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Effects of dietary potassium diformate in piglets and fatteners under tropical conditions – a performance analysis

Lückstädt, Christian

ADDCON, Bonn, Germany, christian.lueckstaedt@addcon.com

Abstract

Dietary potassium diformate (KDF) has been widely applied in pig production for almost 20 years and has been reported in numerous publications and conference contributions, for its use in sows, piglets and fatteners. It was the first organic acid salt to be approved as a non-antibiotic growth promoter in pig feed in the European Union, where it has been shown to improve growth performance and feed efficiency in pig production in several efficacy trials. A holo-analysis of all published data on KDF under temperate conditions (n=59) demonstrated that the additive significantly improved feed intake (+3.52%), weight gain (+8.67%) and FCR (-4.20%) compared to negative controls. As a result of its success in Europe, it has also subsequently been tested under tropical conditions. This study analyzed the average impact from all data collected under tropical conditions on the effect of the additive on the performance parameters weight gain and feed efficiency from commercial and academic trials. The final data-set contained the results of 18 documented studies, comprising 37 trials with KDF-inclusion in piglets and fatteners, at an inclusion rate ranging from 0.2% to 1.8%. These studies were carried out between 2003 and 2015 in Australia, Brazil, China, Philippines, Thailand and Vietnam under both commercial and institutional conditions and included more than 3620 pigs. The results are expressed as the percentage difference from the negative control. The average level of dietary KDF from the data-set in all treated pigs was 0.80%. Daily gain was significantly increased by 11.2% ($P<0.001$). Furthermore, the FCR was also significantly improved (6.3%; $P<0.001$). In agreement with the findings of the holo-analysis, this study shows that dietary potassium diformate can also significantly improve pig production under tropical conditions, demonstrating that the additive is a valuable tool in reducing reliance on antibiotic growth promoters.

Keywords: Potassium diformate, pig, tropics, performance analysis

Introduction

Sustaining growth rate and optimal feed efficiency in young pigs is key to their economic performance through to market. With mounting pressure on the costs of pig production in general worldwide, nutrition is increasingly under scrutiny. Compound feed is not only an effective way of delivering nutrients to animals, but it has long been utilised as a delivery strategy for non-nutritive additives used to promote health. As such, the industry relied heavily on the use of antibiotics as growth promoters in the feed for decades, until it became clear that the development

of bacterial resistance against these compounds could jeopardise their future in the fight against bacterial disease, not only in animals, but also in human health care. The search for alternatives became critical around 15 years ago, beginning in Europe, but more recently in developing countries, such as India, Indonesia or Vietnam.

In many countries, the use of acidifiers in diets for pigs at all stages is already considered an effective tool for achieving efficient utilisation of nutrients from the diet for productivity and health, having been demonstrated in university studies and under commercial conditions. Organic acids, their salts and mixtures of these are authorised for use as feed preservatives and as zootechnical feed additives, both in Europe and elsewhere. Of the non-antibiotic growth promoters, organic acids are among the most reliable and can be used safely with other additives. PAPATSIROS AND BILLINIS (2012) reported that "…Dietary acidifiers can actually become the most common and efficacious alternative solution to antibiotics, in order to improve health status and performance in pigs."

The mode of action of organic acids and their salts has been described extensively in the literature (as summarised by FREITAG, 2007; METZLER AND MOSENTHIN, 2007). However, the magnitude of the effect on performance has not always been consistent. The reason for this is likely to lie in the variability of pig production conditions, including environmental factors, feed formulation and management.

The data from technical trials carried out worldwide using acidifiers in the feed can be used to generate useful information as to the potential economic benefit of using organic acids in a pig production operation. Modelling the potential outcomes of the inclusion of a dietary acidifier in a diet for pigs at a particular production stage under a given set of conditions with a given feed formulation can be used with a statistical method to predict the likely value of the additive. Difficult as this may seem, there is a modelling technique that can make use of all the available trial data reported in the literature, combining them into a mathematical model that can estimate the effects of feed additives irrespective of other conditions such as feed composition, housing, temperature or even altitude. 'Holo-analysis' takes its name from the Greek, *holo*, meaning whole; and this is an accurate description of the principles involved. Essentially, *holo*analysis is an extension of a statistical technique commonly used in science. Meta-analysis involves pooling data from similarly designed studies to build a bigger, more accurate model, while *holo*analysis can take advantage of all the data available.

The late Gordon Rosen, pioneered this system of modelling (MELLOR, 2008). Beginning with extensive data-mining, a total of 484 publications on the use of dietary acidifiers made up the initial collection, of which only those with negative controls were included in the model leaving data from 658 trials, reporting the effects of 158 different acid products on a total of 37,924 pigs (ROSEN, 2008). Using a modified multiple regression analysis, inputs are identified that have a significant effect on feed intake, live weight gain and feed conversion ratio. In this way, feed composition variables were found to be important, especially that using acids in pig diets improved the productivity parameters of greatest importance to economic success. When the input data is confined to one acidifier in particular (59 trials carried out in Europe and North America to 2008), the models constructed also show that the inclusion of potassium diformate (KDF, FORMI) has beneficial effects on feed intake (+3.52%), live weight gain (+8.67%) and feed conversion ratio (-4.20%) compared to negative controls.

As a result of its success in Europe, it has also subsequently been tested under tropical conditions. This study analyzed the average impact from all data collected under tropical conditions on the effect of the additive on the performance parameters weight gain and feed efficiency from commercial and academic trials.

Material and Methods

The final data-set contained the results of 18 documented studies, comprising 37 trials with KDF-inclusion in piglets and fatteners, at an inclusion rate ranging from 0.2% to 1.8%. These studies were carried out between 2003 and 2015 in Australia, Brazil, China, Philippines, Thailand and Vietnam under both commercial and institutional conditions and included 3624 pigs. Data were analysed using the t-test and a significance level of 0.05 was used in all tests. Results are expressed as percentage difference from the negatively controlled pigs.

Results and Discussion

The average level of dietary KDF from the data-set in all treated pigs was 0.80%. The complete data-set is presented in Figures 1 (ADG) and 2 (FCR), which show the difference from the control of all documented trials.

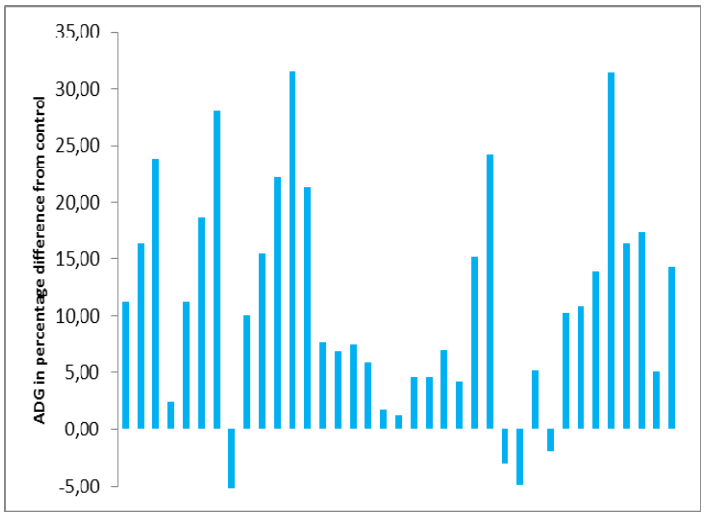

Figure 1. Average daily gain of 37 KDF trials in % difference from the negative controls.

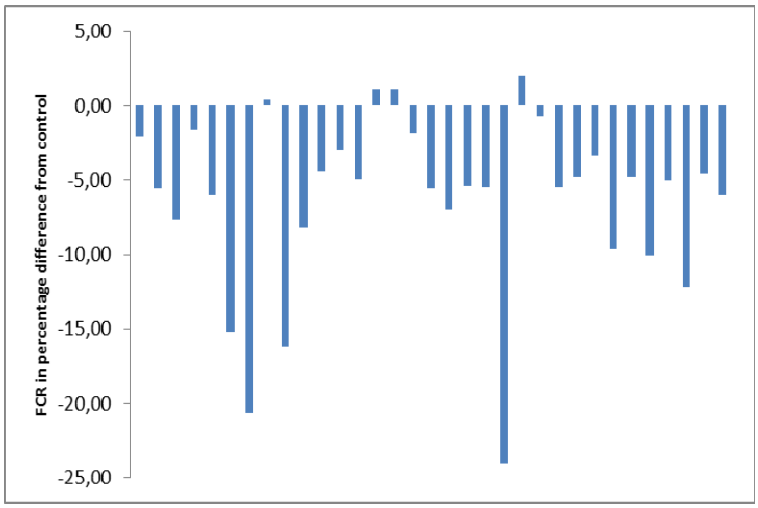

Figure 2. Feed conversion ratio of 33 KDF trials in % difference from the negative controls.

The results of the statistical analysis are shown in Table 1.

Table 1. Performance analysis of 37 trials with piglets and fatteners, fed diets with KDF, expressed as true value and an average percentage difference from negative control.

	ADG	Difference [%]	FCR	Difference [%]
Negative control	449		1.89	
0.8% KDF	492	+11.2	1.78	-6.3

Daily gain was significantly increased by 11.2% ($P<0.001$). Furthermore, the FCR was also significantly improved (6.3%; $P<0.001$) compared to the negative controls.
In agreement with the findings of the holo-analysis, this analysis shows that dietary potassium diformate can also significantly improve pig production under tropical conditions.

Conclusions and Outlook

The findings of the present analysis support the use of dietary KDF as an effective and sustainable growth promoter in post-weaned piglets as well as in fatteners. Current findings suggest that KDF can also be used to enhance growth as well as improve the overall economic productivity on-farm under tropical conditions. Further to its successful use in Europe as the first non-antibiotic growth promoter for pigs, it has recently been included in the first antibiotic-free feed for pigs in Vietnam (Lückstädt, personal communication).

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