ORIGINAL ARTICLE

Effects of garlic supplementation on parasitic infestation, live weight, and hematological parameters in Black Bengal goat

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ABSTRACT

This study was conducted to determine the effects of garlic on egg per gram (EPG) count of feces for gastrointestinal parasites, live weight, and hematological parameters in Black Bengal goat. A total of 18 dry does of 18-22 months of age were divided into 3 groups as T_0, T_1 and T_2; where, each group comprised of 6 goats. The goats of T_0 were feed with normal feeds, whereas the goats of T_1 and T_2 were fed with normal feeds plus 25 mL and 50 mL of 10% water solution of garlic twice per day, respectively for 60 days. The EPG count was performed by McMaster counting chamber, and live weight was measured by digital electric balance. EPG count for gastrointestinal parasites was found significantly lower in the treatment groups as compared to T_0. Weight gain was recorded significantly higher in the treatment groups. The hematological parameters like total leucocyte count (TLC), erythrocyte sedimentation rate (ESR), packed cell volume (PCV), hemoglobin (Hb) and total erythrocyte count (TEC) showed significant changes in the treatment groups. The study suggests that 10% water solution of garlic is a useful supplementation to decrease EPG count, body weight gain; thus, the 10% aqueous garlic solution can improve the general health condition of goat.

INTRODUCTION

Bangladesh is an agriculture-based country. In Bangladesh, the term "Agriculture" is considered as the integration of crop, livestock, fisheries and forestry. Among livestock, goat population in Asia constitutes nearly 63.6% of the total Asiatic population (FAO, 2003). Goats are very important and promising animal in the developing countries especially in Asia, and ranks second in terms of milk, meat and skin production, representing about 28.0, 23.0 and 28.0% respectively among the total contribution of livestock in Bangladesh (FAO, 2002). The Government of Bangladesh has started a national program in 2002 (Islam and Huque, 2002) on poverty alleviation, self-employment, food supply and increase of skin export through goat rearing. The total number of goats in Bangladesh is 34.4 million; among them about 90% are Black Bengal goats (*Capra hircus*) with a few crossbreds along with some other types of goats (Husain et al., 1998). The poor production of milk and meat from goats is due to their poor genetic makeup and improper nutritional status (Husain, 1999).

Garlic (*Allium sativum*) is a member of the family Liliaceace. The extracts of garlic have been used in the treatment of several disorders (Alan et al., 1995). Garlic oil is found to be active against fat infiltration of liver (Sang et al., 1995). In China, garlic is used for the

prevention of influenza, toxicities, and kills parasites such as tapeworm and roundworm (Bensky and Gamble, 1993).

Garlic is used as a home remedy for diverse health problems such as head cold, toothache, earache, nausea, high blood pressure and for the treatment of cancer and other chronic diseases (Brown and Marcy, 1991). Garlic has an active ingredient, allicin diallyl disulfide-oxide, which is a systemic vasodilator (Sang et al., 1995), and this plant containing preparation showed decrease in diastolic blood pressure (McMahon and Vargas, 1993). Under investigation, garlic has specific roles such as antibacterial activity (Dausch and Nixon, 1990), lipid-lowering effects (Silagy and Neil, 1994), anti-platelet activity (Petry, 1996), anti-carcinogenic effects (Singh et al., 1996), and antiparasitic activity (Singh et al., 2000; Allug and Kaptan, 2002). Treatment with garlic extracts was found to improve the activation of function of T-lymphocytes, natural killer cells, and interleukin-2 (Tang et al., 1997). Also, *in vitro* and *in vivo* studies showed that aged garlic extracts can stimulate immune response (Sumiyoshi, 1997).

Due to lack of information about the effects of garlic on egg per gram (EPG) count in feces for gastrointestinal parasites, live weight and hematological parameters in goats, the present study was undertaken to determine the effects of garlic on body weight and hematological parameters (TEC, Hb, PCV, ESR, and TLC) in Black Bengal goat.

MATERIALS AND METHODS

Experimental site: The study was conducted at Sylhet Government Goat Development Farm, Sylhet, Bangladesh for a period of 60 days from November 2014 to January 2015. EPG count for gastrointestinal parasites and hematological study were conducted at the Department of Physiology, Sylhet Agricultural University, Faculty of Veterinary and Animal Science, Sylhet-3100, Bangladesh.

Experimental animals and feeding management: With prior permission from the appropriate authority, a total of 18 female Black Bangle goats (*Capra hircus*) were randomly selected from a dry flock at the Sylhet Government Goat Development Farm. Live weights varied from 15 to 17-Kg, and their age ranged from 18 to 22 months. Goats were kept according to intensive system with traditional tethered grazing system, and fresh water was supplied *ad libitum* throughout the

experimental period. Napier grass (*Pennisetum purpureum*) and para grass (*Bracharia mutica*) have been cultivated and fed to fulfill the dry matter requirement for the animals. Green grass was provided to all animals following the instructions given by Banerjee (1998). A concentrate mixture was given daily to all animals following the thumb rule methods of Banerjee (1998), as mentioned in **Table 1**.

Table 1: Standard concentrate feed used in the experiment.

Feed ingredients	Quantity (gm)	Composition (%)
Corn	750	25
Wheat bran	600	20
Rice polish	450	15
Khesari dal (*Lathyrus sativus*)	600	20
Soya bean meal	510	17
Dicalcium phosphate (DCP)	60	2
Salt	30	1
Total	3000g	100

Experimental design: A total of 18 goats (dry doe) were randomly assigned into 3 equal groups (n=6 goats for each); these were control group (T_0), and treatment groups (T_1 and T_2). The goats of group T_0 were reared on normal diet, and the goats of group T_1 and T_2 were reared on normal feeds supplemented with 50 mL and 100 mL of 10% water solution of garlic per day respectively for 60 days.

Preparation of 10% water solution of garlic: The garlic, used in this research was procured from the local market of Sylhet, Bangladesh and was brought to the Laboratory at the Department of Physiology, Faculty of Veterinary and Animal Science, Sylhet Agricultural University, Sylhet-3100, Bangladesh. After collection, all fresh garlics were washed in running tap water, and were cut into small pieces, which were then ground by pestle and mortar. After proper grinding, little amount of distilled water was added to make paste of garlic. From this paste, 10 gm was added to fresh drinking water in a clean beaker and then made up to 100 mL by adding fresh drinking water to make a final 10% water solution (w/v) of garlic.

Administration of garlic solution: An amount of 25 mL and 50 mL of 10% water solution of garlic were orally administered twice per day to the goats of group T_1 and T_2, respectively for 60 days. The total solution for treatment groups (T_1 and T_2) was divided into two equal halves, and offered twice during morning and evening.

Egg per gram (EPG) count of feces for gastrointestinal parasites: EPG of feces from the naturally infected

goats were measured on day 0, 15, 30, 45 and 60 of experimental period using McMaster counting chamber.

Measuring the live weight: The live weight of each doe was measured with the help of digital electric balance on day 0 and every 15 days interval during the experimental period. The live weight of the animal was taken before feeding in the morning and expressed in kilogram (Kg).

Collection of blood sample and determination of hematological parameters: To evaluate the hematological parameters, blood samples were collected aseptically with sterile syringe and needle from the jugular vein of all goats at day 0 and every 15 days interval during the experimental period (60 days). About 5 mL of blood was collected from each goat and was transferred immediately to a clean, dried test tube containing anticoagulant (Na-EDTA) at a ratio of 1:10 for the hematological studies and were performed within 5 h after collection of blood. Determination of Total Erythrocyte Count (TEC; million/mm^3 of blood), Hemoglobin concentration (Hb; gm%), Packed Cell Volume (PCV%), Erythrocyte Sedimentation Rate (ESR mm in first hour) and Total Leukocyte Count (TLC; thousand/mm^3 of blood) were performed following International Council for Standardization in Hematology (1993).

Statistical analysis: Experimental data were calculated and expressed as Mean±SE. EPG count, live weight and hematological parameters (TEC, Hb concentration, PCV, ESR, and TLC) were analyzed statistically using MS-STAT statistical software developed by Anon (1996) with the help of a one way ANOVA method by F variance test.

RESULTS AND DISCUSSION

Effect of 10% water solution of garlic on live weight of goat

The changes in live weight of goats after 10% water solution of garlic supplementation are presented in **Figure 1**. The goats treated with garlic showed increased live weight than the control group (T_0). Significantly ($P<0.05$) higher weight gain was recorded in the animals of T_1, and significantly ($P<0.01$) higher weight gain was also recorded in the animals of T_2 on day 15 and onward up to day 60. The highest live weight (18.140±l0.02 Kg) in goats of T_2 on day 60, and the lowest live weight (16.440±l0.06 Kg) in goats of T_0 on day 60 were recorded. In the case of human, the use

of garlic was found to be associated with decrease in body weight (Kim et al., 2007). In goats, the effects might be species-specific; however, it needs further study (Worku et al., 2009). Internal parasitism is one of the biggest problems in the small ruminant industry. In fact, most of the economic losses caused by internal parasites are actually not due to mortality but production loss (Waller, 2004). Hampering of the growth of small ruminants (goats and sheep) throughout the world was due to the associated morbidity, mortality, cost of treatment, and control measures (Silvestre et al., 2000). Decrease parasitic load increases the productivity and body weight in treated calves than experimental control group (Blackburn et al., 1991).

Garlic is most commonly used as an anthelmintic (Guarrera, 1999) and has been reported to be a parasiticide (Duke, 2002). From the present study, it was observed that the live weight of goats was increased significantly in the garlic (anthelmintic) treatment groups (T_1 and T_2); this might be due to the removal of gastrointestinal parasites, which is more or less similar with the report of Islam (2003). Islam (2003) reported significantly ($P<0.05$) increased live weight of goats treated with anthelmintic than the control group.
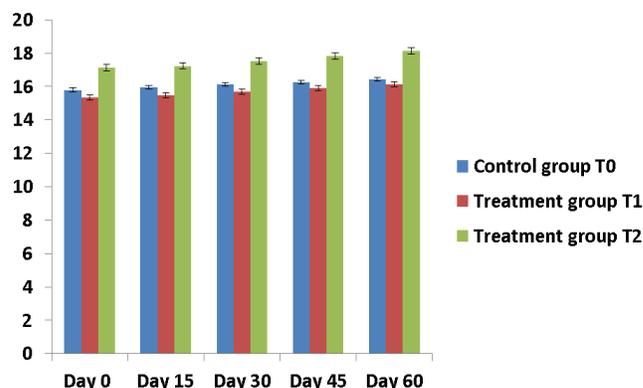

Figure 1. Effect of 10% water solution of garlic on live weight of goat. T_1 indicate * = Significant at 5% ($P<0.05$) level of probability, and T_2 indicate ** = Significant at 1% ($P<0.01$) level of probability.

Effect of 10% water solution of garlic on EPG count for gastrointestinal parasites of goat

The effect of 10% water solution of garlic supplementation against gastrointestinal parasitic infestations of goats were evaluated based on EPG count reduction on naturally infested goats, as presented in **Table 2**. Goats treated with garlic showed significantly lower EPG count compared with control group T_0. Among the treated groups, EPG count

Table 2. Effect of 10% water solution of garlic on EPG count for gastrointestinal parasites of goat.

Group	EPG counts (Mean±SE)				
	Day 0	Day 15	Day 30	Day 45	Day 60
Control group - T_0	255.00±0.03	270.00±0.20**	287.00±0.30**	305.00±0.10**	325.00±0.40**
Treatment group - T_1	266.50±0.40	232.00±0.10*	202.00±0.50*	170.00±0.20*	134.00±0.20*
Treatment group - T_2	248.00±0.50	158.00±0.30**	112.00±0.20**	78.00±0.40**	32.00±0.30**

The values are expressed as the Mean±SE of 6 animals in each group. The probability are calculate particular day between treatment group.
* = Significant at 5% ($P<0.05$) level of probability
** = Significant at 1% ($P<0.01$) level of probability

Table 3. Effect of 10% water solution of garlic on TEC (million/mm³ of blood), Hb (gm %) concentration, PCV (%), ESR (mm in first hour) and TLC (thousands/mm³ of blood) of goat.

Hematological Parameters	Mean±SE														
	Day 0			Day 15			Day 30			Day 45			Day 60		
	Control group	Treatment group		Control group	Treatment group		Control group	Treatment group		Control group	Treatment group		Control group	Treatment group	
	T_0	T_1	T_2	T_0	T_1	T_2	T_0	T_1	T_2	T_0	T_1	T_2	T_0	T_1	T_2
TEC	10.54±0.03	10.51±0.02	10.58±0.04	10.50±0.04	10.62±0.02*	10.71±0.04**	10.42±0.02	10.80±0.04*	11.22±0.05**	10.33±0.03	11.00±0.04*	11.77±0.02**	10.29±0.01	11.25±0.02*	12.24±0.02**
Hb	7.65±0.04	7.55±0.01	7.60±0.02	7.60±0.03	7.65±0.04**	7.80±0.03**	7.45±0.01	8.05±0.02**	8.25±0.04**	7.40±0.02	8.55±0.03**	8.85±0.02**	7.30±0.02	9.05±0.1**	9.45±0.01**
PCV	27.05±0.03	26.95±0.02	27.10±0.01	27.00±0.03	27.15±0.03**	27.40±0.04**	26.90±0.04	27.50±0.01**	27.85±0.01**	26.80±0.05	27.90±0.04**	28.35±0.03**	26.75±0.01	28.25±0.2**	28.85±0.04**
ESR	0.95±0.01	1.05±0.03	0.90±0.01	1.15±0.03	0.75±0.02**	0.40±0.02**	1.20±0.01	0.45±0.02**	0.00**	1.35±0.01	0.00**	0.00**	1.40±0.03	0.00**	0.00**
TLC	10.46±0.03	10.52±0.02	10.42±0.05	10.59±0.02	10.41±0.02*	10.23±0.05**	10.72±0.02	10.25±0.03*	9.98±0.01**	10.79±0.03	10.07±0.04*	9.70±0.04**	10.87±0.03	9.85±0.04*	9.41±0.04**

The values are expressed as the Mean±l SE of 6 animals in each group. The probability are calculate particular day between treatment group.
* = Significant at 5% ($P<0.05$) level of probability
** = Significant at 1% ($P<0.01$) level of probability

significantly ($P<0.05$) decreased in goats of T_1 and further reduction were observed in goats of T_2 ($P<0.01$) on day 15 and onward up to day 60 compared to goats of T_0. The lowest EPG count (32.00±0.30) in the goats of T_2 on day 60 and the highest EPG count (325.00±0.40) in the goats of T_0 on the day 60 were recorded. These findings coincides with the findings of Pena et al. (1988) who carried out research with *Cyprinus carpio* infested with *Capillaria* spp., using minced garlic bulbs and showed the greatest anthelmintic activity (100%). Singh et al. (2000) also described an *in vitro* activity of garlic oil against poultry worms such as *Ascaridia galli* and *Heterakis gallinarum*. Allug and Kaptan (2002) described with recommendations of using garlic

(*Allium sativam*) which was effective against Ascaris in Turkey. Guarrera (1999) stated that *Allium sativum* was the most commonly used anthelmintic, which was resemble to that of the present study.

Effect of 10% water solution of garlic on hematological parameters of goat

The effect of 10% water solution of garlic supplementation with feed on hematological parameters of goats is presented in **Table 3**. TEC, Hb concentration and PCV were increased but ESR and TLC were decreased in the goats of garlic treated groups than control group. TEC showed significantly ($P<0.05$) higher values in the goats of T_1 and further significantly ($P<0.01$) increased in the goats of T_2 on day 15, that followed up to day 60. In the goats of T_1 and T_2, the values of Hb concentration and PCV significantly ($P<0.01$) increased on day 15, 30, 45 and 60 than the goats of T_0. The goats of T_1 showed significantly ($P<0.01$) decreased ESR values on day 15 and 30 and the value was 0.00 mm in first hour on day 45 and 60, but simultaneously ESR significantly ($P<0.01$) decreased in the goats of T_2 on day 15 and the value was 0.00 mm in first hour on day 30, 45 and 60. Among the treated groups, TLC significantly ($P<0.05$) decreased in goats of T_1 and significantly ($P<0.01$) decreased in goats of T_2 on day 15 and onward up to day 60 than the goats of T_0. Garlic can be used as an anthelmintic (Guarrera, 1999), and has been reported to be a parasiticide (Duke, 2002). Results showed that 10% water solution of garlic improved the hematological profiles including TEC, Hb concentration, PCV, ESR and TLC in all treated groups than the control, which were coincided with the findings of Mukherjee (1992). Islam (2003) also reported that TEC, Hb and PCV of anthelmintic treated goats significantly ($P<0.05$) increased, whereas ESR values decreased significantly ($P<0.05$).

CONCLUSION

It is concluded that 10% water solution of garlic may be an additional management approach with normal feeding to reduce the load of gastrointestinal parasitic infestation, gaining live weight and improving the general health condition of goats.

LIMITATIONS

To minimize the minimum perplexity and get comprehensive results, the duration of the experiment should be prolonged including more species and parameters and further study need to be carried out to determine the side effects of garlic extract supplementation on livestock and poultry feeding for a limited period as remedy.

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