area of the animal?

Group C: was treated with ivermectin @ 200 µg/kg body weight S/C.

All the calves of treated and control groups were closely observed for 28 days after treatment and following parameters were studied

a) Clinical parameter (severity of infestation, body weight, condition of hair coat and feeding efficiency)

b) Hematological parameters (Hb, PCV, ESR and TEC)

During experimental period, both control and treated calves were kept in animal shade. Wheat bran, rice polish, maize and salt are mixed together and supplied to the calves up to 1-2 kg approximately daily. All the calves were allowed for free pasture grazing for 2-3 hours daily. Adequate amount of water was also supplied.

Clinical parameters

Severity of infestation

The severity of infestation of ticks was observed by counting the number of ticks in a selected area of the individual calves. The ticks were detected by visual examination in calves and the number of ticks was recorded. The procedure of examination was to count the ticks of dewlap region within an area of 7 cm × 6 cm (42 square cm). The selected 42 square cm were marked with a permanent color and the ticks within this area were counted at pre and post-treatment period.

Body weight

To observe the effects of neem leaves extract and ivermectin on the body weight of each calves of treated and control group was taken before treatment and post-treatment.

Hair coat

Hair coat of the treated calves as well as the control group was physically examined by visual examination before and after treatment as per above mentioned schedule of treatment period.

Feeding efficiency

Feeding efficiency of treated and control groups were compared at pre and post-treatment period. Feeding efficiency of the calves was determined by following formula:

$$\text{Feed efficiency} = \frac{\text{Unit of live weight gain}}{\text{Unit of dry matter intake}}$$

Hematological parameters

Blood samples were collected from Jugular vein of calves of both control and treated groups in vials containing anticoagulant (Sodium Citrate 3.8%) at day₀, day₇, day₁₄, day₂₁ and day₂₈ of treatment to determine the effect of neem leaves extract and ivermectin on the hematological parameters such as TEC, Hb, PCV and ESR. These hematological parameters were determined following the procedures as described previously (Coffin, 1955).

Statistical analysis

Data obtained from the experiment on body weight, hematological parameters such as (Hb, PCV, TEC, ESR) were

analyzed statistically by using SPSS, version 11.5. Students't test were performed to compare the data among various groups.

Results and Discussion

Effect on tick

In the group B, neem leaves extract at 15% spray was found to be 68.8% effective against tick infestation. On the day₀, the number of mean value of ticks was 12.20±0.60 in the selected area but on the day₂₈, the number of mean value of ticks was 3.80±0.46. However, ticks gradually decreased within the selected area on day₇, day₁₄, day₂₁ and day₂₈ after the treatment (Table 1).

In group A, the number of ticks increased gradually on day₇, day₁₄, day₂₁ and day₂₈ of treatment. On the day₀ the number of mean value of ticks was 12.80±0.77 in the selected area but on the day₂₈ the number of mean value of ticks was 15.60±0.37 (Table 1). The present findings supports the earlier observation of Titcherer *et al.* (1994) and Sangwan *et al.* (1995) who reported 90% to 100% efficacy of ivermectin against tick infestation in calves. It was seen that no tick was present on the body of animal after day₇ to the end of the experiment.

In group C, calves treated with ivermectin showed 100% efficacy i.e. no ticks were found by physical examination on the day₇, day₁₄, day₂₁ and day₂₈ of post treatment (Table 1).

Effect on hair coat

On Day₀ (pre-treatment) the hair coat of all infected calves was rough with discolored hair. In group B and C, after treatment with neem leaves extract and ivermectin, the hair coat started to become smooth and shiny gradually and on day₂₈ of treatment the hair coat of the treated calves was almost bright. The hair coats of all calves treated with indigenous medicinal plant (neem spray) and ivermectin were found smooth and shiny at the end of treatment.

Table 1. Effect of neem leaves extract and ivermectin against tick infestation

Treatment group	Pre (Mean±SE) Day ₀	Treatment Status (Number of Tick)			
		Day ₇	Day ₁₄	Day ₂₁	Day ₂₈
Group A (Control)	12.8±0.77	13.6±0.32	14.0±0.25	14.4±0.24	15.6±0.37
Group B	12.2±0.60	9.4±0.53*	6.6±0.45**	4.4±0.42**	3.8±0.46**
Group C	13.6±0.51	0	0	0	0

* =Significant at (P<0.05), **= Significant at (P<0.01)

Table 2. Effects of neem leaves extract and ivermectin on body weight

Treatment group	Pre Day ₀	Body weight (kg) (Mean±SE)			
		Day ₇	Day ₁₄	Day ₂₁	Day ₂₈
Group A (Control)	22.4±0.17	22.2±0.12 (0.80)	21.2 ±0.13 (4.12)	21.4± 0.1 (1.61)	20.17±0.17 (6.63)b
Group B	22.5±0.08	23.4±0.14 (4.77)	23.6±0.11** (1.11)	23.7±0.20** (0.55)	25.8±0.80** (4.26)a
Group C	20.0±0.28	22.5±0.11 (0.54)	23.2±0.11** (3.46)	23.6 ±0.16* (2.07)	24.2±0.08 (3.11)a

* =Significant at (P<0.05), **= Significant at (P<0.01), %a = Percent of increased, %b = Percent of decreased b.

Hematological parameters

Hb content

In control group (A), Hb content decreased upto 4.52% after 28 days. On the other hand, the Hb contents increased in treated groups (B and C) to the extent of 1.10%-3.02%, respectively (Table 3).

Table 3. Effects on Hemoglobin content (gm%) in calves

Treatment group	Hemoglobin content (gm%)				
	Pre		Post		
	Day ₀	Day ₇	Day ₁₄	Day ₂₁	Day ₂₈
Group A (Control)	6.6±0.42	7.08 ±0.19 (6.98)	6.6±0.18 (6.88)	6.9± 0.19 (3.80)	6.6±0.16 (4.52)b
Group B	7.1±0.11	7.4±0.11** (3.25)	7.7±0.10** (3.66)	8.6± 0.14** (10.97)	8.7±0.11** (1.10)a
Group C	6.5±0.14	7.3±0.09** (11.75)	7.6±0.15** (3.17)	8.3± 0.12* (9.35)	8.6 ± 0.19* (3.02)a

* =Significant at (P<0.05), **= Significant at (P<0.01), %a = Percent of increased, %b = Percent of decreased b.

Effect on body weight

On the Day₀, the mean initial body weight of group B and C were 22.488 kg and 20.01 kg, respectively. On the day₂₈ of post treatment the mean values of body weight were 24.80kg and 24.22 kg, respectively. The average body weight of calves increased significantly (P<0.01) in treated groups but the body weight in control group (A) were decreased upto 6.63% on day₂₈ of treatment.

Packed Cell Volume (PCV %))

The PCV (%) values in control group were decreased upto 14.07% on 28th day of treatment and increased in all treated groups (B and C) to the extent of 1.11%-1.45% (Table 4).

Total Erythrocyte Count (TEC) (million/cu.mm of blood)

In group A, TEC values decreased upto 2.45% on 28th day of treatment, whereas the values increased in treated groups B and C to the extent of 5.20%-9.25% indicating treatment significantly(P<0.05) increased TEC count in calves (Table 5).

Erythrocyte sedimentation rate (ESR mm/1sthr)

In control group (A), ESR (mm/1st hr) values increased upto 5.19% on 28th day of treatment. On the other hand, the ESR (mm/1st hr) values decreased in all treated groups (B and C) to the extent of 38.89% -176.67% (Fig.1).

The hematological changes in calves affected with ticks were determined at pre and post treatment period dosed with neem and ivermectin. The mean value of Hb decreased in non-treated calves (control group). The results are in agreement with the reports of Nettelton and Beekett (1976) and Anosa (1977).In the present study, significant changes in Hb and PCV% were observed in the treated group of calves and this might be due to expulsion of blood sucking parasites from the body. The significant reduction in the sedimentation rate of erythrocytes in successfully treated group was observed and this may be due to recovery from inflammation induced by ectoparasites. There are very limited literatures showing the effects of neem and ivermectin on hematological parameters. However, Anil-Kumar and Joshi (1992), found increase of Hb level in ivermectin treated calves.

Table 4. Effects on Packed cell volume (PCV) (%) in calves

Treatment group	Packed cell volume (PCV) (%)				
	Pre	Post			
	Day ₀	Day ₇	Day ₁₄	Day ₂₁	Day ₂₈
Group A (Control)	28.1±0.90	29.6±0.25 (2.17)	29.2±0.25 (1.49)	26.4±0.26 (10.44)	23.9±0.29 (14.07) b
Group B	28.4±0.34	28.5±0.38 (0.34)	28.9±0.17** (1.33)	29.8±0.88 (3.11)a	29.4±0.38 (1.45)
Group C	29.7±0.30	29.6±0.22 (0.57)	29.5±0.15** (0.31)	30.7±0.43** (3.93)a	30.4±0.46** (1.11)

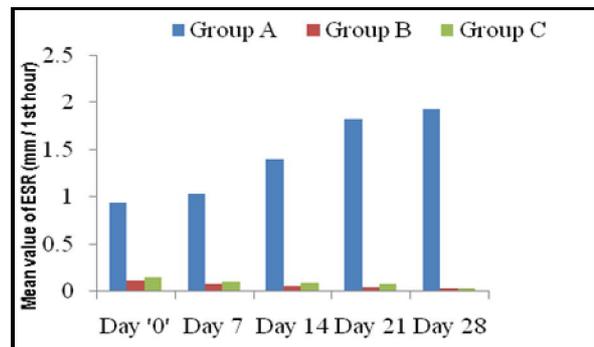
**= Significant at (P<0.01), %a = Percent of increased, %b = Percent of decreased b.

Table 5. Effects on Total Erythrocyte Count (million / cu. mm) in calves

Treatment group	Total Erythrocyte Count (million / cu. mm)				
	Pre	Post			
	Day ₀	Day ₇	Day ₁₄	Day ₂₁	Day ₂₈
Group A (Control)	7.2±0.10	6.7±0.11 (6.55)	6.5±0.15 (4.02)	6.4±0.13 (1.25)	6.5±0.15 (2.45)b
Group B	6.5±0.15	7.5±0.07 (13.46)	8.9±0.21** (16.09)	10.0±0.07 (11.50)	10.6±0.18** (5.20)a
Group C	6.8±0.08	8.3±0.12** (18.27)	9.0±0.07** (8.03)	10.3±0.16* (12.72)	11.4±0.16* (9.25)a

* =Significant at (P<0.05), **= Significant at (P<0.01), %a = Percent of increased, %b = Percent of decreased b.

Fig. 1. Effects of neem leaves extract and ivermectin on ESR (mm / 1st hour) in calves



Conclusions

The efficacy of ivermectin was found 100% whereas neem leaves extract was 68.8% effective against natural tick infestation in calves. Hemoglobin and PCV level increased significantly (P<0.05), whereas the ESR values significantly (P<0.05) decreased. The calves after neem spray and ivermectin injection remained healthy, growth rate and coat color was improved. It suggested that neem leaves extracts may be used as an alternative approach to treat tick infestation where conventional producers are not available.

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