International Journal of Food, Agriculture and Veterinary Sciences ISSN: 2277-209X (Online)
An Open Access, Online International Journal Available at http://www.cibtech.org/jfav.htm
2015 Vol. 5 (2) May-August, pp. 86-91/Suryanarayana and Ramana
Research Article

EFFECT OF ANTIBIOTIC, INULIN AND HERBAL RESIDUE ON THE PERFORMANCE OF CROSS-BRED FINISHER PIGS

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ABSTRACT

In a CRD design, twenty four male finisher crossbred pigs (36.1 kg ± 0.66,) divided into four groups at random were fed a basal die t (T_1-control), T_1+ 0.25% tetracycline was T_2, T_1+ 2% *Gingiberis officinale* residue was T_3 and T_1 with 2% inulin was T_4 Number of days taken to reach the target weight was lower for T3 followed by T4, T1 and T2 and was non-singificant. Average daily gain (g) was highest (P<0.05) for T4 followed by T2, T3 and T1 and it was 1.09, 5.9 and 6.92 percent higher for T2, T3 and T1 as compared to T4. The digestibility of CP and NFE were higher (P<0.05) for T3. There was a decreasing trend (P<0.05) in total viable count, Coliforms, *Staphylococci* and *Salmonella* in T3. The serum triglycerides, total cholesterol, LDL cholesterol (mg/dl) were lower (P<0.05) for T3 (Table.5) where as HDL was higher. Non nutrient feed additives always improve the performance of animals, but owing to a ban on the use of antibiotics other alternatives like *Gingeberis officinale* residue and inulin can be alternatively used at 2% levels in the diet to improve the performance of finisher pigs

Keywords: *Antibiotic, Ginger Residue, Inulin, Pathogen, Lipid Profile*

INTRODUCTION

Antimicrobial agents such as antibiotics have been used in pig production since long time. Studies on the effects of antibiotic feed additives have indicated significant improvements in growth rate and feed efficiency. A recent study on the use of in-feed antibiotics in modern production systems showed that such additives are still effective in improving the growth in nursery pigs although the magnitude is less in finisher pigs (Gaskins *et al.,* 2002). Alternate ingredients to substitute antibiotic growth promoters in swine diets are studied and developed based on the new concepts of food safety such as prebiotics and probiotics which alter the microbial balance in the gut (Fuller, 1989). Prebiotics like inulin are indigestible oligosaccharides (Delzenne, 2003) having the capacity to promote the growth of beneficial bacteria like *bifidobacteria* and *lactobacilli* (Kaplan and Hutkins, 2000; Mikkelsen *et al.,* 2004; Molbak *et al.,* 2007; Kelly, 2008; Zentek *et al.,* 2003) in the gut.

More recently, there has been an increased concern about the use of anti-microbials in animals contributing to the rise in antibiotic resistant infections in humans. In the past two decades, an intensive amount of research has been focussed on the development of alternatives to antibiotics to maintain swine health and performance. The most widely researched alternatives include probiotics, prebiotics, enzymes, acidifiers, plant extracts, nutraceuticals etc.

The plant-derived natural bioactive compounds termed as Phytobiotics or phytogenic feed additives if supplemented in the diets were reported to reduce bacterial colony counts, fewer fermentation products including ammonia and biogenic amines, lessen the activity of the gut-associated lymphatic system and enhance nutrient digestion in pigs and poultry (Windisch *et al.,* 2008). These substances improve the endogenous enzyme secretions, stimulates the appetite, improve the digestibility and absorption of nutrients, promote proliferation of beneficial bacteria like *Lactobacillus spp.* in the gut. In addition, anti bacterial, anti viral and anti diarrhoeal activity and stimulation of immune system has also been observed with herbal residues.

The present experiment was planned with the objective to make a comparative study on the use of antibiotic, ginger herbal residue and inulin on the performance of crossbred finisher pigs.

MATERIALS AND METHODS

The experiment was carried out at All India Coordinated Research Project on Pigs, College of Veterinary Science, Tirupati during September, 2013 for a period of about 110 days. One basal diet formulated (NRC, 1998) was evaluated during finisher (35-85 kg) phase. The diet was fed *adlibitum* to 24 male pigs (75% LWY X desi cross) with an average body weight of 36.1 kg ± 0.66, divided into four groups at random. Group one (T_1) was the control without any feed additive, T_1+ 0.25% Tetracycline antibiotic was T_2, T_1+ 2% *Gingiberis officinale* residue was T_3 and T_1 with 2% inulin was T_4.

The ingredient composition (%) of the basal diet was 50 (maize); 20 (Soybean meal); 27 (deoiled rice bran); 2 (mineral mixture) and 1 (salt) and the chemical composition (%) was 90.5, 88.3, 16.9, 8.7, 2.2 , 9.6 and 77.1 for dry matter (DM), organic matter (OM), crude protein (CP), total ash (TA), ether extract (EE),crude fibre(CF) and nitrogen-free extract (NFE), respectively. The pigs were housed individually in separate pens and had unlimited access to water. All the pigs were dewormed before the start of the grower phase. The daily feed offered and the left over was recorded and the body weights of the pigs were recorded at weekly intervals. The impact of faecal bacterial counts was also studied for every fort-night. For bacteriological enumeration, fresh faecal samples (1-2g) were taken directly from the rectum under sterile conditions. One digestion trial was conducted after the animals attained a body weight of about 55kg using all the six animals in each treatment. The pigs were individually placed in metabolic cages and had free access to water. Feed was offered according to the groups. The pigs were acclimatized to the cages for 3 days followed by a collection period of 5 days. During the collection period, faeces were collected daily from each pig. The daily feed intake, left over and faeces voided was recorded. An aliquot of $1/10^{th}$ of the total faeces voided was preserved for further laboratory analysis. At the end of the growth trial, 4 animals per each group were slaughtered to study the carcass traits (USDA, 1970). At the time of slaughter, 25 cm of large intestine between caecum & colon was ligated on both sides and it was cut by a sterilized knife and the same was collected in a sterilized potato tube by following all the aseptic precautions and it was brought to the laboratory for microbiological analysis. The diet and faecal samples were analyzed for proximate composition (AOAC, 1995). The data were subjected to one-way classification of analysis of variance (Snedecor and Cochran, 1989) and the means were tested by least significant difference.

RESULTS AND DISCUSSION

The initial weight and the final weights (kg) were non-significant among the groups (Table 1). The total weight gains (Kg) were 49.5± 0.67, 49.1 ± 0.85, 48.1 ± 0.62 and 48.7 ± 0.67 for groups 1, 2, 3 and 4, respectively. Number of days taken (Table.1) to reach the target weight was lower for T3 followed by T4, T1 and T2 and was non-singificant. Though the average daily feed intake, total feed intake, feed per kg gain and cost of feed per kg gain were not significant among the groups, average daily gain (g) was highest ($P<0.05$) for T4 followed by T2, T3 and T1. ADG (g) was 1.09, 5.9 and 6.92 percent higher for T2, T3 and T1 as compared to T4.

The CP digestibility was higher ($P<0.05$) for T3 followed by T2, T4 and T1 and (Table.2) the values for the NFE digestibility were 81.4± 1.26, 84.5± 1.32, 86.2± 0.90 and 85.7± 0.68 and the highest ($P<0.05$) value was recorded for T3.Since the pathogens are eliminated in the gut by the antibacterial activity more of soluble sugars present in the NFE fraction are spared which are otherwise used by the bacteria as their energy source and this may the reason for enhanced NFE digestibility in T2 to T4 fed groups. Organic matter digestibility was more in T4 fed group and which is in agreement with Lynch *et al.*, (2009) where in they have reported that addition of 1.5% inulin in piglet diets improved the digestibility of DM, OM and mineral matter

In T2, T3 and T4 growth performance was better compared to the control and the reason is attributed to the elimination of pathogens by competitive exclusion since the harmful bacteria compete with nutrients for absorption sites in the gastro-intestinal tract. This improved performance is directly related to higher CP digestibility in T2, T3 and T4.

Table 1: Showing the productive performance among treatments

Particulars	T1	T2	T3	T4
Initial Weight (kg)	36.5 ± 1.00	35.4 ± 0.52	36.7 ± 0.73	35.7 ± 0.39
Final Weight (kg)	86.0 ± 0.60	85.6 ± 0.75	84.8 ± 0.92	85.3 ± 0.68
Total Weight Gain (kg)	49.5 ± 0.67	50.2 ± 0.85	48.1 ± 0.62	49.6 ± 0.67
No. of Days	107 ± 2.80	110.6 ± 2.23	104.8 ± 2.59	106.6 ± 1.70
ADG * (g)	434.8 ^{b} ± 7.42	458.1^{b} ± 6.34	463.6 ^{a} ± 6.85	437.3 ^{a} ± 6.34
ADFI (kg)	2.51 ± 0.06	2.49 ± 0.05	2.48 ± 0.06	2.52 ± 0.05
Total Feed intake(kg)	269.5 ± 11.57	276.0 ± 8.04	267.6 ± 8.49	269 ± 8.72
Feed per kg gain(kg)	5.41 ± 0.08	5.6 ± 0.08	5.51 ± 0.21	5.5 ± 0.25
Cost of feed/kg gain(Rs)	99.5 ± 3.29	102.8 ± 3.38	101.2 ± 3.81	101.0 ± 4.59

^{abcd} *Values in a row not bearing common superscripts differ significantly * (P<0.05)*

Table 2: Showing the Digestibility of Nutrients (%) among treatments

Particulars	T1	T2	T3	T4
DM	72.8 ± 1.07	71.5 ± 1.18	70.9 ± 0.96	71.3 ± 1.46
OM	71.4 ± 1.26	75.9 ± 2.04	76.4 ± 2.33	76.9 ± 2.33
CP *	71.6 ^{b}± 1.11	74.4 ^{ab} ± 0.52	77.7 ^{a} ± 1.68	73.7 ^{b} ± 1.15
CF	40.8 ± 1.32	41.9 ± 1.25	42.2 ± 1.82	43.9 ± 0.99
EE	66.0 ± 1.06	67.0 ± 0.94	65.1± 0.61	64.6 ± 1.18
NFE *	81.4 ^{b} ± 1.26	84.5 ^{a} ± 1.32	86.2 ^{a} ± 0.90	85.7 ^{a} ± 0.68
NDF	41.8± 1.33	43.0±1.12	44.2± 0.87	45.8±0.72
ADF*	31.7 ^{b}± 0.62	35.9 ^{a}± 0.77	32.8 ^{b} ± 1.32	34.8 ^{ab}± 1.21

^{ab} *Values in a row not bearing common superscripts differ significantly * (P<0.05)*

Addition of antibiotics causes the intestinal wall thinner facilitating for more nutrient absorption (Hill *et al.*, 2001) and the destruction of the essential nutrients by the pathogen load is minimized in the GI tract. CP digestibility in T3 group is in agreement with the results of Suryanarayana *et al.*, (2010) where in they have reported that addition of herbal residues (*Emblica officinale*, *gingiberis officinale* and *curcuma longa*)reduce the pathogen load in the gut (Owusu-Asiedu *et al.*, 2003) due to their anti-microbial property and enhance the CP digestibility.
There was a decreasing trend (P<0.05) in total viable count, Coliforms, *Staphylococci* and *Salmonella* in T3 fed group (Table.3) as compared to others. Ginger residue fed group has shown an increased average daily gain (g) and the reason is attributed to the prevention of pathogen growth by the residue indicating a high anti bacterial activity for the residue. In general, phytogenic feed additives have a strong antibacterial and to some extent antifungal properties. They inhibit the growth of *Escherichia coli*, *Proteus sp*, *Staphylococci*, *Streptococci* and *Salmonella* (Aruoma *et al.*, 1996; Benencia and Courreges, 2000; Garcia *et al.*, 2003) which otherwise compete in the host for nutrients.

Table 3: Showing the pathogen count (CFU/ml) among treatments

Particulars	T1	T2	T3	T4
TVC *	127.6 ^{a}± 3.80	110.3 ^{b} ± 3.93	19.85 ^{c} ± 3.32	78.3 ^{d}± 2.71
Coliforms *	71.9 ^{a}± 2.34	52.3 ^{b} ± 7.69	26.3 ^{c} ± 4.43	24.3 ^{c} ± 2.86
Staphylococci *	68.3 ^{a} ± 3.65	55.1 ^{b} ± 3.40	15.1 ^{c} ± 1.96	34.9 ^{d} ± 3.51
Salmonella *	49.3 ^{a} ± 3.06	42.0 ^{ab} ± 2.48	18.6 ^{b} ± 4.54	28.0 ^{b} ± 2.54

^{abcd} *Values in a row not bearing common superscripts differ significantly * (P<0.05)*

T4 fed group recorded lower (P<0.05) pathogen count as compared to T1 group and the possible reason attributed may be due to lowered proportion of VFA production especially acetic acid. These results are in agreement with Loh *et al.*, (2006) and Halas *et al.*, (2009) where in it was reported that inulin –fed pigs had a decreased proportion of acetic acid in the ileum. It is established that the presence of the SCFA will lead to a drop in pH that can have a negative effect on some potentially pathogenic bacteria (Williams *et al.*, 2005). It has also been shown that SCFA inhibit the growth of *Salmonella* (Van derwielen, 2001). VFA can have an antibacterial effect, thereby preventing the establishment of pathogenic bacteria, such as *Salmonella* spp. (Cummings and Englyst, 1987).

This could be the possible reason for less number of days taken to reach the target weight for ginger residue fed group. Except for loin area, none of the parameters (Table 4) were significant (P<0.05) pertaining to carcass characteristics and there are no specified reasons for this recording.

Table 4: Showing the carcass characteristics among the treatments

Particulars	T1	T2	T3	T4
Wt. at slaughter(Kg)	94.1 ± 1.02	94.3 ± 0.97	93.2 ± 0.53	93.6 ± 0.81
Hot Carcass wt (Kg)	64.8 ± 0.56	69.9± 5.49	65.9 ± 0.82	65.7 ± 1.14
Carcass length(cm)	94.2 ± 14.2	94.9± 0.59	94.9 ± 0.74	94.4 ± 0.24
Loin Area * (Sq cm)	34.1 ^{a} ± 1.47	33.0 ^{b} ± 1.16	30.4 ^{c} ± 1.09	29.5 ^{d} ± 0.80
Ave. backfat thickness (cm)	2.74 ± 0.03	2.70 ± 0.07	2.65 ± 0.07	2.69 ± 0.05
Dressing Percentage (%)	84.1 ± 1.19	84.3 ± 1.56	83.0 ± 1.31	84.4 ± 0.57

^{abcd} *Values in a row not bearing common superscripts differ significantly * (P<0.05)*

The serum triglycerides, total cholesterol, LDL cholesterol (mg/dl) were lower (P<0.05) for T3 (Table 5) where as HDL was higher. In general addition of herbs or herbal products affects the serum lipid profile. The present findings correlate with that of Suryanarayana *et al.*, (2010) where in they reported that addition of residues of *Emblica officinale, gingiberis officinale* and *curcuma longa* reduced the levels of the said parameters. Lanjewar *et al.*, (2008) also reported that addition of Tulsi (*Ocimum sanctum*) leaf powder at 0.5 and 1.0% in broiler diets decreased the total cholesterol, serum triglycerides, LDL cholesterol and increased HDL cholesterol levels in serum.

Table 5: showing the serum lipid profile among treatments

Particulars	T1	T2	T3	T4
Triglycerides *	73.8 ^{a} ± 1.45	74.1 ^{a} ± 2.22	64.0 ^{b} ± 3.17	68.8 ^{a} ± 2.25
TC *	84.1 ^{b} ± 1.38	81.3 ^{b} ± 1.08	79.4 ^{b} ± 1.19	92.8 ^{a} ± 2.41
HDL *	51.7 ^{b} ± 2.34	53.4 ^{b} ± 2.23	57.7 ^{a} ± 0.97	59.0 ^{a} ± 1.33
LDL *	32.0 ^{a} ± 1.13	29.1 ^{a} ± 2.23	13.3 ^{b} ± 0.23	23.7 ^{b} ± 1.03

^{ab} *Values in a row not bearing common superscripts differ significantly * (P<0.05)*

Conclusion

Non nutrient feed additives always improve the performance of animals, but owing to a ban on the use of antibiotics other alternatives like *Gingeberis officinale* residue and inulin can be alternatively used at 2% levels in the diet to improve the performance of finisher pigs

ACKNOWLEDGEMENTS

The authors thank The Department of Biotechnology, Ministry of Science and Technology, Govt. of India, New Delhi for financing a research project under which the present work was carried out in association with NIANP, Bengaluru.

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