EFFECTS OF REPLACING ZINC OXIDE WITH A COMBINATION OF *B*-GLUCAN, *BACILLUS* SP. PB6 AND FORMIC AND CITRIC ACIDS ON THE PERFORMANCE OF WEANER PIGS

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INTRODUCTION

Zinc oxide (ZnO) supra nutritional use was banned in June 2022 creating a challenge to piglet management during the post weaning period. This study evaluated the efficacy of a combination of additives to replace ZnO in weaned piglets. As zinc oxide acts on at least three areas, gut integrity, microbiome and immunity, any functional alternative must address these. To manage the microbiome, which undergoes a drastic change at weaning, two approaches are chosen. First a probiotic *Bacillus* sp. PB6 (CLOSTAT®) to promote and maintain the natural healthy gut flora and minimise the risk posed by Clostridia. Secondly organic acids have been shown to be effective against *E. coli*, for this reason a protected form of organic acids calcium formate and citric acid (Formyl™) was included in the solution. *E. coli* diarrhoea is a well-known risk at weaning, without the application of zinc oxide. To modulate the inflammation and damage caused by the changes and inflammation itself after weaning, a β-1,3-glucan was included (Aleta™) derived from an algae, which is used for immune support and modulation to improve general health of the animals.

OBJECTIVES

The objective of this study is to assess the impact of a combination of products that have some of the known modes of action of ZnO at high doses, it is well known ZnO at high doses has an impact on microbiome, pathogen control, immunomodulation, gut integrity and development.

MATERIALS AND METHODS

EXPERIMENTAL DESIGN:

A total of 380 piglets (50% Large White × 25% Landrace × 25% Pietrain) were included in the study, piglets were balanced for sex, weight and randomly allocated to two diets. The trial run over three batches, in each run, 3 pens were allocated to each diet, replicated over 3 periods, a total 9 pens per treatment.

Feed and water were provided ad libitum.

A summary of the trial design can be seen on Table 1.

Table 1. Trial design

STAGE	ADDITIVE TYPE	CONTROL	TREATMENT
Pre-starter (day 28-42)		Basal diet	Basal diet
	Zinc Oxide (ppm)	2500 ppm	0
	Aleta™ (β-glucan; g/ton)	0	200
	Clostat^{R} (*Bacillus subtilis* PB6; g/ton)	0	1000
	Formyl™ (Formic acid; kg/ton)	0	2
Starter (day 43-70)		Basal diet	Basal diet
	Zinc Oxide (ppm)	0	0
	Aleta™ (β-glucan; g/ton)	0	200
	Clostat^{R} (*Bacillus subtilis* PB6; g/ton)	0	500
	Formyl™ (Formic acid; kg/ton)	0	0

Measurements

Body weights at days 1, 28, 42, 56, and 70

Mortalities from 28-70 days

Body condition scores on 5-point scale (Stalder 2006)

Faecal samples collected and analysed for:

- Faecal score, 4-point method (figure 1)(Perez-Calvo et al, 2019)
- Dry matter (DM)
- Neutral Detergent Fibre (NDF)
- Crude protein (CP)
- Lactic acid content and pH

Results

Piglet mortalities postweaning were low and similar on both diets. Faecal parameters such as dry matter, consistency scores and pH were also similar across all diets. The additives used to replace ZnO resulted in similar growth rates and average daily gains compared from days 28-42 and 28 to 56 days but significantly better performance for the other periods of the study, a summary of the results can be seen on Figure 2. The pigs on the Zn replacer were heavier 29.9 kg compared to those on the standard diet (28.9 kg) (P=0.029). Average daily gains from day 28 to 70 were higher in pigs on the Zn replacers (512 vs 490 g/day, P=0.003)

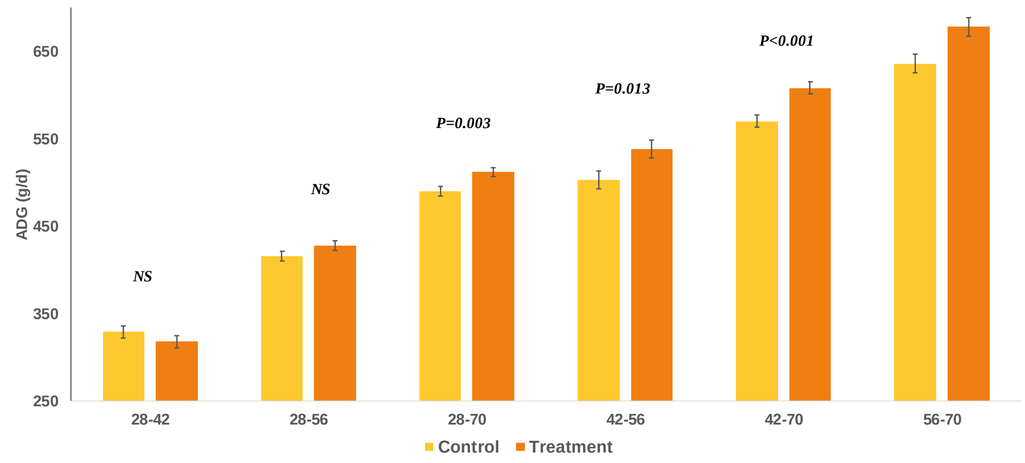

Figure 2. Results for the ADG for the differemt periods of the study

No differences were observed for the faecal analysis between both treatment groups, a summary of the results for dry matter and pH can be seen on Table 2.

Table 2, results for the Dry matter analisis and pH of faeces., NS indicates P> 0.05

	Stage	Control	Treatment	*Sed*	P-value
Dry Matter (DM)	28 d	329	343	32.0	NS
	42 d	248	257	10.1	NS
	56 d	247	246	14.3	NS
	70 d	253	275	18.9	NS
pH	28 d	7.13	7.23	0.186	NS
	42 d	6.65	6.76	0.261	NS
	56 d	7.05	7.11	0.202	NS
	70 d	6.75	6.72	0.147	NS

DISCUSSION and CONCLUSIONS

The combination of additives used elicited comparable levels of performance in weaner pigs and in some cases exceeded the traditional ZnO based diet, this may be very beneficial as post weaning growth has a great impact on lifelong performance. The improvements in performance without ZnO translated into pigs approximately 1 kg heavier at day 70.