

INCLUSION OF CINNAMON AND BANANA FLAVORINGS IN THE DIET OF WEANING PIGLETS

(Inclusão de aromatizantes à base de canela e banana na dieta de suínos recém desmamados)

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ABSTRACT - The weaning period is one of the most critical stages in pig farming because of the stress that animals suffer when separated from their sow, along with the health challenge, fights for hierarchy, food competition and several other factors, which causes a decrease in their feed intake affecting their weight gain. Thus, the objective of this work was to determine the efficacy of including flavorings (cinnamon and banana) in the diet of recently weaned piglets on their weight gain, feed intake and feed/gain ratio. For this, 20 weaned and castrated 28-day-old male piglets weighing between 6.5 - 8 kg were randomly divided into five groups: Control treatment: unflavored food; Treatment 1: food with banana flavor; Treatment 2: food with canela flavor; Treatment 3: food with banana for 10 days - canela 10 days and banana 10 days; and Treatment 4: : food with canela for 10 days - banana 10 days and canela 10 days. The flavorings were added at 1 g/kg of the diet. The feeding period lasted 30 days for each treatment. Analysis of variance (ANOVA) was used for the statistical analysis, and differences were accepted with $p < 0.05$. At the end of the study, it was determined that the weight gain, feed intake and feed/gain ratio were similar between the treatments ($P > 0.05$). From this, it can be suggested that the inclusion of flavorings (cinnamon and banana) in the diet of weaning piglets does not improve their growth performance.

Key words: flavors, food consumption, weight gain, feed/gain ratio.

RESUMO - O período de desmame é uma das etapas mais críticas na criação de porcos, devido ao estresse que os animais sofrem ao serem separados de sua mãe, junto com o desafio da saúde, lutas pela hierarquia, competição alimentar e vários outros fatores, que causa uma diminuição no consumo de alimentos com consequente queda no ganho de peso. Sendo assim, o objetivo deste trabalho foi determinar a eficácia da inclusão de aromatizantes (canela e banana) na dieta de leitões recém-desmamados sobre seu ganho de peso, consumo de ração e conversão alimentar. Para isso, 20 suínos machos desmamados e castrados com 28 dias de idade e peso entre 6,5 - 8 kg foram divididos em cinco grupos: Tratamento controle: alimentos sem sabor; Tratamento 1: alimento com sabor a banana; Tratamento 2: comida com sabor a canela; Tratamento 3: comida com banana 10 dias - canela 10 dias e banana 10 dias; e Tratamento 4: alimentação com canela 10 dias - banana 10 dias e canela 10 dias. Os aromatizantes foram adicionados em 1 g de aromatizante/kg de alimento. O período de alimentação durou 30 dias para cada tratamento. A análise de variância (ANOVA) foi utilizada para a análise estatística, e as diferenças foram aceitas com $p < 0,05$. Ao final do estudo, foi observado que o ganho de peso, o consumo de ração e a conversão alimentar foram semelhantes entre os tratamentos ($P > 0,05$). A partir disso, pode-se sugerir que a inclusão de

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aromatizantes (canela e banana) na dieta de leitões recém-desmamados não melhora o seu desempenho zootécnico.

Palavras-chave - aromas, consumo alimentar, ganho de peso, conversão alimentar.

INTRODUCTION

The Food and Agriculture Organization (FAO) of the United Nations points out that the consumption of pork is one of the largest in the world (FAO, 2016). In Ecuador in 2020, the swine population was approximately 1.06 million heads, being 29.9% were of a specific race, 44.2% mestizo and 25.8% Creole (INEC, 2021); there was a per capita consumption of 10 kg/person/year of pork in the country (YAGUAL, 2015). It is necessary to improve the productive rates in piglets, mainly at the time of weaning when they suffer greater stress.

The continuous genetic selection in sows has resulted in a greater number of piglets per litter but with greater problems in birth weight, as well as various alterations in the gastrointestinal system of the piglets (example less weight of the gastrointestinal tract and reduction in the size of the pancreas), and these effects have ultimately increased animals mortality and productive efficiency (QUISIRUMBAY GAIBOR; VÍLCHEZ PERALES, 2019). In pig farming, weaned piglet feeding is one of the most critical aspects with severe consequences on productive yields throughout its life cycle (GUATO, 2015). Weaning is the stage of greatest stress for newborns with a consequent decrease in dietary intake and drastic weight loss, due to stress caused by exposure to factors such as separation from the mother, switch from liquid to solid diet, new social order within the barn, change of facilities, health challenge, food competition and several other factors (BARBA-VIDAL; MARTÍN-ORÚE; CASTILLEJOS, 2018; ESCRIBANO et al., 2019; PADILLA, 2006)

Several research have been carried out with the purpose of minimizing this effect and proposing several alternatives which provide a solution to the non-consumption or low consumption of food in pigs. One of them is the use of food flavorings that appeal to the animal and cause it to consume more avidly and in greater quantity (MESAS, 2011; VÍLCHEZ, 2013). For that reason, generally, an optimally functioning gastrointestinal tract is very important to the overall metabolism and performance of pigs of all productive stages (PLUSKE; TURPIN; KIM, 2018).

It has also been shown that flavoring supplement tends to reduce the sow weight loss, as well as in weaned piglets, increasing their survival rate (HE et al., 2017), because early exposure to certain flavors may result in an additional beneficial preference for

these compounds. This could be evidenced later in life and could positively affect the acceptance of food that contains a similar flavor and, therefore, benefit all zootechnical parameters (BLAVI *et al.*, 2016). A study on adding taste to piglets diet showed that its use in post-weaning feed may be important for piglets with low weight, as animals favored food with flavoring while the diet without flavoring did not obtain the expected results (VILCHEZ, 2013). Thus, the present investigation evaluated the effect of the nutritional inclusion of 2 flavorings (cinnamon and banana) in the diet of weaning piglets on their daily weight gain, feed intake and feed/gain ratio.

MATERIAL AND METHODS

Animals and facilities

The research was carried out in the pig program facilities of the Uyumbicho Experimental Center, located in the Province of Pichincha, Cantón Mejía, Uyumbicho Parish, Ecuador. 20 Landrace-York castrated male piglets were randomly selected, born in the center itself, with 28 days old and weighing between 6.5 and 8 kg. they were divided into five groups of 4 animals each, considering that the flow of animals in the experimental center is not constant. Once the litter was obtained, the surgically castration of the piglets was carried out at 21 days of age. Weaning was performed on the selected animals 28 days after birth. After selection, the pig pens were cleaned and disinfected. The disinfection was performed with Delegol at a dose of 1ml/100 ml of water. The pig housing was adapted by dividing each corral into four spaces, and infrared spotlights and bells were placed to maintain an adequate temperature. When the piglets entered the rearing area, they were kept at a temperature between 28 and 30°C, and the temperature decreased over the total period. Five groups were established in pens that were 3.50 m long and 1.22 m wide, containing 4 piglets each. The pens and feeders were cleaned daily to prevent any disease or infection. These were chosen completely at random, and later, they were identified according to the treatment to which they belong. The animals were offered food in 4 daily servings and water *ad libitum*.

Experimental Diets

TO (Control group: no flavoring), T1 (Treatment1: 1g of Banana flavoring / kg of food was added), T2 (Treatment 2: 1 g of Canela flavoring / kg of food)), T3 (Treatment 3: flavorings were added interspersed, 10 days banana flavor, 10 days canela flavor and 10 days banana flavor, with a dose of 1 g of flavoring / kg of food), and T4 (Treatment 4:

also intercalated 10 days of canela flavor, 10 days of banana flavor and 10 days of canela flavor, at a dose of 1 g of flavoring / kg of food). The chemical composition of the food is indicated in the Table 1.

Table1: Chemical composition of used food

Nutrient	Parameter	Percentage (%)
Crude protein	min	21.3
Crude fat	min	6.5
Crude fiber	max	2.0
Ash	max	6.5
Humidity	max	10.0

The feeding was carried out with a balanced diet without taste, which was milled in advance and mixed with the flavoring (Flavit Canela and Flavit Banano, PREMEX Company) to 1mg / kg of balanced diet. The amount of food provided to the animals was based on tables recommended by the PRONACA company, and it was served in four daily rations divided as follows: 8 a.m., 10 a.m., 12 p.m., and 3 p.m. to avoid greater waste. Water for each experimental unit was provided ad libitum with the presence of a pacifier for each division.

Data taken and evaluation methods

At the beginning of the experimental phase, the weight was obtained at the time of animal weaning. Likewise, the weekly weight was recorded, that is, the piglets were weighed at an interval of seven days until day 60, which was also measured for recording the final weight; these data were expressed in kg. Weight Gain was achieved thanks to the initial and final weight records divided by the total number of days for the rearing experimental phase period; these data were recorded in kg/animal/day. To determine consumption of food, an exact amount of food was provided to the animals, which was rationed in four portions per day in order to achieve maximal intake and to avoid waste. For data collection, these were recorded in g/animal/day. Daily records of the consumption of the balanced diet were measured, and this was carried out 4 times a day in order to observe if the animals consumed all the food or if they left residues. The

samples were weighed, and the real consumption was determined. Food consumption was obtained with the following formula: food offered - residual food. For calculation of feed conversion index, two important data were considered: weight gain and food consumption (FCI = food consumption/weight gain).

Statistical analysis

Once collected, the data was processed in the free statistical package RStudio version 1.2.5019 [RStudio Inc. Boston, MA, USA] with a level of statistical significance of $p < 0.05$. This analysis was performed to determine measures of central tendency and dispersion for each of the variables under study (weight gain, feed intake, feed/gain ratio). The means were compared through Analysis of Variance (ANOVA) tests, and a value of $p < 0.05$ was accepted for significance.

RESULTS & DISCUSSION

The productive parameters: initial weight, final weight, daily weight gain (GDP), total weight gain (GTP), feed intake (FI) and feed/gain ratio (FGR) of the 5 treatments are detailed in Table 2. It was observed that there was no significant difference ($p > 0.05$) between the treatments performed in all parameters.

Table 2. Mean of the productive parameters (initial weight, final weight, daily weight gain, total weight gain, feed intake and feed/gain ratio) of piglets feed with flavorings.

Productive Parameters	T0(kg)	T1(kg)	T2(kg)	T3(kg)	T4(kg)	P Value
Initial weight	7.13	7.00	7.38	7.00	7.31	0.832*
Final weight	20.25	22.31	20.63	20.44	21.81	0.182*
GDP	0.44	0.51	0.44	0.45	0.49	0.104*
GTP	13.13	15.31	13.25	13.44	14.50	0.24*
FI	17.50	17.88	17.30	17.20	17.53	0.25*
FGR	1.35	1.17	1.32	1.28	1.21	0.284*

T0: Control, T1: Treatment 1, T2: Treatment 2, T3: Treatment 3, T4: Treatment 4, *non-significant

The stress that is caused by weaning in piglets triggers abrupt taxonomic and functional changes in the intestinal microbiome (Li *et al.*, 2018). It disrupts the oxidative balance, which can affect the intestinal barrier and mitochondrial function and, as a result, it can cause mitophagy in piglets (CAO *et al.*, 2018), producing a reduction in the

absorption of nutrients. This can make piglets more susceptible to intestinal diseases that ultimately result in high economic losses to the producer (MODINA et al., 2019). Adequate management in early pig life stages, thus, will result in a digestive improvement in the adult stages of the pig (CHRISTOFORIDOU et al., 2019).

In this study, it was observed that the use of flavorings (banana and cinnamon) in the diet of piglets at weaning did not improve the weight gain, feed intake, feed/gain ratio after one month of feeding. Regarding the final weight parameter, these results do not match those obtained with the use of stevia in freshly weaned piglets water, where the addition of the flavoring had positive effects on the productive parameters (HERNÁNDEZ; RUESGA; OROZCO, 2014). This corroborates those results obtained by Guato (GUATO, 2015) for inclusion of three flavors in the diet of recently weaned piglets, as they did not observe significant differences between their treatments.

Regarding daily weight gain, the results of the present study corroborate those reported in Brazil (MARTÍNEZ et al., 2014). They used flavoring (sugar and sweetener) in the diet of newly weaned piglets, showing a non-significant difference in three of four groups studied. This also supports the results of Rodríguez (20), since they did not find a significant difference in the use of additives for feeding piglets, in addition to demonstrating a small numerical difference between the treatments studied. However, contradictory results were obtained with greater weight gaining in the treatments when compared to the control group. The difference of his research was that he included a symbiotic in the balanced diet of recently weaned piglets (the animals used in his research were both from the same parents and under the same conditions of breeding as those used before), and this could have caused a significant difference in their study (MARTÍNEZ et al., 2014).

Regarding food consumption, in similar study, the authors did not find statistical differences for this variable (MARTÍNEZ et al., 2014). In another investigation, the authors showed that diets with flavoring did not have an influence on them; thus, the use of these supplements was not efficient in improving the nutritional consumption of the animals, indicating that the weight gain was not altered (COSTA et al., 2003). In another study, piglets weaned at 21 days were used, and two types of food were compared: a standard feed without aroma and that same feed with an added coconut-dairy aroma. Their results showed that the animals that received the aromatic version of the feed that included aroma consumed 9% more food and grew 14% more, which does not match the present results (MESAS, 2011). Other research that added flavor to the diet of piglets

before and after weaning, improved food consumption and weight gaining, as animals and their descendants share a similar genetic profile and the same environment, and this leads to a similar physiological response with respect to several types of food. Likewise, the maternal information incorporated in the diet and milk could be transmitted to the offspring and affect their dietary preferences, so family odors associated with the mother could improve safety and reduce stress. This is because when piglets experience a new environment, it has also been proven that weaning animals tend to look for and prefer these familiar foods during lactation (WANG *et al.*, 2014).

With respect to the feed/gain ratio, these results agree with Guato (GUATO, 2015) who showed that there is no significant difference between their treatments and concluded that their results are related to the homogeneity that existed between the treatments at the beginning of their experimental work. The same author referenced Ambi (2014) in his work, and they cited the same contrary results observed for significant differences of values obtained from the experimental groups in the growth stage, reporting feed/gain ratio of 2.56 for the group that consumed the flavoring and 2.88 for the control group.

The present results for all parameters studied coincide with another study (BLAVI *et al.*, 2016), whose authors indicated that the presence or absence of flavor in the diet after weaning did not have an impact on body weight, average daily weight gaining, and feed efficiency throughout the experimental period. However, it appeared that familiar piglets (sows fed in the last stages of gestation with these flavorings) perceived the flavorings, and this induced cerebral responses with positive effects, although it cannot be verified if it is due to the familiarity of the flavoring. In another study, flavor was also added to sow diets, which improved piglet feed consumption and its subsequent growth after weaning (HE *et al.*, 2017).

The limitation in the research was obtaining piglets with the characteristics requested in the methodology, due to the capacity of animals of the study region. However, the study was performed with similar observational units and in experimental units under the same breeding conditions. Further studies that use a larger number of animals are recommended. Additionally, the flavoring could be applied in pregnant sows during the last gestational stage, and then, this study could be repeated with their litters. Another recommendation may be to try the use of flavorings accompanied by other additives, such as fermented probiotic herbal medicines from China, which significantly improve post-weaning stress (WANG *et al.*, 2018), Gamma-aminobutyric acid (GABA) that has positive effects on digestive functions and improves immunity and intestinal

microbiota (CHEN et al., 2019), as well as Vitamin A that contributes to the normal formation, development, and maintenance of epithelial cells (WANG et al., 2020).

CONCLUSIONS

The nutritional inclusion of 2 flavorings (cinnamon and banana) in the diet of recently weaned piglets presented no significant differences in any of the productive parameters studied (daily weight gain, feed intake and feed/gain ratio).

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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