Technical Note

Effect of the bioproduct IHplus® on the productive and health indicators of pre-fattening pigs

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Abstract

A study was conducted under production conditions in order to evaluate the effect of the bioproduct IHplus® on the productive [(live weight increase, LW; mean daily gain, MDG; feed conversion, (FC) and health indicators (sick, recovered and dead piglets)]; and epizootiological indicators: prevalence, IPV; negative incidence per recovery, NIR; mortality, Mt) of pre-fattening pigs. A total of 480 animals were used, with average age of 26 days and average weight of 5,96 kg. Starter concentrate feed for piglets (of national origin) was used as feedstuff. The experimental period was 21 days. Four treatments were evaluated: a control and three doses of IHplus®: 40, 80 and 120 mL piglet^{-1} day^{-1}, in a completely randomized design. The worst productive results were obtained with the control treatment (7,26 kg LW; 60,5 g day^{-1} MDG and 6,01 FC) and with the lowest probiotic dose (7,22 kg LW; 60,5 g day^{-1} MDG and 6,01 FC); while with the dose of 120 mL the best results were obtained (7,92 kg LW; 92,3 g day^{-1} MDG and 3,98 FC). The health indicators with 80 and 120 mL piglet^{-1} day^{-1} showed lower prevalence, and the highest dose exerted the best effect on them; these treatments reached a recovery rate of 100 %, with 0 % of mortality. It is concluded that the dose of 120 mL of IHplus® piglet^{-1} day^{-1} produced a higher effect than the other doses on the productive and health indicators of piglets, for which it is recommended as optimum application dose in the diets.

Keywords: weight gain, mortality, probiotic

Introduction

In the pig production industry the post-weaning period not only constitutes a critical stage, but it is also a crucial moment in post-natal growth and for nutrient metabolism in the piglets. This period is characterized by the reduction of the metabolic activity, decrease in nutrient absorption and increase in the susceptibility to enteric diseases, as a consequence of the sudden separation from the sow and the union with other litters in a different environment (Ciro-Galeano *et al*., 2015).

One of the alternatives to decrease these problems is to include in the diets compounds that improve the intestinal health, among which probiotics stand out (Zhao *et al*., 2014); these products were originated in the 20th century, were mentioned for the first time by the Russian scientist Metchnikoff (Lama, 2014) and are formed by living microorganisms which exert a beneficial effect on the intestinal tract of the host, because they contribute to maintain and reinforce the defense mechanisms against pathogens, without disturbing the physiological and biochemical functions (Guevara, 2011).

In Cuba, as part of the research-development work of the Pastures and Forages Research Station Indio Hatuey, a biopreparation was obtained that because of its microbial composition has similar actions to those of probiotics, and which has been registered under the trademark IHplus®. It is composed by a group of microorganisms obtained by spontaneous fermentation, a part of which are lactic bacteria (Suárez *et al*., 2011). Hence the objective of this research was to evaluate the effect of IHplus® on the productive and health indicators of piglets.

Materials and Methods

The study was conducted at the basic state rearing unit (UEB for its initials in Spanish) Laberinto, belonging to the Pig Production Enterprise Matanzas –Colón municipality, Matanzas province, Cuba–, in a rearing system on flat deck (pens of plastic grooved floor separated from the soil at 0,40 m to prevent possible flooding).

The experimental treatments consisted in four groups of newly-weaned piglets (females and castrated males, 26 days old and with average weight

of 5,96 kg), which were divided according to a completely randomized design into: control, without inclusion of IHplus® in the diet (T1), inclusion of 40 mL piglet^{-1} day^{-1} of IHplus® (T2), inclusion of 80 mL piglet^{-1} day^{-1} of IHplus® (T3), inclusion of 120 mL piglet^{-1} day^{-1} of IHplus® (T4).

For each treatment there were twelve pens with 10 piglets each, for a total of 480 animals. The feeding with concentrate feed was done in lineal troughs, three times per day, in equitable portions (table 1), according to the procedures established in the Resolution 12/2010 of GRUPOR (Grupo de Producción Porcina, 2013).

Table 1. Quantity of concentrate feed (kg animal^{-1} day^{-1}) supplied to the piglets during the pre-fattening period.

Day	Week		
	1	2	3
Thursday	0,180		
Friday	0,180	0,200	0,450
Saturday	0,185	0,200	0,460
Sunday	0,190	0,250	0,475
Monday	0,190	0,250	0,485
Tuesday	0,195	0,250	0,485
Wednesday	0,200	0,260	0,530
Thursday	0,200	0,280	0,535
Total intake	1,520	1,690	3,420

The bromatological composition of the feedstuff used (starter concentrate feed, from national origin) is detailed in table 2.

To guarantee that the piglets consumed the indicated doses of IHplus®, it was homogeneously mixed in the solid components of the diet and supplied in the first feedstuff offer in the morning, according to the recommendations made by Rodríguez-Torrens *et al*. (2013).

Table 2. Bromatological analysis of the concentrate feed.

Bromatological composition	%
Crude Protein	16,00
Crude Fat	2,3
Crude Fiber	36,92
Moisture	8,1
Ash	5,14
Calcium	1,53
Dry matter	90,04
Organic matter digestibility	86,77

The experimental period coincided with the time the piglets are maintained in the pre-fattening category in this farm (21 days), which is relatively short, but it is the one established for rearing units when delivering the pigs to individual farmers who have an agreement with the state enterprises.

To evaluate the productive performance the live weight increase, mean daily gain (MDG) and feed conversion (FC) were measured. The animals were weighed twice, with a Kern scale of 15 kg of capacity and accuracy ± 0,01 kg, at the beginning and the end of the trial, specifically in the morning before were fed. Intermediate weighing was avoided, because the experimental period was short and the stress generated by this process could mask the experimental results.

The health indicators were daily supervised, and the pathologies that appeared were evaluated and treated by the veterinary doctor of the unit. To evaluate the epizootiological status of the groups the sick, recovered and total sick animals were counted; and the prevalence, negative incidences per recovery and mortality rate were calculated, through the following formulas:

Prevalence

$$Pv = \frac{ET}{AS} * 100$$

Where:

Pv: prevalence, ET: total sick animals, AS: susceptible animals.

Negative incidence per recovery

$$INR = \frac{AR}{AS} * 100$$

Where:

INR: negative incidence per recovery, AR: recovered animals, AS: susceptible animals

Mortality rate

$$Mt = \frac{AMS}{AS} * 100$$

Where:

Mt: mortality rate, AMS: dead and/or slaughtered animals, AS: susceptible animals

A proportion comparison analysis was performed on the data of those indicators, with the statistical package Statgraphics plus version 5.1 (2002). The differences among means were determined by Duncan's (1955) multiple range test.

Results and Discussion

The initial weights of the groups did not show significant differences, which allowed to initiate the experiment uniformly, condition that, according to Mercado *et al*. (2013), is determinant to corroborate the effectiveness of a biological additive.

At the end of the evaluation period treatments T1 and T2 did not show significant differences between them regarding the productive indicators (table 4), which indicates that the dose of 40 mL of IHplus® animal^{-1} day^{-1} did not have incidence on the productive performance of the animals, possibly due to the low concentration of microorganisms and the passage rate of the digesta which, at early ages, is very fast and does not favor the conditions for their colonization in the digestive system (Palomo, 2015).

The animals that received the highest doses (80 and 120 mL of IHplus®) had a significantly better ($p < 0,05$) zootechnical performance with regards to those of T1 and T2, with higher results in the group to which T4 was offered. The increase of the mean daily gain in 14,4 and 31,8 g day^{-1} for T3 and T4, respectively, with regards to the control, which was also related to the improvement in feed conversion, should be emphasized, because groups T3 and T4 consumed 83 and 66 % of the concentrate feed to reach one kilogram of live weight increase with regards to those of T1 and T2; this shows a better utilization of the feedstuff nutrients and a better development of the animals in the groups that were fed the highest doses.

In this sense, one of the main problems of the post-weaning period is that it generates a disruption in the normal microbiota of the gastrointestinal tract, with changes in the bacterial flora of the cecum, increase in the enterobacteria and decrease of the acid-lactic bacteria that abound in the lactating piglet, for which the addition of adequate doses of this type of lactic bacteria (such as the ones found in IHplus®) could regenerate the digestive balance of these animals (Giraldo-Carmona *et al*., 2015).

Studies conducted by Giang *et al*. (2012) assert that the introduction of microorganisms in the diets promotes modifications in the microbiota of the gastrointestinal tract, with increase in the count of the acid lactic bacteria related to the supplied probiotic and decrease of the pathogen bacteria, especially those corresponding to the group of fecal coliforms. Because this effect is higher as the probiotic supply time increases, the piglets improve their weight gain, feed intake and feed conversion.

On the other hand, (Zhao *et al*., 2014) stated that the use of probiotics in the diet of piglets weaned at 14 days induced higher gains, because it increased the absorption of nitrogen compounds; while (Ciro-Galeano *et al*., 2015) reported that their use promotes mucins, action which, by improving intestinal health, allows piglets to show better clinical, health and productive indicators.

The analysis of the proportion comparison regarding sick, recovered and dead animals with regards to the total is shown in table 5.

These indicators show that the supply of IHplus® improves the expression of all the variables in the animals, with the most positive results in T3 and T4, which statistically differed ($p < 0,05$) from the other evaluated groups for the total proportion of dead animals.

T3 and T4 showed the lowest prevalence percentages, with T4 as the most representative; in addition, they allowed to reach a recovery rate of 100 % of the affected stock, with zero mortality percentage. In the groups T1 and T2 a deterioration of these indicators was appreciated (table 6).

Ciro-Galeano *et al*. (2016) refer that the probiotics improve the health of the animals and constitute an alternative nutritional therapeutic strategy with regards to the use of antimicrobial compounds, because by

Table 4. Productive indicators of the animals.

Treatment	Initial weight (kg)	Final weight (kg)	MDG (g animal^{-1} day^{-1})	FC (kg DM kg^{-1} LW)
T 1	5,99	7,26^{c}	60,5^{c}	6,01^{c}
T 2	5,93	7,22^{c}	61,5^{c}	6,01^{c}
T 3	5,96	7,54^{b}	74,9^{b}	4,99^{b}
T 4	5,98	7,92^{a}	92,3^{a}	3,98^{a}
SE ±	0,24	0,07	0,97	0,91

Values with different superscripts in the same column differ for $p < 0,05$

Table 5. Proportion of sick, recovered and dead animals.

Treatment		SE ±	Sig.
Total proportion of sick animals			
T1	0,37[b]	0,07	*
T2	0,29[ab]		
T3	0,26[ab]		
T4	0,09[a]		
Total proportion of recovered animals			
T1	0,32	0,08	NS
T2	0,29		
T3	0,29		
T4	0,10		
Total proportion of dead animals			
T1	0,75[b]	0,22	*
T2	0,25[b]		
T3	0,00[a]		
T4	0,00[a]		

Similar superscripts in the same column do not differ among themselves ($p < 0,005$)

Table 6. Epizootiological indicators of the groups of animals that were evaluated in each treatment.

Indicator	T1	T2	T3	T4
Prevalence	21,67	16,67	15,00	5,00
Negative incidence	16,67	15,00	15,00	5,00
Mortality	5,00	1,67	0,00	0,00
Total of animals	60	60	60	60

improving the morphometric characteristics and intestinal architecture of the villi and crypts, stimulate the immune response and nutrient absorption.

On the other hand, Lukić *et al.* (2012) reported that the acid lactic bacteria, besides favoring the mucin production at intestinal level, also promote the expression of mucin-binding proteins (MucBP), which inhibits the adherence of pathogen bacteria to the intestinal mucosa.

The results of this research are in correspondence with those obtained by Vélez-Zea *et al.* (2015), who found that the effect of probiotics on the immune response of the animals is not limited to the intestinal tissue, but they also favor the systemic immunity, with beneficial effects on different high-prevalence diseases, as well as on allergic processes.

Arribas (2009) proved that there are variable effects among different probiotics and on the immunological responses of different species. This author reported that many lactobacilli species have the capacity to stimulate mainly humoral responses, while others promote cell immunity. As IHplus® has a varied set of bacteria, from the above-referred facts it can be expected that this bioproduct with probiotic action has a multifactorial effect on the health of the treated animals, which justifies the results of this study.

It can be concluded that with the dose of 120 mL of IHplus® animal^{-1} day^{-1}, mixed with the starter concentrate feed (of national origin), the best results are reached in the productive and health indicators of pre-fattening pigs, because the maximum expression of the probiotic effect of the bioproduct is promoted, by favoring the proliferation of the beneficial flora in the intestine, for which it is recommended to introduce this dose in the diets of this category.

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