Multipurpose Autochthonous Microorganisms to treat Neonatal Swine Colibacillosis

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ABSTRACT

The effectiveness of multipurpose autochthonous microorganisms was evaluated as a therapeutical alternative in Yorkshire pigs with neonatal colibacillosis. Morbidity and mortality data from Camujiro Special Swine Center, Camagüey, Cuba were processed in the June-July, 2012 period; most animals (89.8 %) recovered after the therapy.

Key words: *swine colibacillosis, enterotoxigenic* Escherichia coli, *multipurpose autochthonous microorganisms*

INTRODUCTION

Neonate swine colibacillosis causes numberless losses in swine systems; therefore, there is a need for reproductive specialization to better zootechnical management (Macías *et al.*, 2015). In 2008, the disease caused 8.9 % of the total deaths in Cuba, which accounted for 67 % of all piglet deaths, and 31 % in pre-fattening pigs, in terms of enteropathies (Campal, 2009).

The disease is presented as a consequence of enterotoxigenic *E. coli* strains (ETEC), producing F4, F5, F6, F18 and F41 fimbriae that favor bacterial adhesion to the host's small intestine receptors, colonization, and —when threshold population is reached— release of heat labile (LT), heat stable (STb) toxins, or both, which are responsible for diarrhea and dehydration of animals (Cox, 2011).

Cox (2011) refers to the nutrition-microbiota-host relationship; the newborn are protected with colostrum, especially when the mothers have been vaccinated. A Cuban experience was VACOLI, a recombinant vaccine that included antigens F4; F5; F6 and F41 (Campal, 2009). The protection ends at weaning, though expression of F5; F6 and F41 receptors for enterocytes is poor, abundant ligands for F4 are observed in Jejunum, which make them targets for ETEC $F4^+$, verotoxigenic *E. coli* (VTEC) $F18^+$, or for those with dual phenotypes (Barreto, 2007).

F18 is a little immunogenic fimbria; hence, the vaccines that include it as antigen are ineffective to prevent swine colibacillosis or edema. It is vital to maximize control of factors causing the disease, like overcrowding, heat stress in the summer, and excessive humidity during parturition. It is also important to keep adequate hygiene and proper handling practices during delivery, and vaccinate against ETEC $F4^+$ (Cox, 2011).

That multifactorial task, including antibiotherapy has been used along with efficient microorganisms (EM), started in Japan, in the 1970s (Zakaria *et al.*, 2010), now widespread in Latin America, including Cuba (Rodríguez *et al.*, 2013). As microorganisms live on virgin soils, whose characteristics vary from country to country, they will be called multipurpose autochthonous microorganisms (MAM), given by *Indio Hatuey* Experimental Station.

The aim of the work was to assess regional MAM effectiveness to treat neonatal swine colibacillosis.

MATERIALS AND METHODS

This research took place at Camujiro Specialized Swine Center, on Circunvalación Norte km 2, province of Camaguey, Cuba. The goal of the center is multipurpose; it has an area for breeding and another for growing and fattening Yorkshire pigs. Recorded data from colibacillosis related deaths (100), sick animals during the outbreaks (559), and animals that recovered after treatment with local MAM (502), between June and October 2012, were collected. The effect of this variant on neonatal colibacillosis without the application of another alternative, or conventional treatment, was assessed.

Preparation of MAM mixture

The original preparation was made at *Indio Hatuey* Experimental Station, in Matanzas, Cuba, from dead leaves in virgin areas near the facility studied. It was propagated and activated in a 2 hectoliter plastic tank, with cover, as described by Rodríguez *et al.* (2013). Two weeks later, a sweet sour product from lactic fermentations (pH below 3.5) was achieved, only if these two conditions are met (pH and smell), the product is ready for that purpose, because it has adequate *Lactobacillus* spp. and *Saccharomyces* spp growth.

Treatment applied

The undiluted mixture was orally administered to sick animals with apparent signs of the disease. The dose used was 5-7 ml, depending on the piglets´ body weight and their physiological status.

Processing of the results

The results were statistically analyzed using the t-test for a sample, by Statgraphics Centurion XV 15.2.06 (Stat Point, Inc. 1982–2007).

RESULTS AND DISCUSSION

Effect of MAMs on diarrhea treatment and control

From the total number of 559 sick animals, 502 in the piglet category were recovered, using ME, which represented 89.8 % (see figure).

Diarrhea in domestic animals is very frequent, especially observed in very young and just weaned animals, leading to significant economic losses both in bovine and swine (Meganck *et al.*, 2014; Windeyer *et al.*, 2014). Countries like the United States consider ETEC as the main cause of neonatal and post weaned diarrhea in pigs, which also causes breeders annual millionaire losses (Bunner *et al.*, 2007; Cox, 2011).

In some countries, the choice to prevent colibacillosis is vaccines. In Cuba, the Center of Genetic Engineering and Biotechnology (CIGB), in Camagüey, developed a recombinant alternative known as VACOLI. In spite of its favorable results, it is still not mandatory for swine (Campal, 2009).

Another successful variant against gastrointestinal diseases is the application of prebiotics and probiotics (Boirivanta and Strober, 2007; Delgado, 2014), with just a few adepts, unfortunately, despite its (Aquilina *et al.*, 2014). The efficacy of this alternative has been associated to the presence of bacteria like *Lactobacillus plantarum, Lactobacillus casei* and *Streptoccus lactis*, or well-known yeasts like *Saccharomyces cerevisiae* and *Candida utilis* (also a combination of the two microbial forms) in these products (Zakaria *et al.*, 2010; Abdullah *et al.*, 2011). These are species whose inclusion in the MAM mixtures, such as the one used in this work, is stimulated when the mother solution propagates in media with lacto serum and sugar cane molasses, with a final pH below 3.4, and heightened osmotic pressure, provided by a microaerophilic environment (Rodríguez *et al.*, 2013).

The effects of these species to control and prevent diarrhea are very diverse; bacterial species block ligand for enteropathogens, an essential step to colonization and further release of enterotoxins (Corcionivoschi *et al.*, 2010). Both acidic-lacto yeasts and bacteria modify the pH in the intestinal lumen (pH < 4, not tolerated by certain enteropathogens) due to the production of organic acids (especially lactic acid), and short-chained fatty acids (acetate, propionate, and butyrate) (Morrison *et al.*, 2006). These benevolent microorganisms also produce antimicrobials or antimetabolites, like nysin and lactaline, which destroy toxins (Liévin *et al.*, 2000). Besides these microorganism antagonistic effects to enteropathogens, hydrogen peroxide production must be considered (Corr, 2007).

CONCLUSIONS

The application of efficient microorganisms is a feasible therapeutical alternative to treat neonate swine colibacillosis.

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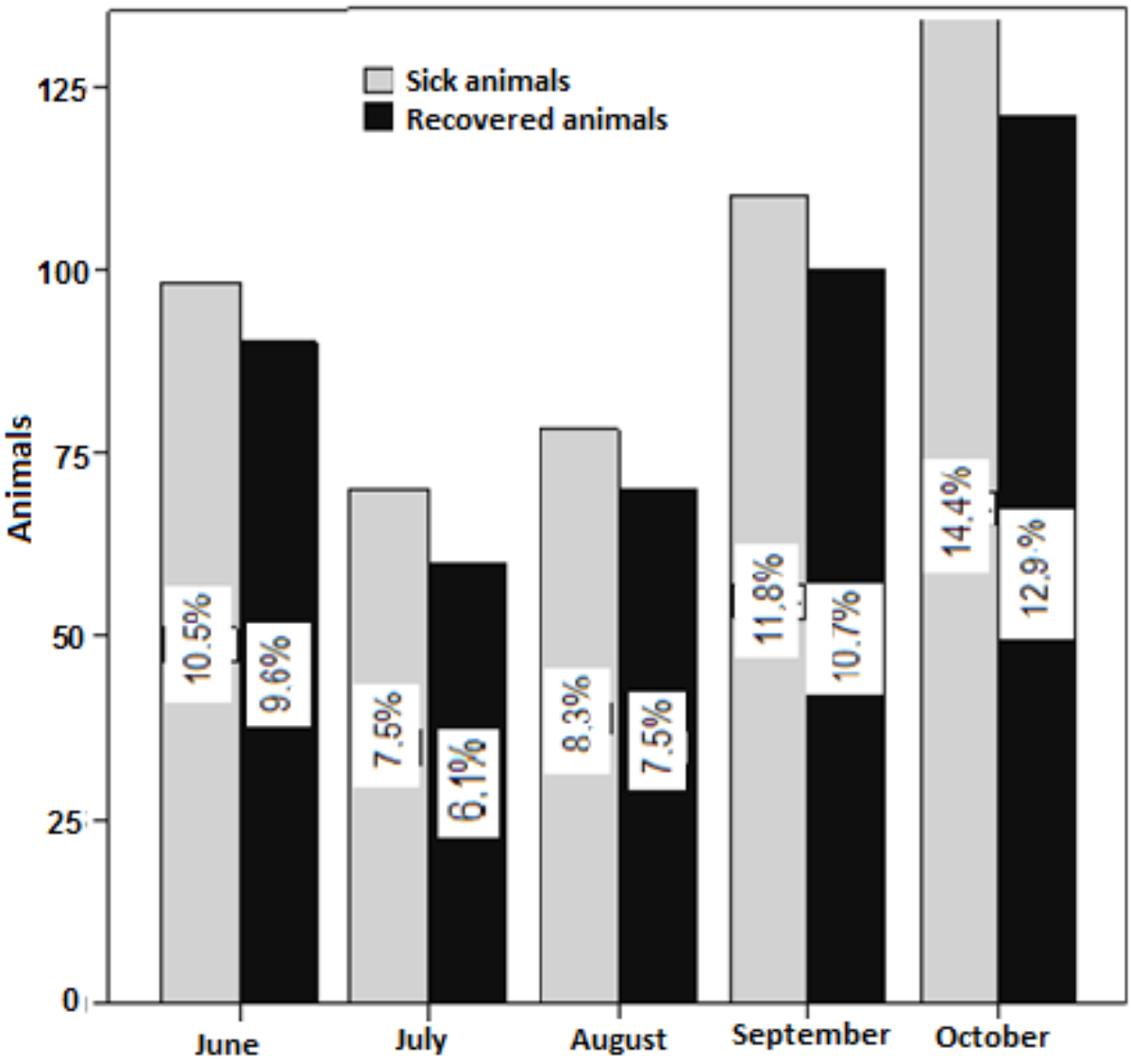

Fig. Sick and recover animals (MAM treatment)