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Field efficacy and prophylaxis of extra – label 0.5 % moxidectin pour–on in a flock of sheep naturally infested with *sarcoptes scabiei*

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ABSTRACT

Objective: This study was carried out to investigate the efficacy and prophylaxis of extra-label 0.5 % Moxidectin pour-on in a flock of 28 sheep, 14 of which were naturally infested with *Sarcoptes scabiei. Methodology and results:* The infested sheep were divided into 2 groups of 7 sheep each. The first group (therapeutic group) was treated with the drug at the dosage of 0.5 mg kg^{-1} twice 14 days apart while the second group served as the infested control (no treatment). The 14 uninfested sheep were also divided into 2 groups of 7 each. The first group was prophylactically treated with the pour-on once on day 0, while the second group served as the uninfested control (no treatment). Skin scrapings of all the sheep were checked for the presence of mites a day to the treatment and skin lesions scored from 0-3. The result showed for the first time, that extra-label applications of 0.5 % Moxidectin pour-on cures and protects against Sarcoptic mange in sheep.

Conclusion and Application: This research has shown that Moxidectin can be used for both curative and prophylactic treatment of mange in Nigerian indigenous sheep.

INTRODUCTION

Moxidectin is a macrocyclic lactone which includes two distinct chemical families: avermectins and milbemycins (Wagner and Wendlberger, 2000). Moxidectin is a semi-synthetic methoxime derivative of nemadectin (Plumb, 1999). The primary mode of action is to affect chloride ion channel activity in the nervous system of nematodes and arthropods, by binding to the receptors that increases membrane permeability to chloride ions. Thus, the electrical activity of nerve cells in nematodes and muscles cells in arthropods is inhibited and the parasite become paralyzed and dies. Moxidectin also enhances the release of gamma amino butyric acid (GABA) at pre-synaptic neurons. GABA acts as an inhibitory neurotransmitter and blocks the post-synaptic stimulation of the adjacent neuron in nematodes or the muscle fibre in arthropods (Plumb, 1999).

Moxidectin has a broad spectrum of activity against both internal and external parasites (Shoop *et al*., 1995). In cattle, it is licensed for the treatment of gastrointestinal parasites, lungworms, cattle grubs, lice, mites and horn flies, and in horses and sheep it is licensed only for the

treatment of gastrointestinal parasites (Wagner and Wendlberger, 2000), probably because of its limited efficacy in these species.

Sarcoptic mange is a highly contagious skin disease affecting seven different mammalian orders, including humans (Arlian, 1989). Sheep shows signs of skin inflammation, pruritis, cutaneous hyper sensitivity and anorexia leading sometimes to excoriation, exudation, haemorrhage and may develop pyoderma as a result of bacterial contamination of the lesions (Bowman, 1995; Collebrook and Wall, 2004). The host often becomes dehydrated and emaciated. There is drop in production and can finally succumb to the infestation (Pence and Ueckerman, 2002; Fthenakins, *et al*., 2000).

In many animal species, the prevalence of mange is very high and often causes death if it is untreated (Kemp *et al*., 2002). It is an important disease in cattle, pigs, sheep and goats worldwide, with many economic implications in prophylaxis and treatment (Rehbein *et al*., 2003; Tarigan and Huntley, 2005; Menzano *et al*., 2007). The aim of this work is to evaluate the field efficacy of extra-label use of 0.5 % pour-on formulation of moxidectin (Cydectin® American Cyanamid Company, Princeton, NJ, U.S.A) at a dosage of 0.5mg kg^{-1} body weight (recommended dose) in a flock of Nigerian indigenous sheep naturally infested with *Sarcoptes scabiei*. The extra-label implies that it is not recommended for use in sheep against *Sarcoptes scabiei*. This research is therefore imperative.

MATERIALS AND METHODS

Experimental design: A group of 28 sheep were used for the study in an isolated pen of an established livestock farm in Sakaru village of Soba Local Government Area, Kaduna State, Nigeria. The sheep were identified by means of ear tags before the onset of the experiment. Fourteen of the 28 sheep were confirmed to be infested with *Sarcopes scabiei*. Seven of the 14 infested sheep were treated with 0.5 % of moxidectin (Cydectin® American Cyanamid Company, Princeton, NJ, U.S.A) pour-on at a dosage of 0.5mg kg^{-1} body weight, serving as the therapeutic group (Group A) and the remaining infested 7 were not treated and therefore served as the control group (Group B). The remaining 14 uninfested were also divided into 2 groups of 7 sheep each. The first group were administered the pour-on, this served as a prophylactic group (Group C) while the pour-on was not administered to the second group (control group D). All the 28 sheep were kept together in a single pen, fed a diet of non-medicated concentrated ration, with hay and water *ad lib* throughout the period of the experiment.

Clinical examination of the animals: A day before the administration of the 0.5 % moxidectin formulation, all the animals were closely examined for the presence of *Sarcoptes scabiei* lesions and also clinically scored for severity of infestation on a scale of 0-3. Clinical evaluation scores were recorded as follows:

0: No clinical signs

1: Mild signs – slight wool derangement, some scratching, some skin erythema,

2: Moderate signs – some loss of wool, exudation, active scratching

3: Severe signs – considerable loss of wool, exudation, active scratching.

These scoring evaluations were repeated on days 7, 14, 21 and 28.

Skin scraping: The examination for mites was made by taking skin scrapings from all the animals. Skin scrapings were obtained from the part of the lesions bordering healthy tissue; scrapings from 3 sites were obtained from each animal and approximately 1 cm^2 at each site was scraped. A scalpel blade was dipped into glycerin; a skin fold was pinched between the forefinger and the thumb while holding the blade at right angle to the skin. The skin was scraped until blood seeped from the abrasion. Scrapings from each animal were transferred into a Petri dish containing some damp cotton wool. Samples were examined for the presence of mites within 6 hours of collection.

Parasitological examination: The scrapings were placed in a test tube with 5 ml of 10% Potassium hydroxide (KOH) and heated until hair and epidermal scales were digested. They were centrifuged at 10 g for 10 minute and the sediment was suspended in distilled water and re-centrifuged. The new sediment was suspended in saturated sucrose solution (10%) and centrifuged again. Mites were removed from the top of the solution and examined under a microscope at x100 magnification. Mites were identified according to the method of Bowman (1995). Treatment: On day 0, both

the therapeutic and the prophylactic groups received a single, topical application of 0.5 % moxidectin pour-on formulation at a dosage of 0.5 mg kg^{-1} body weight. The solution was applied directly on the skin of the dorsum beginning from the tail to the head. The drug was applied with a syringe with no needle attached. A second dose of the drug was repeated to the therapeutic group only at day 14 when mites were still present.

Statistical analysis : The clinical scores between Day 0 (before treatments) and Day 7 (after treatments) were analyzed using student *t* test. Values of $P<0.05$ were considered significant.

RESULTS

Clinical assessment: Clinical assessments were made a day to the treatment and on days 7, 14, 21 and 28 (Tables 1 - 4). There were no discernable differences between the pre- and post-treatment clinical manifestations of the disease during the first week of the commencement of treatment (Table 1). On day 14, a slight and general reduction in the level of erythema was noted, less scratching was observed, and the therapeutic group appeared to be more at ease. At day 21, all previously moist lesions had dried and only sporadic scratching was observed in the therapeutic group. The lesions continued to heal thereafter and all treated sheep recovered. At day 28, all lesions had dried but not healed completely up to the end of the experiment. There was a significant difference ($P<0.05$) in the clinical score on day 0 compared to day 7 (Table 1). However, at 14 to 28 days of the experiment, there was a progressive restlessness and intense scratching and moistening of the skin lesions in the infested control group. There was a significant difference ($P<0.05$) in the clinical score on day 0 compared to day 7 (Table 2). Mites ere were not detected and also there was no observable scratching or skin lesion at day 0 – 28 in the prophylactic group (Table 3). No local and general side effects or other signs of ill health were observed in both the therapeutic and the prophylactic groups. Mites on 3 of the 7 sheep of the uninfested control group were detected at days 14 - 28 with scratching. There was a significant difference ($P<0.05$) in the clinical score on day 0 compared to day 7 (Table 4).

Table 1 : *Sarcoptes scabiei* infestation and clinical score prior to and after the administration of 0.5 % moxidectin pour-on solution to the therapeutic group.

Sheep No.	Clinical Score	Mites Before treatment)	Clinical Score Day 7)	Mites(Day 7)	Mites(Day 14)	Mites(Day 21)	Mites(Day 28)
010	2	+	1	+	-	-	-
024	1	+	0	+	-	-	-
031	3	+	2	+	+	-	-
045	3	+	1	+	+	-	-
052	2	+	1	+	-	-	-
065	3	+	2	+	+	-	-
014	1	+	0	+	+	+	-

+: presence of mites.

Table 2: *Sarcoptes scabiei* infestation and clinical scores of the infested control group during the entire period of the experiment.

Sheep No.	Clinical Score(Day 0)	Mites (Day 0)	Clinical Score (Day 7)	Mites (Day 7)	Mites (Day 14)	Mites (Day 21)	Mites (Day 28)
015	2	+	3	+	+	+	+
016	2	+	3	+	+	+	+
020	1	+	3	+	+	+	+
017	1	+	3	+	+	+	+
021	1	+	3	+	+	+	+
023	3	+	3	+	+	+	+
018	2	+	3	+	+	+	+

+: presence of mites.

Table 3: Clinical scores prior to and after the administration of 0.5 % moxidectin pour-on solution to the uninfested prophylactic group.

Sheep No.	Clinical Score (Before treatment)	Mites (Day 7)	Mites (Day 14)	Mites (Day 21)	Mites (Day 28)
013	0	-	-	-	-
027	0	-	-	-	-
036	0	-	-	-	-
022	0	-	-	-	-
001	0	-	-	-	-
029	0	-	-	-	-
011	0	-	-	-	-

-: no mites detected, 0, no observable skin lesion.

Table 4: Clinical scores of the uninfested control group and the demonstration of mites on animal during the course of the experiment.

Sheep No.	Clinical Score (Day 0)	Mites (Day 0)	Clinical Score (Day 7)	Mites (Day 7)	Mites (Day 14)	Mites (Day 21)	Mites (Day 28)
037	0	-	2	-	+	+	+
028	0	-	0	-	-	-	-
039	0	-	0	-	-	-	-
026	0	-	1	-	+	+	+
032	0	-	2	-	+	+	+
040	0	-	0	-	-	-	-
041	0	-	0	-	-	-	-

+: presence of mites, 0, no observable skin lesion.

DISCUSSION

Two applications, 2 weeks apart, of 0.5% moxidectin pour-on formulation at 0.5 mg kg^{-1} body weight were found effective for the treatment of sarcoptic mange in sheep; a single dose was insufficient. This result is in consonance with the earlier work of Fthenakins *et al*. (2000). The significant difference ($P<0.05$) (Table 1) however suggest that considerable healing took place and that the impact of the treatment was significant.

The reduction in the severity of skin lesions and the obvious health improvement at day 14 post-treatment may tempt the farmers to ignore the second application of the drug probably for economic reason. The implication of this result is that, since moxidectin is not oocidal, viable larvae would be seen after the hatching from the eggs. It is only the application of the second dose at day 14 that would eliminate the new generation of mites, since the previous generations had been killed by the first dose. Clinicians must therefore ensure that the application of the second dose, otherwise, surviving mites would maintain and exacerbate the disease.

Skin lesions though dried up but not healed completely up to the end of the experiment was not surprising, because skin lesions are considered to be a form of allergic dermatitis initiated by the faeces of mites. Faecal antigens remain active long after the mites have died (Bates, 1993). Moxidectin kills the causative agents, but does not directly cure the clinical lesions. Therefore, lack of complete healing of the skin lesions and regrowth of hair should not be interpreted as persistent infection after all wound healing and growth of hairs are gradual processes (Arlian, 1989).

Cross-sucking by mites is often observed in sheep (Gonyou and Stooking, 1987). The untreated infested control group remained infested throughout the experiment and in fact served as a source of infestation to the uninfested control group that were not protected with the pour-on. Although the prophylactic group was mixing with the infested sheep, they remained uninfested up to 28 day of the experiment. The significant difference ($P<0.05$) recorded in infested control (Table 2) was an indication that the lesions

worsen and that of uninfested control (Table 4) suggest the significant development of lesions. The two conditions therefore emphasize the need for treatment once some members of the flock are infested.

Macrocyclic lactones like avermectins offer better alternative over organophosphates like Chlorofenyinphos for the treatment of mange. They are safe to the environment, the sheep and the farmers. (Natala and Ochoje, 2009). There is the ease of application and to the best of our knowledge; no reports have been made on resistance of mites to them. They also provide worm control due to their anti-nematode activity. To the best of our knowledge also, this is the first time that the extra-label use of 0.5 % moxidectin pour-on formulation is reported for the treatment of Sarcoptic mange in sheep in Nigeria.

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REFERENCES

Arlian LG, 1989. Biology, host relations and epidemiology of *Sarcoptes scabiei*. Annual review of Entomology. 34: 139 - 161

Bates PG, 1993. Alternative methods for the control of sheep scab. Veterinary Record. 133: 467 – 469.

Bowman D, 1995. Georgis' parasitology for veterinarians, 6th ed. Sanders, Philadelphia, PA, 430 pp.

Collebrook E. and Wall R, 2004. Ectoparasites of livestock in Europe and the Mediterranean region. Veterinary Parasitology. 120: 251 – 274.

Fthenakins GC, Papadopoulos E, Himonas C, Leontidis L, Kritas S, Papatsas J, 2000. The efficacy of moxidectin against Sarcoptic mange of sheep and the effects of the treatment on the milk yield of ewes and the growth of lambs. Veterinary Parasitology. 87: 207 - 216.

Gonyou HW. and Stookey JM, 1987. Maternal and neonatal behaviour. Veterinary Clinics of North America: Food Animal Practice 3: 231 – 249.

Kemp DJ, Walton SF, Harumas P, Currie BJ, 2002. The scourge of scabies. Biologist (London) 49: 19 – 24.

Menzano A, Rambozzi L, Rossi L, 2007. A severe episode of wildlife – derived scabies in domestic goats in Italy. Small Ruminant Research. 70: 154 – 158.

Natala AJ. And Ochoje OS, 2009. Survey of pesticides used in the control of ectoparasites on farm animals in Kaduna State, Northern Nigeria. Journal of Animal and Plant Sciences. 4: 276-280.

Papadopoulos E, Fthenakis GC, Himonas C, Tzora A, Leontides L, 2000. Persistent efficacy of moxidectin against *Sarcoptes scabiei* in sheep. Journal of Veterinary Pharmacology and Therapeutics. 23: 111 – 112.

Pence DB. and Ueckerman E, 2002. Sarcoptic mange in wildlife. Revue Scientifique et Technique / Office International de Epizooties 21: 385 – 398.

Plumb D, (Ed.): 1999. Vet. Drug Handbook. Iowa state university press, Ames, IA, pp. 443 – 445.

Rehbein S, Visser M, Winter R, Trommer B, Matthes AE, Maciel AE, Marley SE, 2003. Productivity effects of bovine mange and control with ivermectin. Veterinary Parasitology. 114: 267 – 284.

Shoop W, Mrozik H, Fisher M, 1995. Structure and activity of avermectins and milbermycins in animal health. Veterinary Parasitology. 59: 139 – 156.

Tarigan S. and Huntley JF, 2005. Failure to protect goats following vaccination with soluble proteins of sarcoptes scabiei: evidence for a role for IgE antibodies in protection. Veterinary. Parasitology. 133: 101 – 109.

Wagner R. and Wendlberger U, 2000. Field efficacy of moxidectin in dogs and rabbits naturally infested with *Sarcoptes spp., Demodex spp.* and *Psoroptes spp*. mites. Veterinary. Parasitol. 93: 149 – 158.