

## Effect of Enrofloxacin on Post Weaning Diarrhea in Pig

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### Abstract

For the purpose of effective therapy and prevention of post weaning *E. coli* diarrhea, Enrofloxacin (Baytril premix) was administered in the feed and a series of investigations were made the occurrence of diarrhea, weight gain, feed conversion rate, changes in the counts of faecal *E. coli* and susceptibility of the isolated *E. coli* strains to antimicrobials. The results obtained were as follows;

1. The weaned piglets which were treated with Baytril premix gained the average body weight of 3.2kg over the control group at the age of 62 days. The result indicates a marked weight gain effect which, by statistical analysis, showed a significant difference ( $p < 0.01$ ).

Administration of Baytril premix also resulted in the improvement of feed conversion rate and prevention of post weaning diarrhea.

2. The counts of faecal *E. coli* in Baytril premix treated piglets showed a marked decrease from  $3.14 \times 10^8$  cells/g to  $2 \times 10^7$  cells/g at 5 days post treatment and  $1 \times 10^5$  cells/g at 10 days post treatment.

3. 10 strains of *E. coli* isolated from the experimental pig farm were highly susceptible to Baytril, gentamicin and trimethoprim plus sulfamethoxazole.

### Introduction

Baytril is a new chemotherapeutic agent with broad antibacterial activity for oral and parenteral administration which was first synthesized in 1983 and developed solely for use in veterinary medicine. Chemically it belongs to the group of the quinolone carboxylic acid derivated with the generic name of enrofloxacin (Scheer, 1987).

In Korea, Baytril was introduced to the veterinary field as a therapeutic agent for gram positive, negative and mycoplasma infection since 1987. This study was undertaken to ascertain the effect of Enrofloxacin when

used as a feed additive (Baytril premix) for the prevention and treatment of post weaning diarrhea in piglets. The changes in the numbers of *E. coli* were searched among the piglets treated with the product and the results thereby obtained are reported.

### Materials and Methods

**Experimental pig farm:** The farm where this trial was performed is located in Ichon county Kyunggi province and is a large scale production integrated and intensive rearing pig farm.

**Experimental method of administration with sample drug:** All piglets of 25 days old were regularly

weaned at the experimental farm and 18 piglet of 25 days old were administered for 10 days with Baytril premix 2.5%(Enrofloxacin 281088-071 V. BAY VP 2674) which was mixed with the feed so as to contain Enrofloxacin at the level of 50 ppm in the feed.

18 control piglets were feed with normal starter feed without antibiotic.

All experimental piglets were weighed prior to administration(25 days old), 10 days after administration and at the end of experiment(62 days old) and feed conversion rate was calculated.

#### The counts of faecal *E. coli* in experimental piglets

: More than one gram of the faecal sample was collected from each of the 4 piglets which were selected randomly from each group. And the number of faecal *E. coli* was counted prior to(0 day), 5 days and 10 days post treatment.

The count of faecal *E. coli* was made according to the method described by Semjen *et al.*(1990). In detail, one gram of faeces was diluted with 9ml of PBS and the mixture was centrifuged for 5 minutes at 500 rpm and supernatant was diluted with PBS.

0.5ml of the diluted supernatant was inoculated onto the surface of MacConkey agar and incubated after the inoculum was dried.

Following incubation of the inoculated MacConkey agar for 24 hours at 37°C, the lactose fermenting colonies are selected and identification of *E. coli* was made according to Bergey's manual.

**Susceptibility test for antimicrobials** : Susceptibility of *E. coli* to various antimicrobials was tested by disk diffusion method using a Sensi disk(BBL) followed by Bauer *et al.*(1966).

12 such antimicrobials as amikacin, ampicillin, baytril, cephalothin, chloramphenicol, colistin, erythromycin, gentamicin, neomycin, penicillin, streptomycin and tetracycline were tested in this trial.

## Results

#### Feeding effect of Baytril premix in weaned pigs :

Weight gain and feed conversion in 62 days old piglets which were fed with Baytril premix for 10 days presented in table 1. During 37 days of trial period, 16.4kg of weight gain and feed conversion rate of 1.7 were observed in Baytril premix treated group whereas in control group, weight gain was 13.2kg with feed conversion rate of 1.8 which resulted in a difference of 3.2kg in weight gain per head.

At the termination of this trial, it was observed that the average body weight was 24.3kg in Baytril premix treated group and that of 21.3kg in control group, and there was a difference of 3kg in average body weight per head at the age of 62 days. The results were statistically analysed by T. test and found highly significance( $p < 0.01$ ). Other observations were that there was no diarrhea symptom in Baytril premix treated group whereas in control group, all piglets were appeared to

**Table 1.** Weight Gain Per Head of Piglets Treated Baytril Premix

Investigated items	Baytril premix treated group	Control group
No. of piglets	18	18
Average body weight before medication	7.9kg	8.1kg
Average body weight after medication	9.7kg	8.2kg
Average body weight at the end of trial	24.3kg	21.3kg
Body weight gain	@ 16.4kg	Ⓟ 13.2kg
Amount of feed intake (in average)	28.2kg	24.0kg
Feed conversion rate	1.7	1.8

1. Age of piglets at the beginning of trial : 25 days old

2. Period of medication : 10 days

3. Age of piglets at the end of trial : 62 days old

4. Period of trial : 37 days

\* @, Ⓟ : Significant difference( $p < 0.01$ )

**Table 2.** Number of *Escherichia coli* in Faecal Contents

Date	Group	No. of <i>E. coli</i> per 1 g of faeces	Mean
Before Baytril treated	Baytril treated group	1) $2.37 \times 10^7$	$3.14 \times 10^3$
		2) $2.13 \times 10^7$	
		3) $2.24 \times 10^7$	
		4) $1.19 \times 10^9$	
	Control	1) $1.19 \times 10^7$	$2.04 \times 10^7$
		2) $2.34 \times 10^7$	
		3) $2.59 \times 10^7$	
		4) $2.04 \times 10^7$	
5 Days after treated	Baytril treated group	1) $5.6 \times 10^7$	$2.0 \times 10^7$
		2) $2.4 \times 10^7$	
		3) $10^5$	
		4) $10^5$	
	Control	1) $2.15 \times 10^7$	$2.6 \times 10^7$
		2) $4.16 \times 10^7$	
		3) $1.50 \times 10^7$	
		4) $2.6 \times 10^7$	
10 Days after treated	Baytril treated group	1) $1.0 \times 10^5$	$10^5$
		2) $10^5$	
		3) $10^5$	
		4) $10^5$	
	Control	1) $2.5 \times 10^6$	$1.24 \times 10^7$
		2) $1.2 \times 10^6$	
		3) $1.35 \times 10^7$	
		4) $3.25 \times 10^7$	

diarrhea for 3 days after weaning, and then recovered gradually in 7 days.

**The changes of the number of faecal *E. coli* in Baytril premix treated piglets:** The changes of the number of faecal *E. coli* in the groups of weaned piglets between Baytril treated and control are presented in table 2. As shown in the table, the numbers of faecal *E. coli* were  $3.14 \times 10^3$  cells/g before treatment, however,  $2 \times 10^7$  cells/g at 5 days post treatment and  $1 \times 10^5$  cells/g 10 days post treatment which showed a particular tendency of marked decrease in the number of *E. coli*.

In control group, the counts of faecal *E. coli* were ;  $2.04 \times 10^7$  cells/g,  $2.6 \times 10^7$  cells/g and  $1.24 \times 10^7$  cells/g respectively.

**Susceptibility to antimicrobials :** 10 strains of *E. coli* which were isolated from the experimental pig farm

were tested to antimicrobial susceptibility. The test results revealed that these strains were highly susceptible to baytril, gentamicin, and trimethoprim plus sulfamethoxazole. However, they were resistant to ampicillin, chloramphenicol, erythromycin, neomycin, penicillin, streptomycin and tetracycline.

### Discussion

Among the swine diseases, the incidence of pig diarrhea is observed more frequently than that of others and it brings a great economic damage to the swine industry, The causes of pig diarrhea are attributed to not only infections by virus, *E. coli*, *Salmonella* spp. and other organisms but also failure in feeding, management and hygiene condition in the farms. Nevertheless, pig diarrhea which is caused by *E. coli* infection re-

sulted in a high incidence rate and believed to be the most common piglet disease. With this background, numerous studies have been conducted (Kim *et al.* (1981). However, during the past decade many antibacterial agents were developed and used widely in the prevention and treatment of Colibacillosis. The authors have conducted a trial using Baytril premix which prepared from a newly synthesized substance developed by Bayer AG. The trial has intended to ascertain the effect of the product (Baytril premix) in the prevention and treatment of piglet diarrhea as well as measuring the changes in numbers of *E. coli* in the faecal samples.

Regarding weight gain and feed conversion, the piglets weaned at 25 days old and treated with Baytril premix for 10 days have reached the average body weight of 24.3kg at the age of 62 days whereas that of control pigs was 21.3kg with the feed conversion rate of 1.7 and 1.8 respectively.

An observation on the incidence and frequency of diarrhea among the piglets, it was confirmed that no diarrhea symptom was observed in Baytril premix treated group whereas in control group, all piglets were affected with diarrhea symptom which lasted for 3 days and then gradually recovered from the 7th day after the onset of diarrhea.

The results of this observation indicated that the effect of prevention and treatment of diarrhea in weaned piglets was well proved by feeding the piglet with Baytril premix.

Semjen *et al.* (1990) reported in his study that the counts of *E. coli* in weaned piglets which were treated with Baytril premix for 7 days were markedly decreased from  $10^{7.9}$  cells/g to  $10^{5.19}$  cells/g and  $10^{5.35}$  cells in 5 days and 10 days following the treatment respectively. Nevertheless, no change in the counts of Lactobacilli was observed. In this study, the results of treatment with Baytril premix were similar to that of Semjen's report in which the counts of faecal *E. coli* were decreased from  $3.14 \times 10^3$  cells/g to  $2 \times 10^7$  cells/g and  $10^5$  cells/g in 5 days and 10 days after treatment respectively.

Scheer (1987) investigated the MIC (Minimal Inhibi-

tory Concentration) level to Enrofloxacin (Baytril) against various pathogens with the results of; *E. coli* -0.06  $\mu$ g/ml, *Salmonella* spp. -0.03  $\mu$ g/ml, *Campylobacter* spp. -0.25  $\mu$ g/ml, *Pseudomonas aeruginosa* -0.75  $\mu$ g/ml, *Bordetella bronchiseptica* -0.5  $\mu$ g/ml, *Haemophilus* spp. -0.02  $\mu$ g/ml, *Pasteurella multocida* -0.008  $\mu$ g/ml, *Staphylococcus aureus* -0.12  $\mu$ g/ml, *Erysipelothrix* sp. -0.06  $\mu$ g/ml, *Mycoplasma* -0.25  $\mu$ g/ml and *Clostridium perfringens* -0.5  $\mu$ g/ml.

Truszczynski (1990) conducted a study and concluded that Enrofloxacin was proved to be effective on *Salmonella choleraesuis* infection. He indicated that Enrofloxacin was an acceptable antimicrobial substance which could be selected and used for the treatment of *Salmonella choleraesuis* infection on the pig farm.

Oliel and Bertschinger (1990) reported that the treatment of experimentally induced *E. coli* mastitis with Enrofloxacin in sows showed a superior result.

Kobisch (1990) also reported some therapeutic effect of Enrofloxacin against such infections as *Actinobacillus* (Haemophilus) pleuropneumoniae, *Mycoplasma hyopneumoniae* and *Pasteurella multocida*.

Yeh and Seok (1990) reported a high susceptibility of the domestic isolates of *Erysipelothrix rhusiopathiae* to Baytril. In this study, authors were observed that 14 strains of *E. coli* isolated from the experimental pig farm were also highly susceptible to Baytril.

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## 돼지의 이유자돈 설사증에 대한 Enrofloxacin의 효과

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### 초 록

돼지의 이유자돈 설사병을 효과적으로 치료, 예방하고자 Enrofloxacin(Baytril premix)을 사료에 혼합 투여하여 설사 발생여부, 증체량, 사료요구율, 돈분내 대장균수의 변화, 분리한 대장균의 항균물질에 대한 감수성을 조사하여 다음과같은 결과를 얻었다.

1. 이유자돈에 Baytril premix를 급여하였던 바 대조구보다 62일령에서 체중은 3.2kg의 통계적 유의차 이를 보여( $p < 0.01$ ) 현저한 증체효과를 나타내었으며, 사료요구율도 개선되었고 설사발생도 예방할 수 있었다.
2. Baytril premix를 급여한 자돈의 분변내 대장균수는  $3.14 \times 10^8$ 개/g에서 5일후  $2 \times 10^7$ 개/g, 10일후  $1 \times 10^5$ 개/g으로 현저히 감소하였다.
3. 공시농장에서 분리한 *E. coli* 10종의 항균물질에 대한 감수성은 baytril, gentamicin 및 trimethoprim + sulfamethoxazole에 감수성이 우수하였다.