

Efficacy of Ivermectin Pour-On Administration against Natural Oesophagostomum Radiatum Infestations and Prevalence Rate of it in Cattle

¹Garedaghi Yagoob and ²Khayatnouri Mirhadi

¹Department of Pathobiology, ²Department of Pharmacology,
Tabriz Branch, Islamic Azad University, Tabriz, Iran

Abstract: These days, one of the real problems that cause the prejudice economic in animal farms yearly is parasitic diseases. For that reason to prevent these problems, the use of antiparasitic drugs is necessary. Ivermectin is a broad spectrum antiparasitic agent and different dosage forms such as injection, oral and pour-on used. The aims of this study were evaluation of the efficacy of ivermectin pour-on administration against natural oesophagostomum radiatum nematode infections in cattle and also determine the prevalence rate of this parasite in Tabriz area. In this study in 120 heads of male and female hybrid cattle were carried out LPG (larves per g of feces) feces test. Willis method was applied for feces test and Stoll method was used for counting nematode larves (LPG). After confirm worm contamination and counting oesophagostomum radiatum nematode larves in feces, in infected animals, ivermectin (0.5 mg kg⁻¹) pour-on was administrated. Feces test was repeated in 1, 7, 21 and 28 days after treatment. Results showed that total prevalence of oesophagostomum radiatum nematode infections was 18.33% in cattle's of Tabriz area. The effects of ivermectin pour-on on oesophagostomum radiatum nematode were 56.36, 70.75, 92.68 and 99.52% in 1, 7, 21 and 28 days, respectively. In conclusion because the effect of this drug against oesophagostomum radiatum nematode was >99% (p<0.05), so in cattle can use this drug in antiparasitic program. Of course, the effect of this drug on other nematodes and parasitic infections are needed to be more investigated.

Key words: Ivermectin, pour-on administration, oesophagostomum radiatum, cattle, nematode, Tabriz

INTRODUCTION

Infections with Gastrointestinal (GI) nematodes are very common on cattle farms in Iran and all over the world. Parasitic infections of cattle's are major factors responsible for economic losses through reduction in productivity and increased mortality. Parasites cause the animals to be unthrifty which may include the loss of weight, low birth weights and difficulty in kidding. Due to parasitism, the animals become susceptible to other health problems which can lead to death. However, there is substantial evidence that they can also exert important negative effects on the productivity of adult dairy cows (Sanchez *et al.*, 2004).

Many researchers for prevalence rate of gastrointestinal parasites in all the word have been reported but research for effect of anti-parasitic drug by different administration ways is low and in Iran, the study on present subject has not been done (Chaudhri *et al.*, 2003; Hooke *et al.*, 1997; Georgi *et al.*, 1990; Kassai, 1999; Mandal, 2006; Soulsby, 1982). Ivermectin is a member of the macrocyclic lactone class of endectocides commonly referred to as avermectins. It is labeled for the treatment of

internal and external parasites in dogs, cats, horses, pigs, sheep and cattle. Subcutaneous (SC) and Topical (TOP) formulations are available for use in nonlactating dairy cattle at a dose of 0.2 and 0.5 mg kg⁻¹ Body Weight (BW), respectively. Ivermectin is a highly potent broad-spectrum anthelmintic that is widely used in cattle. It is available in injectable, oral and topical formulations for use in cattle (Vermunt *et al.*, 1995). The most important GI nematode responsible for considerable production losses in cattle is oesophagostomum radiatum (Armour, 1989). By attention to this subject which in Iran study on pour-on administration of ivermectin on oesophagostomum radiatum has not been done and the facile use of this drug the objective of this study were to determine the evaluation of the effect of ivermectin pour-on administration against natural oesophagostomum radiatum nematode infections and prevalence rate of them in cattle. This study is the first report in Iran.

MATERIALS AND METHODS

In present study, a total number of 120 dubious cattle to oesophagostomum radiatum infestation from 20

different farms in Tabriz area for fecal examination and LPG were collected. After 3 time fecal examination, a total number of 110 head infected to *Oesophagostomum radiatum* were distinguished and after this step, infected cattle's were isolated and then pour on ivermectin at a dose of 0.5 mg kg⁻¹ were administrated. Also, pour-on form of ivermectin by melting the ivermectin powder in solution of isopropyl alcohol (weight-weight) with 0.5% concentration were made (Reinemeyer and Courtney, 2001).

In this study for differential diagnostic of *oesophagostomum radiatum* larvae from other larvae of authentic book were used (Soulsby, 1982) also for exact distinguish from fecal culture and shape of L₃ (there stage form of larvae) were used (Georgi *et al.*, 1990; Kassai, 1999; Soulsby, 1982; Urquhart *et al.*, 2003). After and before the beginning of cattle treatment, in 3 time fecal samples taken for fecal examination and after examination, results of larvae enumeration in one designed form were written. Fecal examination in days of 1, 7, 21 and 28 after treatment were repeated.

In this study for fecal examination from Willis method and for larvae examination (LPG) of Stool method were used (Rehbein *et al.*, 1999). In end by use of following formula for determine the effective rate of pour-on administration of ivermectin were used:

$$\text{Drug efficacy (\%)} = P - R/P \times 100$$

Where:

R = Average of parasite larvae no. in g of fecal sample after treatment

P = Average of parasite larvae no. in g of fecal sample before treatment

Data were analyzed by non-parametric Crosscal-walis and p<0.05 was considered significant (Aguirre *et al.*, 2005; Marley *et al.*, 1995).

RESULTS

The results of present study indicated which from 120 cattle's, 22 head of them infected to *oesophagostomum radiatum* were distinguished and prevalence rate of this parasite 18.33% were calculated. Average number of enumerated larvae was 424. The average number of enumerated larvae in fecal samples of different days after treatment with pour-on ivermectin in Table 1 has been shown.

The rate of ivermectin pour-on administration affect in different days after treatment by formula was calculated and in days of 1, 7, 14 and 21 was respectively

Table 1: Average no. of enumeration, the larvae in fecal samples of different days of before and after the treatment with pour-on ivermectin

Parameters	Values
Before treatment	424
After treatment (days)	
1	185
7	124
21	31
28	2

Table 2: Rate of ivermectin pour-on administration affect in different days after treatment for control of *oesophagostomum radiatum*

After treatment (days)	Values
1	56.36
7	70.75
21	92.68
28	99.52

56.36, 70.75, 92.68 and 99.52 (Table 2). The ivermectin pour-on administration reduced the natural parasite infestation.

DISCUSSION

According to results of Crosscal-walis test can say which pour-on administration of ivermectin cases decrease the natural infestation of cattle to *oesophagostomum radiatum*. The effect rate of ivermectin on this parasite is >99%. In these days, ivermectin have different drug shapes.

Half time of intra venal administration of ivermectin with dose of 300 µg kg⁻¹ in cattle is 2.8 days but in subcutaneous administration with dose of 200 µg kg⁻¹ is 8 days and also has been shown that the effect of sustained-release administration of this drug in cattle is very more than to oral and subcutaneous administration of that (Reinemeyer and Courtney, 2001). The importance base in use of antiparasitic drug is the increase of contact time of drugs with parasites is very effective in comparison with increase the dose of these drugs (Georgi *et al.*, 1990; Kassai, 1999; Reinemeyer and Courtney, 2001; Soulsby, 1982; Urquhart *et al.*, 2003). This subject has been demonstrated that ivermectin with dose of 1 mg kg⁻¹ (oral or injection) have effective antiparasitic role in veterinary. The dose of this drug in cattle for oral and subcutaneous administration is 0.2 mg kg⁻¹ and for pour-on administration is 0.5 mg kg⁻¹; these doses of ivermectin have importance antihelmintic effect between 97-100% on adult form and L₄ (4th stage of larvae) of *haemonchus*, *ostertagia*, *cooperia*, *trichostrongylus*, *strongyloides*, *bonostomum*, *nematodirus*, *trichuris*, *oesophagostomum*, *dictyocaulus* and *chabertia ovina* also with these doses have effective role in reduce of some arthropods (Georgi *et al.*, 1990; Kassai, 1999; Reinemeyer and Courtney, 2001; Soulsby, 1982; Urquhart *et al.*, 2003). According to findings of

researchers tablet form of ivermectin with dose of 0.4 mg kg⁻¹ causes reduce in eggs in feces during 10 weeks after treatment but have not protective role for reinfection of cattle with one dose of drug administration. Subcutaneous administration of ivermectin with dose of 0.2 mg kg⁻¹ and pour-on of that with 0.5 mg kg⁻¹ dose have high effective role for control of parasites also have importance protective role for reinfection in cattle's. Also according to findings of researchers one administration of ivermectin with dose of 0.5 mg kg⁻¹ have high effect between 95-100% on haemonchus, oesophagostomum and bunostomum (Egerton *et al.*, 1981; Garg *et al.*, 2007; Reinemeyer and Courtney, 2001) and when ivermectin with present dose used in this time have importance effect on boophilus, damalina and others arthropods (Barth and Preston, 1988; Borges *et al.*, 2008; Colwell and Jacobsen, 2002; Lonneux *et al.*, 1997; Marley *et al.*, 1993; Reinemeyer and Courtney, 2001). Doramectin administration (with ivermectin are in one family) after 14 and 21 days, respectively 99.2 and 90.7% on cooperia after 21 and 28 days, respectively, 99.9 and 93.7% on ostertagia after 21 and 28 days, respectively, 100 and 99.9% on dictyocaulushave importance effect. In one study on natural infestation of cattle's, doramectin causes deleting this infestation to ostertagia and cooperia, respectively in days of 19 and 22. By attention to this subject that effect of drug on most parasites is after 14 days, therefore permanent of drug on surface of body have very importance in effective rate of drugs (Reinemeyer and Courtney, 2001). In present study, effective rate in 28 days after treatment by pour-on ivermectin administration on oesophagostomum radiatum 99.52% determined which with calculated effective rate of Williams *et al.* (1997a) is confirm. Williams *et al.* (1997b) in one study on natural infected cattle's to ostertagia, cooperia, oesophagostomum, trichostrongylus, haemonchus and bunostomum with comparison the effect of injection doramectin and ivermectin with pour-on ivermectin shows which these 3 drugs causes decrease the number of eggs and larvae of these parasites in feces and from effect comparison aspect these drugs have not considered different and they reported which pore-on administration of these is similar to injection administration. In study by Eysker *et al.* (1998) indicated which this drug have protective effect on cattle and causes reduce the specific antigen of cooperia oncophora.

In other study by Williams *et al.* (1999) on comparison the effect of pour on administration of ivermectin, doramectin, eprinomectin and moxidectin shown that maximum and minimum effect was with eprinomectin and ivermectin observed, respectively. In one study on comparison the effect of suspension

Albendazole, Oxfendazole and Fenbendazole with pour-on ivermectin on gastrointestinal and respiratory nematods indicated which maximum effect was with pour-on administration of ivermectin with 99.2, 98.3 and 98.1% effect on ostertagia, cooperia and dictyocaulus, respectively and minimum rate was with Fenbendazole (63.6, 17.7 and 39.7) and Oxfendazole (78.5, 42.1 and 32%) (Williams *et al.*, 1997b). Gayrard *et al.* (1999) says that can use of ivermectin and doramectin for control of gastrointestinal parasites in cattle (Gayrard *et al.*, 1999). Whang *et al.* (1994) has been reported which pour-on and injection administration of Moxidectin have positive effect >90% on ostertagia and cooperia and significant different between these two type of administration were not reported.

Two studies indicated that moxidectin have very importance role for control of parasitic disease (Williams *et al.*, 1996; Williams and De Rosa, 2003). Skogerboe *et al.* (1999) and Rehbein *et al.* (1999) reported that pour-on administration of ivermectin during rain too have antiparasitic effect >90% and rain have not specific effect on reduction the role of ivermectin, of course other studies on this subject as been done and indicated that during raining pour-on ivermectin is active against parasites (Rehbein *et al.*, 1999; Rolfe *et al.*, 1997; Skogerboe *et al.*, 1999).

In fact, pour-on administration of ivermectin is very easy for farmers and so far for this way of ivermectin administration any specific side effect has not been reported (Rehbein *et al.*, 1999; Reinemeyer and Courtney, 2001; Rolfe *et al.*, 1997; Skogerboe *et al.*, 1999).

CONCLUSION

Results show that ivermectin is very effective drug for control of gastrointestinal parasites in ruminant and use of that is very easy and have not need to specific tools. Of course, effect of pour-on administration of ivermectin on other helminths and arthropods need to more studies.

REFERENCES

- Aguirre, D.H., A.B. Gaido, M.M. Cafrune, M.E. Castelli, A.J. Mangold and A.A. Guglielmone, 2005. Eprinomectin pour-on for control of *Boophilus microplus* (Canestrini) ticks (Acari: Ixodidae) on cattle. *Vet. Parasitol.*, 127: 157-163.
- Armour, J., 1989. The influence of host immunity on the epidemiology of trichostrongyle infections in cattle. *Vet. Parasitol.*, 32: 5-19.
- Barth, D. and J.M. Preston, 1988. Efficacy of topically administered ivermectin against chorioptic and sarcoptic mange of cattle. *Vet. Rec.*, 123: 101-104.

- Borges, F.A., H.C. Silva, C. Buzzulini, V.E. Soares, E. Santos, G.P. Oliveira and A.J. Costa, 2008. Endectocide activity of a new long-action formulation containing 2.25% ivermectin + 1.25% abamectin in cattle. *Vet. Parasitol.*, 155: 299-307.
- Chaudhri, S.S., S.K. Gupta, D.P. Banerjee, P.K. Bhatnagar and N.S. Ruprah, 2003. *Manual of Veterinary Helminthology*. 1st Edn., International Book Distributing Co., Lucknow, pp: 87-88.
- Colwell, D.D. and J.A. Jacobsen, 2002. Persistence activity of topical ivermectin against artificial infestation with hypodermal lineatum (Diptera: Ostridae). *Vet. Parasitol.*, 105: 247-256.
- Egerton, J.R., C.H. Eary and D. Suhayda, 1981. The anthelmintic efficacy of ivermectin in experimentally infected cattle. *Vet. Parasitol.*, 8: 59-70.
- Eysker, M., J.H. Boersema, J.B. Githiori and F.N.J. Kooyman, 1998. Evaluation of the effect of ivermectin administered topically at zero and six weeks after turnout on gastrointestinal nematode infection in first-season grazing cattle. *Vet. Parasitol.*, 78: 277-286.
- Garg, R., R.R. Kumar, C.L. Yadav and P.S. Banerjee, 2007. Duration of anthelmintic effect of three formulations of ivermectin (Oral, Injectable and Pour-on) against multiple anthelmintic-resistant *Haemonchus contortus* in sheep. *Vet. Res. Commun.*, 31: 749-755.
- Gayraud, V., M. Alvinerie and P.L. Toutain, 1999. Comparison of pharmacokinetic profiles of doramectin and ivermectin pour-on formulations in cattle. *Vet. Parasitol.*, 81: 47-55.
- Georgi, J.R., M.E. Georgi and V.J. Theodorides, 1990. *Parasitology for Veterinarians*. 5th Edn., W.B. Saunders Co., Philadelphia, pp: 53-61.
- Hooke, F.G., P. Clement, D Dell'Osa, R.M. Porter, D. MacColl and R.S. Rew, 1997. Therapeutic and protective efficacy of doramectin injectable against gastrointestinal nematodes in cattle in New Zealand: A comparison with moxidectin and ivermectin pour-on formulations. *Vet. Parasitol.*, 72: 43-51.
- Kassai, T., 1999. *Veterinary Helminthology*. 1st Edn., Butterworth-Heinemann, Oxford, Pages: 260.
- Lonneux, J.F., T.Q. Nguyen and B.J. Losson, 1997. Efficacy of pour-on and injectable formulations of moxidectin and ivermectin in cattle naturally infected with *Psoroptes ovis*: Parasitological, clinical and serological data. *Vet. Parasitol.*, 69: 319-330.
- Mandal, S.C., 2006. *Veterinary Parasitology at a Glance*. 1st Edn., International Book Distributing Company, Lucknow, India, pp: 1-203.
- Marley, S.E., R.D. Hall and R.M. Corwin, 1993. Ivermectin cattle pour-on: Duration of a single late spring treatment against horn flies, *Haematobia irritans* (L.) (Diptera: Muscidae) in Missouri, USA. *Vet. Parasitol.*, 51: 167-172.
- Marley, S.E., S.E. Knapp, M.C. Rognlie, J.R. Thompson and T.M. Stoppa *et al.*, 1995. Efficacy of ivermectin pour-on against *Oestertagia oestertagi* infection and residues in the American Bison, Bison Bison. *J. Wildlife Dis.*, 31: 62-65.
- Rehbein, S., R.A. Barrick, A.F. Batty, M.D. Drag, P.F. Rolfe and J.L. Cox, 1999. Evaluation of the effect of simulated rainfall on the efficacy of Ivomec Pour-on against *Cooperia* spp. infection in cattle. *Parasitol. Res.*, 85: 783-786.
- Reinemeyer, C.R. and C.H. Courtney, 2001. Antinematodal Drugs, Section 11, Chemotherapy of Parasitic Diseases. In: *Veterinary Pharmacology and Therapeutics*, Adams, H.R. (Ed.). 8th Edn. Iowa State University Press, Ames, pp: 963-971.
- Rolfe, P.F., K.L. Dawson, G.N. Nichols, M. Webster and W.G. Ryan, 1997. Efficacy of topical ivermectin following exposure of treated cattle to rains. *Vet. Rec.*, 141: 269-270.
- Sanchez, J., I. Dohoo, J. Carrier and L. Des Coeaux, 2004. A meta-analysis of the milk-production response after anthelmintic treatment in naturally infected adult dairy cows. *Prev. Vet. Med.*, 63: 237-256.
- Skogerboe, T.L., V.C. Cracknell, D.J. Walstrom, L. Ritzhaupt and V.K. Karle, 1999. The effect of simulated rainfall on the efficacy of doramectin pour-on against nematode parasites of cattle. *Vet. Parasitol.*, 86: 229-234.
- Soulsby, E.J.L., 1982. *Helminths, Arthropods and Protozoa of Domesticated Animals*. 7th Edn., Bailliere Tindall and Cassell, London, pp: 231-257.
- Urquhart, G.M., J. Armour, J.L. Duncan, A.M. Dunn and F.W. Jennings, 2003. *Veterinary Parasitology*. 2nd Edn., Book Power, Blackwell Science, New York, pp: 268-279.
- Vermunt, J.J., D.M. West and W.E. Pomroy, 1995. Multiple resistance to ivermectin and oxfendazole in *Cooperia* species of cattle in New Zealand. *Vet. Rec.*, 137: 43-45.
- Whang, E.M., C. Bauer, D. Kollmann and H.J. Burger, 1994. Efficacy of two formulations (injectable and pour on) of moxidectin against gastrointestinal nematode infections in grazing cattle. *Vet. Parasitol.*, 51: 271-281.
- Williams, J.C. and A. De Rosa, 2003. Dose confirmation of moxidectin 0.5% pour-on against adults and fourth-stage larvae of various *Cooperia* spp. and *Trichostrongylus colubriformis* in Louisiana. *Vet. Parasitol.*, 114: 295-303.

- Williams, J.C., A.F. Loyacano, A. De Rosa, J. Gurie, D.F. Coombs and T.L. Skogerboe, 1997a. A comparison of the efficacy of two treatments of doramectin injectable, ivermectin injectable and ivermectin pour-on against naturally acquired gastrointestinal nematode infections of cattle during a Winter-Spring grazing season. *Vet. Parasitol.*, 72: 69-77.
- Williams, J.C., A. DeRosa, Y. Nakamura and A.F. Loyacano, 1997b. Comparative efficacy of ivermectin pour-on, albendazole, oxfendazole and fenbendazole against *Ostertagia ostertagi* inhibited larvae, other gastrointestinal nematodes and lungworm of cattle. *Vet. Parasitol.*, 73: 73-82.
- Williams, J.C., A.F. Loyacano, A. De Rosa, J. Gurie, B.C. Clymer and F. Guerino, 1999. A comparison of persistent anthelmintic efficacy of topical formulations of doramectin, ivermectin, eprinomectin and moxidectin against naturally acquired nematode infections of beef calves. *Vet. Parasitol.*, 85: 277-288.
- Williams, J.C., S.D. Broussard and G.T. Wang, 1996. Efficacy of moxidectin pour-on against gastrointestinal nematodes and *Dictyocaulus viviparus* in cattle. *Vet. Parasitol.*, 64: 277-283.