Pakistan Veterinary Journal

ISSN: 0253-8318 (PRINT), 2074-7764 (ONLINE)
Accessible at: www.pvj.com.pk

RESEARCH ARTICLE

Cost Benefits Analysis of Anthelmintic Treatment of Cattle and Buffaloes

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ARTICLE HISTORY

Received: December 24, 2010
Revised: December 29, 2010
Accepted: December 30, 2010

Key words:
Cost benefit analysis
Helminths
Oxyclozanide
Pakistan

ABSTRACT

A study was carried out to determine the point prevalence of various helminths of cattle and buffalo population of district Toba Tek Singh, Pakistan and economic benefits of deworming with oxyclozanide. Out of 540 fecal samples examined, 205 (37.96%) were found infected with helminths. Significantly higher (OR=2.2; P<0.05) prevalence of helminths was recorded in buffaloes (40%; 112/280) as compared to cattle (35.77%; 93/260). *Oesophagostomum, Cooperia, Trichostrongylus, Strongyloide, Ostertagia, Fasciola (F.) hepatica, F. gigantica* and *Haemonchus contortus* were the helminth species identified in the study area. Oxyclozanide medicated buffaloes (E=96.66%) and cattle (E=95.64%) showed a significant decrease in fecal egg counts on day 14 post-treatment. An average daily increase of 0.89 and 0.71 liters of milk along with 0.42 and 0.37% more fat per buffalo and cattle, respectively was observed in oxyclozanide medication. The economic value of reduced production of infected animals was estimated as US$ 0.47 (Pak Rupees 40) and US$ 0.41 (Pak Rupees 35) per animal per day for cattle and buffaloes, respectively. It can be concluded that single dose of oxyclozanide is effective against all bovine helminths.

To Cite This Article: Athar LA, MN Khan, MS Sajid, TU Rehman and IA Khan, 2011. Cost benefits analysis of anthelmintic treatment of cattle and buffaloes. Pak Vet J, 31(2): 149-152.

INTRODUCTION

Gastrointestinal parasitism is a world-wide problem for both small- and large-scale farmers and is a great threat to livestock industry (Saddiqi *et al*., 2010). In parasitism, gastrointestinal (GI) helminths are recognized as a major constraint to livestock production throughout the tropics and elsewhere (Githiori *et al.,* 2004). Economic losses are caused by gastrointestinal helminths in a variety of ways; these cause losses through lowering fertility, weight gain and milk production, reducing work capacity, involuntary culling, a reduction in food intake, treatment costs, and mortality in heavily parasitized animals (Regassa *et al.,* 2006). It is estimated, however, that US$ 2.5 billion is spent on pharmaceutical products by the cattle industry for control of internal parasites especially nematodes (Williams and Loyacano, 2001).

Prevalence of GI helminths has been reported ranging from 0.72 to 84.1% in domestic animals from various parts of the world (Bundy *et al.,* 1983; Fikru *et al.,* 2006). In Pakistan, several studies have been conducted on ruminant helminthiasis of various regions reporting a prevalence range from 25.1 to 92% (Raza *et al*., 2007; Khan *et al*., 2009). Khan *et al.* (2010) reported the significant losses due to fascioliasis but still there is no study describing the estimate of economic losses conferred by total helminth population to livestock industry in Pakistan.

MATERIALS AND METHODS

Study area

Study area confined to district T.T.Singh which is located in central Punjab between 30°33' to 31°2' degree north latitudes and 72°08' to 72°48' degree longitudes. The district comprises of three tehsils (Gojra, Kamalia and T.T.Singh) and 82 union councils (UC). It occupies an area of 3252 Km^2, most of which is lowland that floods during the rainy season. The floods originate from the Ravi River that runs along the southern and southeastern borders. According to Pakistan Livestock Survey (2006), T.T.Singh has an average sheep population of 0.50 million. May to July are the hottest months of the year with maximum mean temperature of 40.7ºC while December and January are the coldest months of the year with minimum mean temperature of 6ºC. An average annual rainfall is 254-381 mm.

Prevalence

Based on two stage cluster random sampling, the number of primary units (UC) and elementary units (animals) were sampled using the formulae as given by Thrusfield (2008). Selection of primary units to be sampled was done using map grid method. A total of 540 fecal samples were collected. Five grams of fecal samples were collected directly from rectum or immediately after defecation and preserved in 10% formalin. Fecal samples were analyzed using floatation technique (Zajac and Conboy, 2006). Quantitative fecal examination was performed by McMaster technique to determine the number of egg per gram of feces (EPG) as per the procedures of MAFF (1986). Identification of helminths ova was done with the aid of taxonomic keys (Iqbal *et al.,* 2006; Soulsby, 2006).

Chemotherapeutic efficacy of Oxyclozanide

Fifty cattle and buffaloes each, found to be naturally infected with helminths, were selected for the determination of the effect of chemotherapeutic treatment on their milk production. The selection criteria of animals included similar nutrition, lactation status and no history of deworming. Selected animals were divided into four groups using a randomized complete block design, having 25 animals in each group. One group of buffaloes and cattle each administered oxyclozanide (Oxanid®, Glaxowellcome Limited, Lahore, Pakistan) orally @ 16.6% of body weight, while remaining group received normal saline as control. The pre- (PR) and post-treatment (PT) values of mean EPG were calculated. The efficacy (E) of a drug was calculated using the formula for fecal egg count reduction (FECR; %) according to the recommendations of World Association for Advancement of Veterinary Parasitology (WAAVP) guidelines (Wood *et al.,* 1995). The drug was considered effective if FECR was more than 95% and the lower limit of the 95% confidence interval was more than 90%.

Effect of chemotherapy on the milk yield and fat

PR and PT milk production (liters) and fat (%) records were maintained for 14 days in order to calculate per animal per day increase in the quantity and quality of milk yield (if any). These data were used to estimate the economic value of daily milk loss of infected bovines.

Data analyses

Parasitic abundance followed an aggregated distribution in naturally infected animals, more evident by the greater value of the variance of the mean than of the arithmetic mean (Table 1). Thus, the frequency distribution of fecal egg count (FEC) was modeled as a negative binomial distribution (Torgerson *et al.,* 2005). The differentiation between PR and PT milk yield was made through a paired t-test. The EPG and drug efficacy between buffaloes and cattle were compared through analysis of variance. Paired characteristics were analyzed through Odd's Ratio (OR). All the analyses were carried out using the SAS (1998) software package at 95% confidence level.

RESULTS

Prevalence

Out of 540 fecal samples examined, 205 (37.96%) were found to be infected with helminths. Significantly higher (OR=2.2; P<0.05) prevalence of helminthes was recorded in buffaloes (40%; 112/280) as compared to cattle (35.77; 93/260). The highest prevalence of *F. gigantica* (20.0%) was followed by *Cooperia, Ostertagia, Trichostrongylus, Oesophagostomum, Strongyloide, H. contortus* and *F. hepatica* (Table 1).

Table 1: Prevalence of helminths in fecal samples of infected animals (n=205)

Species	Infected animals	
	No.	%
F. gigantica	41	20.00
Cooperia	37	18.05
Ostertagia	35	17.07
Trichostrongylus	34	16.58
Oesophagostomum	33	16.09
Strongyloide	27	13.17
H. contortus	26	12.68
F. hepatica	10	4.87

Effect of chemotherapy on the milk yield and fat

Both cattle (E=95.64%) and buffaloes (E=96.66%) treated with oxyclozanide showed a significant decrease in fecal egg count on day 14 post-treatment (Table 2). Relative to this effect, differences between PR and PT milk yields of oxyclozanide-treated buffaloes (0.89 liter) and cattle (0.71 liter) were positive, indicating an increase in the milk yield of treated bovines. Statistical analysis showed that PT milk yield is increased significantly (P<0.05) in oxyclozanide-treated cattle (*t* value=2.15) and buffalo groups (*t* value=5.54). Statistically significant differences were observed between PT and PR fat (%) of milk of oxyclozanide-treated cattle (0.37%; *t* value=2.69) and buffaloes (0.42%; *t* value=4.79) as compared to control groups (Table 3).

Estimation of economic value

The local unit price of buffaloes and cattle milk was recorded as US$ 0.47 (Pak Rupees 40) and US$ 0.41 (Pak Rupees 35), respectively. Estimation of economic losses due to helminths in terms of lowering of quantity and quality of milk revealed that helminthiasis caused a loss of US$ 0.44 and 0.29 in buffaloes and cattle, respectively.

DISCUSSION

Species of helminths identified in this study have also been reported by other researchers in different areas of Pakistan (Sajid *et al*., 1999; Raza *et al*., 2007; Khan *et al*., 2009). *T. vitulorum* and *H. contortus* were the most prevalent species in these studies. However, in the present study, the highest prevalence of *F. gigantica* may be attributed to usage of ponds and lakes as source for drinking water and regional variations due to change in agro-climatic conditions required for the development of free living stages of different helminthes (Spithill *et al.,* 1999).

Table 2: Mean EPG of helminthes in oxyclozanide-treated buffaloes and cattle and controls (untreated buffaloes and cattle)

Groups	Pre-treatment EPG			Post-treatment EPG			Efficacy (E) (Max. Likelihood)	95% CI (Max. Likelihood)	P value
	Arithmetic mean	Variance	95% Negative Binomial CI	Arithmetic mean	Variance	95% Negative Binomial CI			
Treated buffaloes	1324.8	4197.33	675-2913	33.60	321.11	9-126	95.64	92.49-97.32	0.009
Untreated buffaloes	1310.4	3719.98	636-2829	1286.40	3027.21	630-2763	-	-	-
Treated cattle	1224	3859.99	345-2196	28.8	419.6	3-87	96.66	92.02-98.19	0.011
Untreated cattle	1233.6	410.00	312-2295	1219.2	3961.12	357-2340	-	-	-

Table 3: Average milk yield and the proportion of fat (%) in oxyclozanide-treated buffaloes and cattle compared with controls (untreated buffaloes and cattle)

Groups	PR	PT	Difference (PT-PR)	T value	P value
Average Milk Yield per day					
Treated buffaloes	5.51	6.40	0.89	5.54	0.001
Untreated buffaloes	5.42	5.49	0.07	0.52	0.601
Treated cattle	3.49	4.20	0.71	2.15	0.035
Untreated cattle	3.59	3.63	0.04	0.12	0.900
Average Fat (%)					
Treated buffaloes	5.58	6.0	0.42	4.79	0.001
Untreated buffaloes	5.56	5.57	0.01	0.05	0.960
Treated cattle	4.49	4.86	0.37	2.69	0.007
Untreated cattle	4.47	4.49	0.02	0.09	0.921

Higher prevalence of helminths in buffaloes may be attributed to swamp liking nature of the host (Banerjee, 1991) as marshy environment is suitable for development of several helminth species as well as snails especially those acting as vector of fascioliasis (Lima, 1998; Tembely, 1998; Waruiru *et al*., 1998).

Increase in average daily milk production post-treatment indicates lower production of animals than their potential due to helminths infestation. Gains in milk yield in cattle have been described following anthelmintic treatment by various researchers (Spence *et al.,* 1992; Sanchez *et al*., 2004). Oxyclozanide was found to lower EPG upto 0% at day 28 post treatment in sheep (Yildirim *et al.,* 2008). An average increase of 164 liters per cow per lactation (4.8%) was recorded in cows when treated with fenbendazole, levamisole hydrochloride and oxyclozanide consecutively in a year (Spence *et al.,* 1992). These findings are consistent with the findings of Gross *et al.* (1999) who observed increase in milk production and milk fat after anthelmintic treatment in cows. 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).

Conclusions

Single dose of oxyclozanide was found to be highly effective in reducing fecal egg count of helminthes in both buffaloes and cattle. Quantity and quality of milk was significantly improved with administration of oxyclozanide in both in buffaloes and cattle.

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