Scientific Paper

Effect of VITAFERT® on the productive and health performance of growing-fattening pigs

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Abstract

The objective of the study was to evaluate the effect of the zootechnical additive VITAFERT® on the productive and health performance in pigs, in the growing-fattening stage. Four inclusion levels of VITAFERT® were used, which constituted the treatments: CG: control group, GI: 5 mL/kg of live weight (LW), GII: 10 mL/kg of LW and GIII: 15 mL/kg of LW, with five repetitions each and a completely randomized design. In the case of the productive variables variance analysis was used; and Duncan's test was applied to compare the differences among means, through the package INFOSTAT®. To establish whether there were statistical differences in the incidence of diarrheas and mortality, analysis of proportions was carried out and ComparPro version 1 was used. As the VITAFERT® levels were increased there was a rise ($p < 0,001$) in the mean daily gain of live weight (0,64; 0,64; 0,71 and 0,75 kg), which brought about an increase ($p < 0,001$) in the total live weight gain at the end of rearing (57,36; 57,36; 64,30 and 67,68 kg). The feed conversion (kg of DM per kg of LW increase) was favored by the increase ($p < 0,001$) of the product doses, with values of 4,38; 4,37; 3,90 and 3,73. Likewise, when including the zootechnical additive there was a decrease in the incidence of diarrhea. The inclusion of VITTAFERT® in the feeding of pigs in the growing-fattening stage improved the productive and health performance, and the best results were obtained with the highest dose.

Keywords: animal performance, diarrhea, probiotics

Introduction

Commercial pig production was significantly intensified in the last decades and is distributed throughout the world, excluding some regions that maintain certain cultural and religious reservations with regards to the consumption of this meat (FAO, 2014a).

The most widely consumed red meat throughout the world is pork, whose demand in the last decades experienced a strong increase; this is due to the changes in consumption patterns derived from the increase of incomes in developing countries with fast-growth economies. Along with the poultry subsector, pig production is the animal husbandry subsector of higher growth, with a number of animals that reached one billion before 2015, two times higher than in the 1970's (FAO, 2014b).

Due to the intensive management methods, farm animals are highly susceptible to enteric bacterial imbalances in the digestive tract, which leads to an insufficient conversion of nutrients and a delay in growth (Pérez-Quintana *et al*., 2015). To counteract such difficulties, for years the diets were supplemented with antibiotics, which proved to be effective in the decrease of diarrhea and as promoters of animal growth (Milián-Florido *et al*., 2017). Nevertheless, their indiscriminate use caused the development of pathogen strains resistant to these antimicrobials; for which it is necessary, in feeding and management practices, to study and introduce different products that contribute to counteract such negative effects (Limares, 2015).

Among these products are zootechnical additives with probiotic effect, which improve animal productivity in the animals and represent a potentially significant and safe therapeutic advance (Flores-Mancheno *et al*., 2015). The existence of some registered zootechnical additives, such as PROBIOLEV®, SUBTILPROBIO®, PROBIOLACTIL® and PROBIOMEX®, is known, with positive response in poultry, pigs and calves.

The unusual practice in Cuba with these additives has generated affectations in the productive, physiological and health performance in the different pig categories. However, Beruvides *et al*. (2018) obtained a positive response in the productive and health indicators when using additives in lactating pigs. For such reason, the objective of this study was to evaluate the effect of the zootechnical additive VITAFERT® on the productive and health performance in pigs, in the growth-fattening stage.

Materials and Methods

Location. The studies were conducted in the pig production unit Agüica of the Agüica Farm, belonging to the Animal Husbandry Enterprise of the Ministry of Interior (MININT) –Matanzas province, Cuba– geographically located at 22º 44' 39" North latitude and 80º 49' 53" West longitude, at 22,02 m.a.s.l.

Climate. The experimental period corresponded to the months from January to March, 2017, in which the mean temperature varied between 20,7 ºC and 26,1 ºC, and the rainfall fluctuated around 42 mm.

Treatments and design. Four levels of inclusion of VITAFERT® were used: 0, 5, 10 and 15 mL/kg of live weight (LW), according to the recommendations made by Vitaluña-Moya (2014), which constituted the treatments: CG: control group, GI: 5 mL/kg of LW, GII: 10 mL/kg of LW and GIII: 15 mL/kg of LW, with five repetitions each and a completely randomized design.

Characteristics of the animals. A total of 200 crossbred pigs, clinically healthy at the beginning of the trial, was used, from crossings of York-Land (YL), Large White-Landrace (LWxL) sows and Duroc Jersey and L-35 boars, females and castrated males in equal proportion; all of them belonged to the growth-fattening category, were 76 days old at the beginning of the experiment and had an average live weight of 29,8 ± 0,4 kg. They were distributed at a rate of 10 animals per pen, and were reared on cement floor and under the same feeding and management system.

Management and feeding. The studied animals were fed according to the regulations established by IIP (2015), and the zootechnical additive VITAFERT® was added. It was elaborated according to the methodology proposed by Elías and Chiliborste (2010), substituting the final molasses by raw sugar for animal consumption. To produce it 220-L plastic tanks, wood spatulas for stirring and raw material (corn, soybean, urea, mineral salt, ammonium sulfate, raw sugar for animal consumption and 1 L of natural yoghurt) were used. Tables 1 and 2 show the chemical composition of the concentrate feed and the formulation of the additive.

Table 1. Chemical composition of the concentrate feed.

DM (%)	CP (%)	DE (MJ/kg)	Ca (%)	P (%)	C (%)
90,81	19,00	18,97	0,61	0,49	4,55

Table 2. Formulation of the zootechnical additive VITAFERT®.

Raw material	Quantity in 100 L of water (kg)
Inoculant/natural yoghurt	1
Soybean meal	4
Corn meal	4
Urea	0,5
Magnesium sulfate	0,25
Mineral salt	0,5
Raw sugar	15

Measurements. The pigs were weighed at the beginning and every 15 days, until the end of the experiment. The following productive indicators were quantified: initial live weight, final live weight, mean daily gain (MDG), total gain and feed conversion. As health indicators, mortality and incidence of diarrhea were evaluated, through observation once a day.

Statistical processing. For the productive variables variance analysis was carried out, after testing the variance homogeneity and normality assumptions, through the statistical package INFOSTAT version 2012 (Di Rienzo *et al*., 2012); and in mean comparison Duncan's test (1955) was applied. To detect whether there were statistical differences in the incidence of diarrhea and mortality, an analysis of proportions was carried out. The statistical package ComparPro version 1 (Font *et al*., 2007) was used, with 95 % of confidence.

Results and Discussion

Tables 3 and 4 show the productive indicators in growing-fattening pigs. An improvement was observed in such indicators in GII and GIII with regards to the control and GI ($p < 0,01$), with the best values in GIII. Between CG and GI no significant differences were observed, which could have been due to the fact that the dose of 5 mL/kg of live weight did not have the necessary concentration of microorganisms to produce a positive effect on the productive performance.

These results could be related to the production of lactic acid, acetic acid an antibacterial substances by *Lactobacillus* spp., and digestive enzymes generated by the yeasts present in VITAFERT (Elías and Chiliborste, 2010), which can provide a favorable eubiosis state for the animal. In that sense, Rondón *et al*. (2013) and Rodríguez (2017) also obtained an

Table 3. Live weight of growing-fattening pigs fed with VITAFERT®.

Indicator (kg)	CG	GI	GII	GIII	SE ±
Initial live weight	29,4	30,0	29,8	30,0	0,1055
Weight 15 days	35,73[a]	36,07[a]	38,29[b]	40,4[c]	0,1424**
Weight 30 days	44,42[a]	44,44[a]	48,46[b]	50,5[c]	0,1153***
Weight 45 days	51,93[a]	52,42[a]	58,32[b]	59,48[c]	0,1379***
Weight 60 days	60,44[a]	60,87[a]	65,95[b]	69,15[c]	0,1593***
Weight 75 days	68,84[a]	69,59[a]	74,93[b]	78,41[c]	0,1363***
Final live weight at 90 days	80,04[a]	80,21[a]	87,52[b]	91,41[c]	0,1629***

CG: control group, GI: 5 mL/kg of LW, GII: 10 mL/kg of LW, GIII: 15 mL/kg of LW.
Different letters in the same row indicate significant differences ($p < 0,05$).
** $p < 0,01$ *** $p < 0,001$.

Table 4. MDG, total gain and feed conversion of growing-fattening pigs, fed with VITAFERT®.

Indicator	CG	GI	GII	GIII	SE ±
Mean daily gain (kg/animal day^{-1})	0,64[a]	0,64[a]	0,71[b]	0,75[c]	0,01*
Total gain (kg)	57,36[a]	57,36[a]	64,3[b]	67,68[c]	0,0992*
Feed conversion (kg of concentrate feed/kg^{-1} of L)	4,38[a]	4,37[a]	3,9 [b]	3,73 [c]	0,0228***

CG: control group, GI: 5 mL/kg of LW, GII: 10 mL/kg of LW, GIII: 15 mL/kg of LW.
Different letters in the same row indicate significant differences ($p < 0,05$).
* $p < 0,05$, *** $p < 0,001$.

improvement in the productive indicators when the zootechnical additives PROBIOLACTIL®, SUBTILPROBIO® and PROBIOLEV® were evaluated in other categories of zootechnical interest.

Flores-Mancheno (2015) stated that one of the benefits of probiotics lies on the fact that they are capable of carrying out the synthesis of compounds that can be deficient in the animal diet, among which are: B-complex vitamins, essential amino-acids, digestive enzymes, minerals, acetates and other necessary substances in animal growth and development; in addition, probiotics improve the palatability of feedstuffs and cause their intake to increase.

A similar performance was reported by Giang *et al*. (2011) when supplementing the diets with a complex of lactic acid bacteria, alone or in combination of *Bacillus subtilis* and *Saccharomyces boulardii*, which improved the productive indicators in post-weaning pigs.

Quemac-Males (2014) obtained differences regarding the weight increase, mean daily gain and conversion, in pigs treated with probiotics (*Rhodopseudomonas* spp., *Lactobacillus* spp., *Saccharomyces* spp.). Likewise, Sánchez-Gaitán (2016), when applying a nutraceutical additive with probiotic effect, achieved improvements in these indicators.

The results of this study coincide with the report by Jurado-Gómez *et al*. (2013), who studied the *in vivo* application of *Lactobacillus plantarum*, as alternative to the use of antibiotics in piglets. Heo *et al*. (2013) stated that probiotics and prebiotics seem to be capable of improving the yield and enteric health of piglets.

Table 5 shows the incidence of diarrheas during the experimental stage. All the treatments differed from the control group in the indicators digestive diarrhea and dysentery-caused diarrhea, with the lowest incidence in GIII. In the case of diarrheas caused by *Salmonella* spp., there were no differences among the treatments.

These results coincide with the ones obtained by Hou *et al*. (2015), who reported that the *Lactobacillus* strains, and specifically *Lactobacillus reuteri* when supplied in pigs, produce decrease in the incidence of diarrheas.

Table 5. Classification of the incidence of diarrheas in growing-fattening pigs fed with VITAFERT®.

Indicator	CG	GI	GII	GIII	SE ±
Digestive diarrheas	0,48[a]	0,26[b]	0,16[b]	0,1[b]	0,07***
Diarrheas due to *Salmonella* spp.	0,08	0,03	0,01	0,01	0,13
Diarrheas due to dysentery	0,4[a]	0,08[b]	0,03[b]	0,03[b]	0,05***

CG: control group, GI: 5 mL/kg of LW, GII: 10 mL/kg of LW, GIII: 15 mL/kg of LW).
Different letters in the same row indicate significant differences ($p < 0,05$) *** $p < 0,001$.

Beruvides *et al*. (2018) reported a decrease in the incidence of infectious and digestive diarrheas with the inclusion of VITAFERT® formulated with fermented sugar and in levels of 5, 10 and 15 mL/kg of live weight. In this sense, López (2000) stated that there are many reasons for the use of organic acids in pig diets, especially in the rearing and weaning stage, because they help to reduce the gastric and intestinal pH below 4,2; which improves the digestibility of the diet proteins, besides influencing the gastric movement and emptying. On the other hand, Ayala *et al*. (2014) reported that the action of these acids inhibits to a large extent the growth of pathogen bacteria.

It is known that growth-promoting antibiotics reduce enteric infections and the concentration of pathogens capable of adhering to the intestinal mucosa (Ihara *et al*., 2013), which has incidence on the decrease of metabolites or toxic substances that modify the morphology of hairs and the weight of digestive organs; this, in general, affects the intestinal health of the animals.

The effects of the zootechnical additive VITAFERT® on mortality in pigs in the growth-fattening stage are shown in table 6; differences were found between the control and the experimental treatments, with the highest values in the control. In the treatments in which VITAFERT® was administered there were no deaths, which proved the effectiveness of the product to decrease mortality in this category and indicates that it can be used preventively. García-Hernández *et al*. (2016) also found a positive effect when including a microbial preparation based on lactic acid bacteria and yeasts in diets of post-weaning pigs.

The results in the health indicators have a multifactorial approach where their action begins from the presence of microorganisms such as lactic bacteria and yeasts. Rodríguez (2017) proved that yeasts are capable of adhering to the intestinal epithelium, colonizing it and exerting their activity, with the subsequent effect on the productive indicators. Rondón *et al*. (2013) defined that lactic bacteria, generally, have the capacity of preventing the adherence and colonization of pathogen microorganisms on the walls of the gastrointestinal tract, in order to preserve their function of protective barrier and inhibit the cell functions of some pathogens, such as *Escherichia coli* and *Salmonella*. In addition, lactic bacteria can cause decrease of potential pathogens in the intestinal lumen, due to the antimicrobial substances they produce (for example: bacteriocins and organic acids), and, thus, improve the productive performance of pigs.

Table 6. Effect of the zootechnical additive VITAFERT® on the mortality of pre-fattening pigs

Treatment	Mean (kg)	SE ±
CG	0,75[a]	0,02*
GI	0,00[b]	
GII	0,00[b]	
GIII	0,00[b]	

CG: control group, GI: 5 mL/kg of LW, GII: 10 mL/kg of LW, GIII: 15 mL/kg of LW. Different letters in the same row indicate significant differences ($p < 0,05$) * $p < 0,05$

It is concluded that the inclusion of the zootechnical additive VITAFERT® in pig feeding in the growth-fattening stage improves the productive and health performance; the best performance was found with the highest dose.

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