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Economic Impact of Gastrointestinal Helminth Infections on Milk Production in Swamp Buffalo

Meena Das[1*] and Dillip Kumar Deka[2]

[1]*Division of Animal and Fishery Science, ICAR Research Complex for NEH Region, Umiam, Meghalaya, INDIA*
[2]*Department of Parasitology, College of Veterinary Science, AAU, Khanapara, Assam, INDIA*

Corresponding author: M Das; E-mail: meenad3@gmail.com

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ABSTRACT

The objective of the present study was to assess the economic impact of gastrointestinal helminth infections on milk production in naturally infected swamp buffaloes of Guwahati, Assam, India. Selected animals were divided into three groups (I, II and III) having 10 animals in each group. Animals of group I (*Amphistome* sp.+ *Strongyle* sp.+ *Trichuris* sp.) and group II (*Strongyle* sp.) are infected treated groups whereas group III (*Amphistome* sp. + *Strongyle* sp.) was untreated control group. The animals of group I and group II was treated with Neozide plus bolus @ 10 mg/kg b.wt. and Minthal bolus @ 7.5 mg/kg b.wt., respectively. The egg per gram of feces (EPG) and milk production (litres) were recorded pre-treatment and post-treatment (1, 2, 3 and 4 weeks). Post-treatment EPG (Mean±SE) in animals of group I and group II was reduced to zero which was maintained up to 4th weeks. Post-treatment milk yield in animals of group I during 1st, 2nd, 3rd and 4th weeks were 0.83±0.16, 0.88 ±0.15, 0.92±0.16 and 0.96±0.17 litres, respectively while in group II post-treatment milk yield in animals during 1st, 2nd, 3rd and 4th weeks were 0.93±0.11, 0.95±0.11, 0.97±0.10 and 1.00±0.10, respectively. An increase of 24.67% and 25% milk production was recorded over a period of 4 weeks in animals of group I and group II, respectively. However, in group III (control), milk production was reduced significant ($P<0.05$) by 38.46% over a period of 4 weeks.

HIGHLIGHTS

- Study focused on impact of helminth infections on milk production in swamp buffaloes.
- Helminth infections reduced milk production significantly.

Keywords: Gastrointestinal, Helminth, Milk, Impact, Swamp Buffalo

Livestock plays an important role in Indian economy and is an important subsector of Indian Agriculture. As per 20th Livestock census (2019), the buffalo population of the country are 109.85 million, accounting 20.50% of total livestock population (535.78 million). Majority of the small and marginal farmers depend on buffaloes for their livelihood as they also serve as an insurance against the risk of crop failure due to natural calamities (Sreedevi and Hafeez, 2014). Parasites of livestock cause diseases of major socioeconomic importance worldwide, responsible for financial loss and have a substantial impact on farm profitability (Roeber *et al*., 2013). In buffaloes high prevalence rate of helminths may be attributed to the swamp liking nature of the host (Banerjee, 1991) as marshy environment is suitable for development of several helminth species as well as snails (Waruiru *et al*., 1998). The economic losses are mainly due to subclinical effects which go unnoticed to the owner's. Subclinical infections are responsible for high morbidity and mortality in young animals and enormous production losses in adults. The economic losses occurs in terms of lowered fertility, reduced work capacity, involuntary culling, reduced feed

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intake, low milk production, treatment cost and mortality (Raza *et al*., 2012). Generally, low level of G.I. parasitic infection is present in animals without causing much damage to the susceptible animals. But when the intensity i.e. egg per gram (EPG) faeces in infected animal is high then it is harmful for the animals and require immediate treatment. Therefore, the present study was designed to assess the economic impact of gastrointestinal helminth infections on milk production in swamp buffaloes of Guwahati, Assam.

MATERIALS AND METHODS

Study area

The present study was conducted in Guwahati, the capital city of the state of Assam, India that lies within the latitude of 26°11′0″N and longitude 91°44′0″E. The city is situated on an undulating plain with varying altitudes of 49.5-55.5m above mean sea level. The southern and eastern sides of the city are surrounded by hillocks.

Study design

The assessment of economic impact of gastrointestinal helminth infections on milk production was studied in naturally infected swamp buffalo cows by treating them with anthelmintics (Rahman and Samad, 2010). The selection criteria of animals included similar nutrition, no history of deworming, 3rd-5th lactation (mid lactation 3-6 months) and aged between 5-7 years. Selected animals was divided into three groups (I, II and III) on the basis of egg per gram of faeces (EPG) having 10 animals in each group. Animals of group I (Amphistome+Strongyle +*Trichuris*) and group II (Strongyle) was infected treated groups whereas group III (Amphistome + Strongyle) was untreated control group. The animals of group I and group II was treated with Neozide plus bolus (oxyclozanide and levamisole, @ 10 mg/kg b.wt.; Intas Pharmaceuticals Ltd.) and Minthal bolus (albendazole, @ 7.5 mg/kg b.wt.; Alembic Pharmaceuticals Ltd.), respectively. The egg per gram (EPG) of faeces was counted pre-treatment and 1st, 2nd, 3rd and 4th weeks post-treatment (Solusby, 1982). Pre-treatment (0 day) and post-treatment (1st, 2nd, 3rd and 4th weeks) milk production (litres) records were recorded in order to calculate per animal per day increase in the quantity of milk yield. Increase or decrease in milk yield production was calculated using the following formula:

$$C = A - B$$

Where, C = Increase/decrease in milk yield (in litres)

A = Milk yield 4 weeks post-treatment (in litres)

B = Pre-treatment milk yield (in litres)

Statistical analysis

Data were statistically analyzed by Analysis of Variance (ANOVA) for significance using SPSS 15 version.

RESULTS AND DISCUSSION

The effects of anthelmintic treatment on pre-treatment and post-treatment EPG swamp buffalo are shown in Table 1. Pre-treatment EPG (Mean±SE) in animals of group I and group II are 650±34.96 and 580±45.46, respectively.

Table 1: Effect of anthelmintic treatment on mean EPG of buffalo

Group	No. of animals	Anthelmintic treatment	Pre-treatment EPG ± SE	Post-treatment EPG (Mean±SE)				Total (Mean ± SE)
				1st week	2nd week	3rd week	4th week	
I	10	Neozide plus	$650^{abc} \pm 34.96$	0.00^{d}	0.00^{d}	0.00^{d}	0.00^{d}	$130^{b} \pm 37.74$
II	10	Minthal	$580^{c} \pm 45.46$	0.00^{d}	0.00^{d}	0.00^{d}	0.00^{d}	$116^{b} \pm 34.27$
III	10	Control	$605^{bc} \pm 41.13$	$585^{bc} \pm 44.75$	$610^{bc} \pm 39.30$	$665^{ab} \pm 40.86$	$710^{a} \pm 28.67$	$635^{a} \pm 18.08$
Total (Mean±SE)			$611.67^{a} \pm 23.33$	$195^{c} \pm 53.19$	$203.33^{bc} \pm 54.87$	$221.67^{bc} \pm 59.68$	$236.67^{b} \pm 62.83$	293.67 ± 26.68

Means with different superscripts differ significantly (P<0.05).

However, post-treatment EPG (Mean±SE) in animals of group I and group II was reduced to zero which was maintained up to 4th weeks. However, the pre-treatment and post-treatment (1st-4th weeks) EPG (Mean±SE) in animals of group III (control) were 605±41.13, 585±44.75, 610±39.30, 665±40.86 and 710±28.67, respectively. ANOVA of anthelmintic treatments on EPG of buffalo (Table 2) revealed significant effect ($P<0.01$) of anthelmintic treatment on EPG of animals over a defined period of time.

The effect of anthelmintic treatment on milk production was shown in Table 3. The pre-treatment average milk yield/animal/day (litres) observed in animals of group I, II and III were 0.77±0.14, 0.80±0.10 and 0.78±0.04, respectively. However, the post-treatment average milk yield/animal/day (litres) was found to increase every week up to 4th week in both the treated groups (I, II). The post-treatment milk yield recorded in animals of group I during 1st, 2nd, 3rd and 4th weeks were 0.83±0.16, 0.88 ±0.15, 0.92±0.16 and 0.96±0.17 litres, respectively. The post-treatment milk yield recorded in animals of group II during 1st, 2nd, 3rd and 4th weeks were 0.93±0.11, 0.95±0.11, 0.97±0.10 and 1.00±0.10, respectively. However, in untreated group III (control), milk yield recorded during 1st, 2nd, 3rd and 4th weeks were 0.71±0.04, 0.62±0.04, 0.55±0.04 and 0.48±0.03, respectively. Therefore, an increase of 24.67% and 25% milk production was recorded over a period of 4 weeks in animals of group I (amphistome + strongyle) and group II (strongyle), respectively. However, in group III (control), milk production was reduced by 38.46% over a period of 4 weeks. Statistically, the difference in the total milk production of group I, II and III was found to be significant ($P<0.05$). ANOVA revealed significant effect ($P<0.01$) of anthelmintic treatment and time on milk production in buffalo (Table 4). A net profit of ₹ 4.28 per animal was observed over a period of 4 weeks following anthelmintic treatment (Table 5). However, a loss of ₹ 75.60 per animal was observed in infected untreated

Table 2: ANOVA of anthelmintic treatment on EPG in buffalo

Source	d.f.	Sum of Squares	Mean Square	F Ratio	Prob > F
Anthelmintic treatment	2	8743033	4371517	1598.79	<.0001**
Animal No.	9	228150	25350	9.27	<.1105
Animal No. × Anthelmintic treatment	18	468300	26017	9.52	<.2132
Time	4	3823567	955892	349.60	<.0001**
Anthelmintic treatment × Time	8	2353133	294142	107.58	<.0001**
Error	108	295300	2734		
C. Total	149	15911483			

**$P<0.01$.

Table 3: Effect of anthelmintic treatment on milk production of buffalo

Group	No. of animals	Anthelmintic treatment	Pre-treatment milk production (Litres) (Mean±SE)	Post-treatment milk production (Litres) (Mean±SE)				Total (Mean±SE)	Percent Increase/ Decrease in milk production over a period of 4 weeks
				1st week	2nd week	3rd week	4th week		
I	10	Neozide plus	$0.77^{de} \pm 0.14$	$0.83^{cd} \pm 0.16$	$0.88^{bcd} \pm 0.15$	$0.92^{abc} \pm 0.16$	$0.96^{ab} \pm 0.17$	$0.87^{b} \pm 0.07$	(+) 24.67
II	10	Minthal	$0.80^{de} \pm 0.10$	$0.93^{abc} \pm 0.11$	$0.95^{ab} \pm 0.11$	$0.97^{ab} \pm 0.10$	$1.00^{a} \pm 0.10$	$0.93^{a} \pm 0.05$	(+) 25.00
III	10	Control	$0.78^{de} \pm 0.04$	$0.71^{ef} \pm 0.04$	$0.62^{fg} \pm 0.04$	$0.55^{gh} \pm 0.04$	$0.48^{h} \pm 0.03$	$0.63^{c} \pm 0.02$	(-) 38.46
Total (Mean±SE)			$0.78^{a} \pm 0.06$	$0.82^{a} \pm 0.06$	$0.82^{a} \pm 0.07$	$0.81^{a} \pm 0.07$	$0.81^{a} \pm 0.08$	0.81±0.03	

Means with different superscripts differ significantly ($P<0.05$).

Table 4: ANOVA of anthelmintic treatment on milk production in buffalo

Source	d.f.	Sum of Squares	Mean Square	F Ratio	Prob > F
Anthelmintic treatment	2	2.586633	1.29	234.01	<.0001**
Animal No.	9	5.415067	0.60	108.86	<.2331
Animal No. × Anthelmintic treatment	18	10.475033	0.58	105.29	<.1120
Time	4	0.028567	0.0071	1.29	0.2777
Anthelmintic treatment × Time	8	1.021533	0.13	23.10	<.0001**
Error	108	0.596900	0.0055		
C. Total	149	20.123733			

**P<0.01.

Table 5: Economic impact of anthelmintic treatment on milk yield of buffalo

Group	**No. of animals**	**Total milk yield (Litres)**					**Total Increase / Decrease in milk production (Ltrs) over a period of 4 weeks**
		One week pre-treatment	**1st week**	**2nd week**	**3rd week**	**4th week**	
(A) Infected Treated (I, II)	20	109.55	122.85	128.10	132.30	137.20	(+) 27.65
(B) Infected Untreated (III)	10	54.60	49.35	43.40	38.15	33.60	(-) 21.00
Income from increased/decreased milk production (₹ 37.0/litre)					**Group A**		**Group B**
					(+) 1023.00		(-) 756.00
Expenditure on anthelmintics (₹)					(-) 937.50		—
Net Profit/Loss* (₹)					(+) 85.50		(-) 756.00
Net Profit/Loss/Animal (₹)					(+) 4.28		(-) 75.60

animals over a period of 4 weeks. In the present study, an average increase of 0.96±0.17 litre and 1.00±0.10 litre of milk yield was observed at the end of 4th week in anthelmintic treated groups.

The present findings are in agreement with the finding of Kumar and Pachauri (1989) who observed 13.8% increase in average milk yield at the end of 4th week in *F. gigantica* infected buffaloes following treatment with albendazole. Similarly, Sharma (2001) observed an increase in milk yield (1.20 litre/day/buffalo) after treatment with triclabendazole in *Fasciola* sp./ *Paramphistomum* sp. infected buffaloes. Sanyal and Singh (1995) stated that long-term strategic low level administration of fenbendazole incorporated medicated urea molasses blocks could effectively remove adult parasites and prevent larval establishment in buffalo. Milk output in treated buffalo was (P<0.01) from 45 days onward with a net gain of 1.20 litre per day. Rahman and Samad (2010) also observed an average increase in milk yield (0.32 litre/day/animal) of Red Chittagong cattle infected with subclinical gastro-intestinal parasitosis following anthelmintic treatment. Gains in milk yield may be attributed to improvement in feed intake and feed conversion ratio after anthelmintic treatment (Oakley *et al*., 1979). Absorption of proteins, lipids, carbohydrates, vitamins and minerals has been reported to be altered by endoparasites resulting in the deficiency of these elements (Lee *et al*., 1999; Saleh *et al*., 2007). Deficiency of trace elements results in weight and yield losses (Herd, 1993). Moreover, Odoi *et al.* (2008) observed that under congenial environmental condition, the parasitic load increases and thereby causes significant economic loss in terms of reduction of daily milk yield. According to Thapa Shrestha *et al.* (2020), the average milk yield (litre/day/cow) significantly increased by 1.06 litres in levamisole hydrochloride-oxyclozanide treated buffaloes. The lactose and solid percentage increased significantly in buffaloes (P=0.002 and P=0.028) after deworming. Similarly, Athar *et al*. (2011) observed a significant decrease in fecal egg counts (FEC) in oxyclozanide medicated buffaloes on day 14 post-treatment. An average daily increase of 0.89 liters of milk and 0.42% fat per buffalo was observed in oxyclozanide medicated buffaloes. They observed that the economic value of reduced production in infected buffaloes was US$ 0.41 per animal per day. Similarly, Verschave *et al*. (2014) observed that eprinomectin treatment around calving increased daily milk yield of 0.97 (±0.41) kg up to 274 days. According to Perri *et al*. (2011) milk production lowered significantly in animals with FEC >10 EPG. Charlier *et al*. (2012), observed that the efficient nematode control could result in an important return on investment with expected benefits for an average herd between $15 and $63/lactation. Thus, it can be concluded that G.I. helminth infections have direct impact on milk production and regular anthelmintic medication required for profitable farming. But it is important to keep in mind that parasites become resistant due to repeated use of similar types of anthelmintics over a considerable period of time, and thus it is mandatory to switch over to the alternative anthelmintic to control parasites effectively.

CONCLUSION

The present study revealed that the gastrointestinal helminth infections have direct impact on milk production in the swamp buffaloes. Effective and regular anthelmintic medication required to prevent production loss as well as for profitable farming.

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