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Research Article

Increases in Crude Protein in Concentrates for Pig Pre-Fat Fermented with Multipurpose Autochthonous Microorganisms

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Resume

The objective of the research was to determine the increase in crude protein in pre-fattening concentrates fermented with activated multipurpose autochthonous microorganisms (MAM-A). For this, three groups were used: 1) Concentrate for pre-priming (control). 2) A ratio of 0.5 kg of concentrate/120 mL of MAM-A, up to a weight of 3 kg. The mixture was covered with water for 12 hours in a 20 L bucket. 3) Same as described above, but fermented for 24 hours. The presence of Salmonella and the total of fungi and yeasts were determined in all of them according to standards for non-lactic products. The crude protein was established using a Kjeltec I system. Three replicates were made for each variant. Only the 24-hour fermented variant reached and exceeded (26,5) the suggested protein content for pre-fattening (23.7). Result that can be associated with greater microbial growth over time, as reflected in the yeast counts: 1.1 x 103, 2.2 x 103 and 2.9 x 103 cfu/g in the feed without mixing and fermented with MAM 12 and 24 hours, respectively. It is an effective and easy-to-apply option in pig production.

Abstract

The purpose of this research was to determine crude protein increase in pre-fattening pig concentrate fermented with activated multipurpose autochthonous microorganisms (MAM-A). The study comprised three groups: 1) Pre-fattening pig concentrate (control); 2) 0.5 kg of feed/120 ml of MAM-A, till 3 kg, the mix was soaked in water for 12 hours in a 20 L bucket; and 3) Same as described above, but following a 24-hour-fermentation. The presence of Salmonella, fungus, and yeast was determined according to the norms for non-lactic products. Crude protein was determined using a Kjeltec system 1. Each variant had three repetitions. Only the 24-h fermented concentrate reached and went above (26.5) the protein contents recommended for pre-fattening animals (23.7). This result may be linked to higher microbial growth over time, as observed during yeast counts: It is an easy effective option for swine production.

Keywords: Pigs; Liquid Feed; Protein Increment; Multipurpose Autochthonous Microorganisms; Pre-Digestion of Food

Introduction

Fermented liquid feed technology in swine nutrition is an ideal option to replace antibiotics as growth promoters after weaning and without their adverse effects . The product contributes to repair the anatomical and physiological damage of the intestinal microvilli typical of the stage and promotes the establishment of

Lactobacillus spp., Streptococcus spp., And other bacterial species with probiotic action on them. The reduction in pH and the production of lactic acid and alcohol in fermentation decrease enteropathies [1].

This simple variant ranges from proposals as simple as mixing the food with water to those incorporating Lactobacillus spp. and preselected yeasts. The fermentation time takes from a few hours to days depending on the proposed purpose; It must always be stopped before the production of acetic acid starts, as the smell and taste it confers to the feed is unpleasant to pigs [2].

The final fermented product, in addition to the advantages mentioned, presents protein increases. A more digestible and better absorbed protein [3]. However, perhaps due to the refusal to give up antibiotics or hormones, some producers argue that the acquisition of the suggested microbial cultures and their maintenance is beyond their resources and possibilities [4].

Microbial mixtures such as "efficient microorganisms" (EM) or "multipurpose indigenous microorganisms" (MAM) are easy to prepare and preserve. They are composed of lactic acid bacteria (Lactobacillus plantarum, L. casei and Streptoccus lactis), phototrophic bacteria (Rhodopseudomonas palustris and Rhodobacter spaeroides) and actinomycetes (Streptomyces albus and S. griseus), yeasts (Saccharomyces cerevisiae and Candida filamentosis) and Candida filamentosis Aspergillus oryzae, Penicillium spp. And Mucor hiemalis). These consortia are readjusted in a system in which some depend on the other and achieve synergy for the exclusion of transitory pathogens [1,5].

Both ME and AMS are applied to piglets directly or in drinking water with the aim of stimulating productive parameters and health indicators [1,5-7]. The pre-fattening and fattening, with the same purpose, are dosed together with the concentrates at the time of giving the rations (Blanco., *et al.* 2017).

The microbial diversity inherent in these mixtures makes it difficult to determine the length of time a fermentation should last to achieve fermented liquid feeds with higher crude protein contents. Therefore, the objective of this research was to determine the increase in crude protein in pre-fattening feeds fermented with MAM for 12 and 24 hours.

Materials and Methods

Preparation of multipurpose autochthonous microorganisms (MAM)

The liquid mother, acquired at the Indio Hatuey Pasture and Forage Experimental Station, was propagated and activated as suggested by Barreto., *et al*. (2021). Two weeks later, a product with a bittersweet smell, typical of lactic fermentations, with a pH lower than 3.5 was achieved. This activated form was used in the experiment.

Concentrates

The experiment comprised three variants: 1) pre-primed concentrate (CP, acted as a control); The composition declared by the manufacturer is attached (Table 1). 2) A homogeneous mixture of 120 mL of MAM-A/0.5 kg of CP to a final weight of approximately 3 kg that was covered with water. The preparation was carried out in a 20 L bucket on which a non-hermetic lid was placed to avoid contact with insects and rodents. It, identified with the type of treatment, was kept in a cool place for 12 hours until its use. 3) Same as above but fermented for 24 hours.

Components (edit)	Percentage
Corn	54.55
Am	37.50
Calcium	0.80
Phosphate	0.90
Salt	0.30
Nucleous porcine	2.50
Methionine	0.10
Lysine	0.40
Hill	0.15
Biotonic	0.10
Glucosyl expanded	0.20
Sugar	2.50

Table 1: Composition of pre-priming concentrates according to the manufacturer.

Taking and processing of the food samples analyzed

It was carried out by the method of the rooms. To this end, the tank was divided into four parts to take portions of two opposite

rooms. The procedure was repeated successively to ensure the amount equivalent to three replicates. Their transfer to the Laboratory of Agro-Environmental Control (LABCA), of the University of Camagüey, was carried out in transparent polyethylene bags of 1 kg, duly identified and tied to avoid the loss of humidity. They worked at the moment so as not to violate the action time of the MAM-A.

Determination of crude protein values

It was determined by the Kjeldahl method, using a Kjeltec I system. The CP contents were expressed as PB = N x 6.25 according to the recommendations of the Association of Official Analytical Chemist [8].

Microbiological analysis of feed

The analysis was carried out in the Territorial Laboratory of Camagüey, belonging to the National Office of State Inspection (ONIE) of the Ministry of the Food Industry. For the transfer of the samples, the procedure was the same as described above. The determinations made were made according to NC 605: 08, for the detection of Salmonella and NC 1004: 2016, concerning the enumeration of fungi and yeasts in non-lactic products (cfu/g).

Results and Discussion

As you can see, Only the concentrate treated with MAM-A for 24 hours reached the protein content required by pre-fattening (Table 2), as established in the Manual of technical procedures for pig farming.

The criteria regarding nutritional requirements have been established under conditions of feeding, racial crossing and ownership of each country, so they differ when compared . In the case of Cuba, it has been regulated that growing pigs weighing between 5 - 10 kg should be given concentrates with 23.70% of crude protein, a value that will decrease as the animals increase their weight (Macías., *et al*. 2015). The one supplied by the manufacturer for these experiments did not meet the requirement.

[9,10] in independent experiments aimed at improving the crude protein (CP) contents in foods based on cassava (Manihot esculenta Crantz) by fermentation with Saccharomyces cerevisiae, achieved values between 30.4% and 47.0%, respectively. Remarkable results if one takes into account that before the treatments the percentages of CP ranged between 2% and 3%. Polyorach., *et al*. (2013) attributed the change to the high growth of yeast (3.0 x 1011 cells/mL). Phenomenon associated with the ability of Saccharomyces cerevisiae to secrete extracellular enzymes (amylases, linamarase and cellulase) in the cassava mass and to degrade starches and other polymers that contribute to said growth.

Study groups	PB content (%) Replicas	Average of PB (%)
Dry concentrate (control)	16.4	16.1 a
	16.5	
	15.6	
Fermented concentrate 12 hours	21.8	20.6 b
	20.2	
	20.0	
24 hour fermented concentrate	25.8	26.5 c
	27.0	
	26.7	

Table 2: Crude protein values determined in the three variants.

Gunawan., *et al*. (2015) with the dual purpose of increasing the protein ranges of cassava pulp and reducing its levels of hydrocyanic acid, subjected it to independent fermentations with Lactobacillus plantarum, Saccharomyces cereviseae and Rhizopus oryzae. In relation to the first objective, from CP levels of 1.92%, they went to 8.58%, 2.29% and 4.72%, respectively. While the hydrocyanic values (17.5 mg/kg), in the same order, were reduced to 1.80; 3.28 and 3.17 mg/kg. Reasons why the authors suggest the use of L. plantarum for fermentations with the same purpose.

More recently, Polyorach., *et al*. (2018) carried out an experiment with fresh pulp and dry cassava grating (with CP contents equal to 3.1f% and 3.5f%, respectively) that were subjected to fermentations with: yeasts (Y), efficient microorganisms (EM) and a mixture of both (EMY). After three days of microorganism-substrate interactions in the shade, followed by drying in the sun for 48 h, the CP contents of the fresh ground substrate were: 28.7e% (Y), 30.4d% (EM) and 31 , 8c% (EMY). Meanwhile, the values obtained for dry scratching amounted to: 42.1% (Y), 44.2% (EM) and 45.3% (EMY).

Polyorach., *et al*. (2018) attributed such high increases to the growth and proliferation of yeasts, as well as to the bacterial complex implicit in MS, equivalent to unicellular proteins (single cell

protein). To this must be added what is contributed by filamentous fungi, both in terms of cellular protein content, and in the abundant production of extracellular enzymes. More detailed and current information on the advantages associated with the production of unicellular proteins by various routes is discussed in the proposal by [11].

In the microbiological analyzes carried out on the three variants of concentrate studied, it was concluded that: there was no presence of Salmonella [12], and the yeast content was 1.1 x 103, 2.2 x 103 and 2.9 x 103 cfu/g in the unfermented feed and the same predigested with MAM-A 12 and 24 hours, respectively [13-15]. Results that corroborate what was stated by Polyorach., *et al*. (2018).

In a parallel experience, in which the three variants were given to homogeneous groups of post-weaning pigs, it was found that only the concentrates fermented with MAM-A 24 promoted positive responses in the blood parameters analyzed (Rodríguez., *et al*. 2021).

In future experiences, it would be of interest to evaluate the participation of other microorganisms present in MAM-type mixtures, not considered in this case.

Conclusions

The highest percentages of crude protein were obtained in the concentrates fermented with MAM for 24 hours, which may be due to a higher microbial population growth, with an emphasis on yeasts. It is a sustainable option and easy to apply in pig production.

Thanks

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Conflict of Interests

They do not exist.

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