# Effective Microorganisms (EM) as an Alternative to Antibiotics in Broiler Diets: Effect on Broiler Growth Performance, Feed Utilisation and Serum Cholesterol.

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***Abstract*** *: An experiment was conducted to evaluate the effect of using Effective Micro-organisms (EM) as an alternative to antibiotics (AB) on growth performance, feed utilisation and serum cholesterol of broilers. Dietary treatments consisted of supplementation with neither AB nor EM, AB only, EM only or AB plus EM. The EM was supplemented at either 15 g/kg or 30 g/kg while the AB (Zinc Bacitracin) was added at 500 mg/kg. At six weeks of age, birds fed diets with neither the EM nor AB had significantly (P<.05) lower weight gains (2066 g) than the rest of the treatments. Birds fed the diet containing AB and EM at 30 g/kg had significantly (P<.05) higher body weight gain (2096g) than the rest of the treatments. The improvements in BWG were associated with slight enhancement of feed efficiency while the EM effects were more pronounced at the higher dosage (30 g/kg). The poorest feed:gain ratio (1.82) was observed in birds fed diets containing neither EM nor AB. Apart from improving dressing percentage, EM supplementation also resulted in birds with low serum cholesterol levels. This study has shown that EM has growth promoting and hypocholesteremic effects and offers a potential alternative to antibiotics in broiler diets.*

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**Introduction** Antibiotics (AB) continue to be used in the poultry industry as growth stimulants and therapeutic agents. However, due to the fact that continued use of AB tends to stimulate development of resistance from harmful micro-organisms, there is currently an outcry from the consumer society and health sector to ban their (AB) use as feed additives in animal and poultry feeds. It is therefore urgent and imperative that an alternative to replace antibiotics should be found. However, such an alternative should elicit positive results similar to those of AB without compromising bird growth, feed utilisation and the quality of final product. According to this criteria, and based on the current available knowledge on feed additives, probiotics seem to be the best alternative.

Probiotics have been shown to have growth promoting (Cavazzoni et al, 1998; Jin et al, 1998; Yeo and Kim, 1997; Mohan et al, 1996) prophylactic (Cavazzoni et al, 1998; Yeo and Kim, 1997) and hypocholesteremic effects (Jin et al, 1998; Mohan et al, 1996). Jin et al (1998) attributed enhanced growth rates by probiotics to improved feed efficiency.

There are several probiotics on the market world wide. In South Africa, Effective Micro-organisms (EM)[1] is a probiotic that has recently been introduced . Use of EM has been shown to improve animal health (Philips and Phillips, 1996). However, there is paucity of information regarding the efficacy and beneficial effects of EM *vis a vis* AB. Without any tangible evidence from empirically derived data, the adoption of this innovation in the poultry industry cannot be guaranteed.

This experiment was conducted to evaluate the effects of supplementing broiler diets with EM at two different inclusion rates as an alternative to AB (Zinc bacitracin) on body weight gain (BWG), feed efficiency (FCR), dressing percentage/ carcass yield (CARC) and serum cholesterol (CHOL) of broilers from 1-42 days of age.

## Materials and Methods

### Birds

Four hundred and fifty chicks were randomly selected and assigned to 6 treatments. The treatments (Trt.) involved addition of AB at 500 mg/kg (AB) and EM at either 15 g/kg (EM15) or 30 g/kg (EM30). Some diets had no EM (EM0) or AB (AB0) added. The 6 treatments were as follows: Trt.1= EM0, AB; Trt. 2= EM0, AB0; Trt. 3 = EM15, AB; Trt. 4 = EM15, AB0; Trt. 5 = EM30, AB; Trt. 6 = EM30, AB0.

Each treatment had five replicates of 15 birds each. Birds were housed in an environmentally controlled broiler house with a floor covered with wood shavings for the whole experimental period.

### Feed

Birds were fed a commercial starter mash (12.8 MJ/kg ME, 22.99 CP) from 1-28d followed by finisher mash (13.4 MJ/kg ME, 20.03 CP) from 29-42 d of age.

Liquid EM was initially mixed with a portion of the basal diet which contained maize meal, soybean meal, molasses and fish meal to make “Bokashi”. The

[1]EM Centre, EMROSA (Pty) Ltd, Centurion, Wierdepart, South Africa

Bokashi was made as per the method of Phillips and Phillips (1996) before being mixed with the rest of the feed.

**Measurements**

Bird weight gains and feed intake (FI) measurements were determined at weekly intervals. On day 42, five birds were randomly selected from each treatment for collection of blood through the brachial vein. The blood was drained into a polythene tube and centrifuged at 5,000 rpm for 10 minutes. Serum CHOL was then determined using the Syncron CX System (Beckman Instruments, Inc., 1995). The birds were then killed by cervical dislocation for determination of carcass. The carcass yield excluded feathers, feet, head and viscera and was expressed as percent of live weight and reported as dressing percentage.

**Data Analysis**

Data were analysed using the General Linear Models procedures of SAS (SAS Institute, 1988) at $P<.05$.

**Results**

The effect of EM and AB supplementation on BWG, FI and CARC are presented in Table 1.

Birds fed diets containing AB and EM0 (Trt.1) had significantly ($P<.05$) higher BWG than those fed diets containing neither AB nor EM (Trt. 2) or the diet containing EM15 (Trt. 4). Diets supplemented with AB, EM15 (Trt. 3) produced BWG similar to diets that contained AB, EM30 and AB0, EM30. A combination of AB and EM30 produced the highest BWG. The high BWG was associated with increased FI. Though not significantly ($P >. 05$) different, feed conversion ratio tended to improve with addition of AB, EM or both. Dressing percentage was significantly ($P<.05$) higher for birds containing EM30 with or without AB supplementation (Trt.5 and 6).

Effects on serum CHOL are presented in the Fig. 1. Supplementing diets with EM resulted in birds with reduced serum CHOL. The CHOL reducing properties of EM occurred in a dose dependent manner . The lowest serum cholesterol content was observed in birds fed diets containing EM 30.

Two other notable results were observed in this study. A negligible mortality rate of only 0.22 per cent (1 out of 450 birds) occurred for the whole experimental period. The bird died in week 5 (Trt. 5) probably due to Sudden Death Syndrome.

Another observation was that during the first few days ( 1-21d), there was a propensity for birds fed diets containing EM diet to have pasted vents.

**Table 1 Effects of EM and Antibiotic Supplementation on Final Body Weight Gain, Food Intake, Feed Conversion Ratio of Broilers at 42 Days of Age**

| | Treatment | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| BW Gain (g, 0-42d) | 2084.96±29.3[b] | 2065.99±28.1[d] | 2090.59±29.6[ab] | 2075.75+27.8[c] | 2095.66±25.9[a] | 2091.70±28.4[al] |
| Food Intake,g | 3737.31±33..4[de] | 3755.15±32.8[c] | 3733.37±31.6[e] | 3739.13+30.7[d] | 3769.61±29.4[a] | 3762.4±32.6[b] |
| Feed: Gain, g:g | 1.79±0.03 | 1.82±0.05 | 1.79±0.04 | 1.80+0.06 | 1.79±0.05 | 1.80±0.07 |
| Dressing Percentage, % of BW | 67.12±1.35[b] | 67.26±1.12[b] | 68.91±0.53[b] | 68.72+0.76b | 72.13±0.92 [a] | 71.80±1.12[a] |
| Serum Cholesterol, (mmol/l) | 3.38 ±0.19[a] | 3.36 ±0.15[a] | 3.32 ±0.18[a] | 3.10+0.15b | 3.08 ±0.17[b] | 3.02 ±0.13[b] |

[abcde]Means with no common superscripts are significantly different

Treatment 1. = 0 EM, 500mg/Kg Zinc Bacitracin; Treatment 2. = 0 EM, 0mg/Kg Zinc Bacitracin
Treatment 3. = 15 g/kg EM, 500mg/Kg Zinc Bacitracin; Treatment 4. = 15 g/kg EM, 0mg/Kg Zinc Bacitracin
Treatment 5. = 30 g/kg EM, 500mg/Kg Zinc Bacitracin, Treatment 6. = 30 g/kg EM, 0mg/Kg Zinc Bacitracin

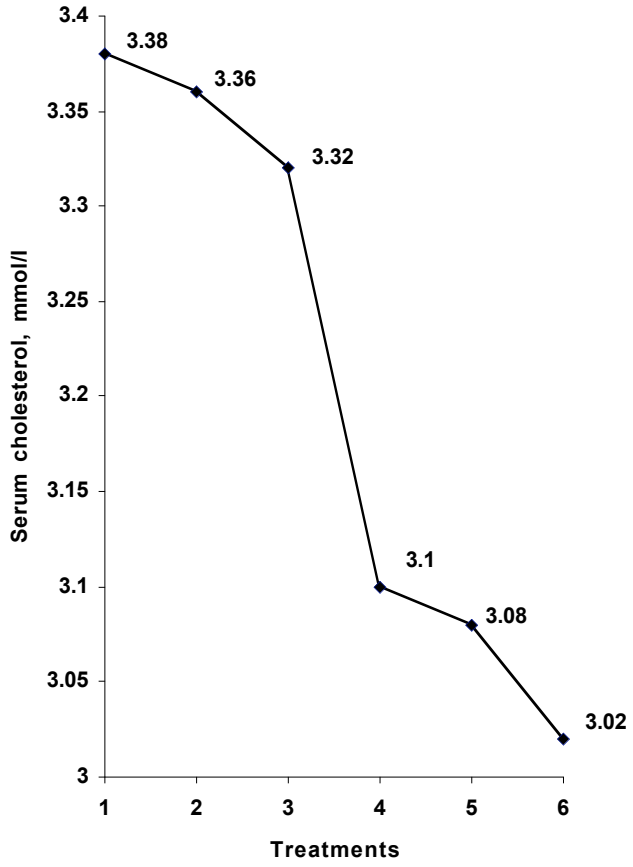


**Fig. 1. Effect of probiotic and antibiotic supplementation on serum cholesterol of broilers at 42 d of age**

**Discussion and Conclusions**

Diets containing AB, EM0 had better BWG than those with AB0, EM0. This is a clear manifestation and demonstration of the growth stimulation effect of AB. Addition of EM at 15g/kg elicited no beneficial effects on BWG unless supplemented together with AB. However, an inclusion rate of 30g/kg of EM with or without AB resulted in improved BWG. These results suggests that a right dosage (30 g/kg of feed) of EM is required to exhibit growth stimulation effects in broilers. At this inclusion level, addition of AB produces a complimentary effect. There were no differences in the FCR reported in this study. However, the FCR tended to improve with addition of EM or AB which may be a reason for the

improvements in BWG. Increased BWG was also associated with high FI. Mohan et al (1996), attributed the growth promotion effects of probiotics to improvements in utilisation of apparent metabolisable energy while enhanced feed utilisation was mentioned by Jin et al (1998).

The high dressing percentage for birds fed the 30 g/kg EM supplemented diet was concomitant with the high BWG observed in the respective treatments. Other studies have shown no differences in dressing percentage between probiotic and no-probiotic supplemented diets (Mohan et al, 1996).

In agreement with other studies involving broilers (Mohan et al, 1996; Jin et al, 1998), this study has demonstrated that probiotics such as EM have serum CHOL reducing properties. These effects are dose dependent and according to this study, the appropriate dosage is 30 g/kg. Eyssen (1973) reported that deconjugation of bile acids in the small intestine may be responsible for reduction of concentrations of serum cholesterol because deconjugated bile acids do not function as well as conjugated bile acids in solubilisation and absorption of lipids. Chikai et al (1987) reported that adherence of deconjugated free bile acids to bacteria and dietary fibre enhances excretion of the bile acids. This mechanism has been implicated to trigger a feedback mechanism that regulates hepatic cholesterol synthesis and subsequent transformation into bile acids which may be responsible for lowering serum cholesterol levels.

A mortality rate of only 0.22 per cent was recorded for the whole trial. Although a prophylactic effect by probiotics has been reported in other studies, (Cavazzoni et al, 1998), it is difficult to draw a similar conclusion in the study presented here because there are no differences in the morbidity and mortality cases among the six treatments some of which had no EM added.

In conclusion, this study has demonstrated and substantiated earlier reports that probiotics such as Effective Microorganisms (EM) has growth promoting effects. Additionally, supplementation of broiler diets with EM has serum cholesterol reducing properties, an element important for the health conscious consumers. A dosage of 30 g/kg is required if the aforementioned benefits are to be attained.

Finally, although further research on beneficial effects of dietary EM is required, the results reported herein bear testimony to the fact that probiotics such as EM offer a potential alternative to antibiotics in broiler diets.

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