

EFFICACY OF SEMDURAMICIN AGAINST AVIAN COCCIDIOSIS IN FLOOR-PEN TRIAL WITH BROILERS IN VENEZUELA

Eficacia de la Semduramicina contra la Coccidiosis Aviar en un Ensayo en Piso con Pollos de Engorde en Venezuela

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ABSTRACT

Efficacy of semduramicin (25 ppm), salinomycin (60 ppm) and maduramicin (5ppm) was compared in broilers exposed to a mixture of *Eimeria acervulina*, *E. maxima* and *E. tenella* isolated fields, in a floor-pen trial located in Venezuela. A 5 day period was set for withdrawal feeding, containing no anticoccidial in all treatments. The weight gain of group that received 25 ppm of semduramicin was comparable to those that received 60 ppm of salinomycin or 5 ppm of maduramicin, and significantly higher compared to group of non-infected/medicated one. Feed consumption was comparable within all the experimental groups. Mortality due to coccidiosis was very low (0.78%) in non-infected/medicated group and no significant differences were observed with medicated groups. In upper, mid and cecal regions of intestine, severity of intestinal lesions was significantly lower ($P < 0.05$) in the group that received semduramicin than the group of non-infected/mediated chickens. As for upper region of intestine (*E. acervulina*), mean of damage was comparable with medicated groups. For mid gut (*E. maxima*) and cecal regions (*E. tenella*) chickens that received semduramicin had a lower range of lesion score ($P \leq 0.05$) than those which received salinomycin. There were no significant differences in controlling damage between semduramicin and maduramicin.

Key words: Semduramicin; floor-pen trial; avian coccidiosis; *Eimeria spp.*

RESUMEN

La eficacia de 25 ppm de semduramicina, 60 ppm de salinomycin y 5 ppm de maduramicina fue evaluada en pollos de engorde expuestos a una mezcla de aislados de campo de *Eimeria acervulina*, *E. maxima* y *E. tenella* suministrados en el alimento y criados bajo condiciones de corrales en piso, en Venezuela. Se estableció un período de retiro de cinco días para todos los tratamientos. La ganancia de peso de los pollos que recibieron 25 ppm de semduramicina fue comparable a la de aquellos que recibieron 60 ppm de salinomycin o 5 ppm de maduramicina y significativamente mejor al compararla con los pollos infectados-no medicados. El consumo de alimento fue comparable entre los tres grupos de tratamiento medicados y las aves infectadas-no medicadas y no hubo diferencias significativas con los grupos de aves medicadas. La mortalidad debida a coccidiosis fue muy baja (0,78%). En las regiones superior, media y cecal, la severidad de las lesiones intestinales fue significativamente más baja ($P < 0,05$) en los pollos que recibieron semduramicina que las del grupo de aves infectadas-no medicadas. Para la región superior (*E. acervulina*) la media del grado de lesiones fue comparable a la de las aves de todos los grupos medicados. Para las regiones media (*E. maxima*) y cecal (*E. tenella*), las aves que recibieron semduramicina tuvieron una media de grado de lesiones más baja ($P < 0,05$) que las que recibieron salinomycin. No hubo diferencias significativas en control de lesiones entre semduramicina y maduramicina. Se comprobó que la semduramicina es una droga anticoccidial efectiva para ser usada contra las principales especies de *Eimeria* en pollos de engorde en Venezuela.

Palabras clave: Semduramicina, ensayo en piso; coccidiosis aviar; *Eimeria spp.*

INTRODUCTION

Avian coccidiosis is a parasitic disease that regardless the high range of technology attained in avian industry in Venezuela as well as in the rest of the world, causes great injury within broilers, breeders, layers and housing farms, estimating a loss due to this disease in approximately 300 million dollars worldwide [2,12]. Out of all available anticoccidial drugs, only a reduced number of them have had success including the effectiveness in control of avian coccidiosis, being to start resistance to them, and this phenomena has limited the maintenance of control programs with a same drug during extended periods [2,12]. Furthermore, the low advance in development of new products with anticoccidial activity, has been due to use of old drugs, such as robenidina, nicarbazina, roxarsona, for decades back [7]. As the main challenge has been research of new anticoccidial substances, which have faced research; creation of a new ionophore in market, semduramicin (Aviax[®], Pfizer), promises to be an effective weapon in chemotherapeutic control of avian coccidiosis, through their action against main species of *Eimeria* affecting commercial fowls [5, 8, 9, 11].

Semduramicin (3-monoglucone) is a monoglicosylated ionophore, a semisynthetic derivate of fermentation of a diglycylated polyether UK-58.852 [5,10] and furthermore was obtained directly from fermentation of an *Actinomadura roseorufa* stock (ATCC39697), both having similar anticoccidial activity [4, 10].

On the other hand, semduramicin shows to have a powerful anticoccidial action, compared to early studies of evolutive cycle of *Eimeria*, having an effect within first 48 to 72 hours after consumption of infective oocysts, and is currently used for control of avian coccidiosis in broiler systems [9,11].

This investigation was made to evaluate efficacy of semduramicin in broilers, in a floor-pen trial in order to use it in Venezuela as an alternate anticoccidial drug in avian industries.

MATERIALS AND METHODS

Experimental fowls and housing

2,000 chicks of one day old were used (50% males and 50% females), obtained from the same incubator, with a range between 35 to 55 g. Birds were kept in an experimental house for floor-pen trials of the CENIAP-FONAIAP (Centro Nacional de Investigaciones Agropecuarias-Fondo Nacional de Investigaciones Agropecuarias) in the Agricultural School Practices, Turmero, Aragua state, Venezuela.

Parasite challenge

A mixture of main species of *Eimeria* isolated from broiler farms in Venezuelan Central Region, containing *Eimeria acervulina* (200,000 oocysts/bird), *E. maxima* (20,000 oocysts/bird), and *E. tenella* (30,000 oocysts/bird) was used as inoculum and adding in the feed of all experimental birds at the 21st day of age.

Experimental design

Semduramicin was dosed at 25 ppm, salinomycin at 60 ppm and maduramicin at 5 ppm into the feed provided to each experimental group from day 0 to 44th. Feeding changes were development on the 28th day. There was a withdrawal period where feed did not contain any anticoccidial, from the 45th to the 49th day. Diets contained 50 ppm of zinc bacitracin. The resulting experimental design is as observed in TABLE I.

Sanitary handling of fowls

Birds were vaccinated according to normal integration practice.

Procedure

Housing place was split into eight blocks/treatment. The four treatments were assigned randomly to each cage per block.

TABLE I
EXPERIMENTAL DESIGN

Treatment	Number of cages/treatment	Total number of birds/cages/treatment	Total number of birds
T1(NM-INF)	8	50	400
T2 (M-SEM)	8	50	400
T3 (M-SAL)	8	50	400
T4 (M-MAD)	8	50	400
Total	32	200	1600

NM-INF = non medicated-infected. M-SEM = medicated semduramicin-infected. M-SAL = medicated salinomycin-infected. M-MAD = medicated maduramicin-infected.

Eight hundred males and 800 females were selected from the flock; infected or sick animals were eliminated in previous process of selection. Birds were selected at random from a pool of males and females in each experimental cage (25 males and 25 females/cage), TABLE I. Total weight was registered for each cage. Four birds from each cage (2 males and 2 females) were pre-selected and identified at the beginning of trial to determine their lesion scores at the 28th day of experiment. Any bird that died during the first 48 hours was replaced, but those that died after 48 hours were not replaced.

All the birds were infected through feeding at the 21st day with oocysts mixture of *E. acervulina*, *E. maxima*, and *E. tenella*.

Parameters to evaluate

- **Birds weight gain/cage (kg):** at beginning and at end of trial (49th day).
- **Birds food consumption/cage (kg):** in periods 0-28; 29-44 and 45-49 days.
- **Observations of birds:** were made twice a day.
- **Registration of birds:** All dead birds were weighed and examined. All data was registered: a) dead weight; b) cage number; c) treatment; d) date; and e) lesion description.
- **Birds lesion scores:** Were made to birds pre-selected at the 28th day of age (4 chicks/cage), using the method described by Johnson and Reid [6].
- **Feeding evaluation:** A sample was taken (500 g) from each food portion for subsequent evaluation.
- **The daily records:** Were made in formats designed for this purpose.
- **Statistic analysis:** Were made analysis of variance (ANOVA) and mean comparison with minimal difference significative test [13].

RESULTS

TABLE II reports weight gain, feed consumption, feed conversion and mortality at the end of study (day 49th). Weight

gain of chicks that received 25 ppm of semduramicin was comparable to those that received 60 ppm of salinomycin or 5 ppm of maduramicin, and significantly better than those of non-medicated-infected group. Mortality due to coccidiosis was very reduced (0.78%) in the non-medicated-infected group and no significant difference was noted within medicated groups.

TABLE III provides evidence of distribution average and percentage degree of lesion scores for coccidia at 28th day. For upper, mid and cecal regions, severity of these intestinal damages were significant ($P \leq 0.05$) but reduced in chickens that received semduramicin in comparison of non-medicated-infected group. For upper region (*E. acervulina*) the average of lesion score was comparable to those all medicated groups. For mid gut (*E. maxima*) and cecal (*E. tenella*) regions, birds that received semduramicin had a lower average ($P \leq 0.05$) than those that received salinomycin. There was no significant difference in control of lesion scores between semduramicin and maduramicin groups.

DISCUSSION

The researches carried out in the United States and some of South American countries showed that semduramicin has a good income and is an effective anticoccidial drug against all species of coccidia of economic importance in broiler farms [1]. This drug improves weight gains, feed conversion, and pigmentation as a result of coccidiosis control and besides, it is safe for other animal species [1].

This research proved that at low levels of coccidia attack, there was no significant difference between semduramicin, salinomycin, and maduramicin on the performance of the trial birds. There were no clinical signs and mortality in the groups treated with semduramicin and maduramicin, but groups treated with salinomycin shows high signs of the coccidial disease.

Different results are registered with maduramicin in other researches carried out [3,13] where birds that were treated with the drug showed some signs of coccidiosis. On the other hand, the growth range in birds and daily feed consumption was very high, may be caused by exacerbation of metabolism or stress during this assay.

TABLE II
WEIGHT GAINS, FEED CONSUMPTION, FEED CONVERSION AND MORTALITY (DAY 49*)

Treatment	Weight Gain (kg)	Feed Consumption (kg)	Feed Conversion (kg:kg)	Mortality	
				Cocc. %	Total**
T1 (NM-INF)	2.180 ^c	4.666	2.286 ^a	0.78	6.5
T2 (M-SEM)	2.286 ^{ab}	4.604	2.139 ^b	0.50	4.5
T3 (M-SAL)	2.304 ^a	4.661	2.161 ^b	0.63	5.2
T4 (M-MAD)	2.220 ^{bc}	4.563	2.200 ^{ab}	0.53	8.2

NM-INF = non medicated-infected. M-SEM = medicated semduramicin-infected. M-SAL = medicated salinomycin-infected. M-MAD = medicated maduramicin-infected. * Significant difference between columns with different components ($P \leq 0.05$). ** Total mortality excluding birds initially examined to detect lesion scores.

TABLE III
MEANS AND DISTRIBUTION PERCENTAGE OF LESION SCORES AT 28th DAY

Treatment	Mean*	Distribution of Lesion Scores (%)**				
		0	1	2	3	4
Upper Intestine						
T1 (NM-INF)	2.37 ^b	0.0	15.6	40.6	34.4	9.4
T2 (M-SEM)	0.84 ^a	56.3	6.3	34.4	3.1	0.0
T3 (M-SAL)	1.44 ^a	12.5	37.5	43.8	6.3	0.0
T4 (M-MAD)	1.21 ^a	17.9	53.6	17.9	10.7	0.0
Mid Intestine						
T1 (NM-INF)	1.22 ^c	15.6	59.4	12.5	12.5	0.0
T2 (M-SEM)	0.12 ^a	87.5	12.5	0.0	0.0	0.0
T3 (M-SAL)	0.84 ^{bc}	31.3	53.1	15.6	0.0	0.0
T4 (M-MAD)	0.46 ^{ab}	57.1	39.3	3.6	0.0	0.0
Ceca						
T1 (NM-INF)	2.41 ^b	0.0	15.6	28.1	56.3	0.0
T2 (M-SEM)	0.50 ^a	75.0	3.1	18.8	3.1	0.0
T3 (M-SAL)	2.25 ^b	0.0	28.1	18.8	53.1	0.0
T4 (M-MAD)	0.32 ^a	67.9	32.1	0.0	0.0	0.0

NM-INF = non medicated-infected. M-SEM = medicated semduramicin-infected. M-SAL = medicated salinomycin-infected. M-MAD = medicated maduramicin-infected. * Inoculum *E. acervulina*, *E. maxima* and *E. tenella*, added in feed pool at 21st day. ** Between intestinal regions, means with different exponents had significant differences ($P \leq 0.05$).

The high feed conversion values in all experimental groups (greater than 2.00) are different from those reported by Ricketts *et al.* [11] who obtained values of 1.383 and 1.570 for salinomycin, and 1.377 and 1.549 for semduramicin, also these results were different from those registered by Vertomen and Peek [14] and Ruiz *et al.* [13] who obtained feed conversion of 1980.

CONCLUSION

Semduramicin proved to be an effective anticoccidial drug against the main species of *Eimeria* in broilers in Venezuela. The efficacy and safety of semduramicin at a dose of 25 ppm in the feed, from one day of age to the withdrawal period were demonstrated without any sign of toxicity or negative effect in performance on the birds.

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