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Vinasse Use on Weaned Piglet Diets

Uso da Vinhaça na Dieta de Leitões Desmamados

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Abstract

The weaned phase is a critical due to the new habitat in which piglets are housed, besides the piglets are from different litters and this enables some sanitary challenges. Researches about alternative feeds inclusion and additives used on animal diet have been developed with the prevent disease's goal, as a vinasse by sugar cane industry. This study aimed to assess the sugar cane vinasse inclusion on weaned piglet phase feeding. The experiment was realized on Experimental Swine Unit of Federal Institute of Minas Gerais (MG) - Bambuí College, were selected 36 weaned piglets from the cross between Agroceres Camborough 25 female and Biribas BM500 male, with 10.5kg and 30 days old. The treatments were: T1 - control; T2 - 5% of vinasse inclusion; T3 - 10% of vinasse inclusion; in an experimental design was entirely randomized. The ANOVA was realized using the Randomized Blocks Lineation. The means test used was the Tukey by C pack of R software. The vinasse inclusion on swine diet is a useful strategy to solve problems as the sugar cane industry waste that is discarded on the environment. This strategy enables that the pig farmer can use good products on weaner piglet diet contributing to low costs and environmental impact reduction.

Keywords: Alternative Animal Feed. Animal Nutrition. Animal Science. Piglet Production. Weaner Phase.

Resumo

A fase de desmame é crítica na produção de leitões devido ao novo ambiente em que os animais são alojados, além do fato dos animais serem oriundos de diferentes ninhadas, o que gera alguns desafios sanitários. Pesquisas sobre a inclusão de alimentos alternativos e aditivos na dieta animal têm sido desenvolvidas com o objetivo de prevenir doenças, como a inclusão da vinhaça da indústria da cana-de-açúcar. Este estudo teve como objetivo avaliar a inclusão da vinhaça da cana-de-açúcar na alimentação de leitões na fase de desmame. O experimento foi realizado na Unidade de Suínos Experimentais do Instituto Federal de Minas Gerais (MG) - Campus Bambuí, onde foram selecionados 36 leitões desmamados resultantes do cruzamento entre fêmeas Agroceres Camborough 25 e machos Biribas BM500, com 10,5 kg e 30 dias de idade. Os tratamentos foram: T1 - controle; T2 - inclusão de 5% de vinhaça; T3 - inclusão de 10% de vinhaça, em um delineamento experimental inteiramente casualizado. A ANOVA foi realizada utilizando-se o pacote de ExpDes.pt por Random Blocks Lineation. O teste de médias utilizado foi o pacote Tukey by C do software R. A inclusão da vinhaça na dieta suína é uma estratégia útil para resolver problemas como o desperdício da indústria da cana-de-açúcar, que é descartado no ambiente. Essa estratégia permite que o produtor de suínos utilize bons produtos na dieta de leitões desmamados, contribuindo para redução de custos e impacto ambiental.

Palavras-chave*: Alimentação Animal Alternativa. Nutrição Animal. Ciência Animal. Produção de Leitões. Fase de Desmame.*

1 Introduction

The swine production has been continuing to develop and show satisfactory productive results even with the world pandemic scenario since 2020 due to the SARS-CoV-2. In 2020, nearly 4.43 million of pork were produced and 77% destined to home market and 23% to international market. The per capita consumption in 2020 increased about 0.7 kg when compared to 2019, totalizing 16kg of pork consumed by habitant (ABPA, 2021). The swine production development was associated to high genetic selection, good nutrition, good animal management and ambience.

The weaned phase is a critical phase during pig farming processes due to the new habitat in which piglets are housed. This new environment has other piglets originate from different litters and this condition enables some sanitary challenges. These factors demand more precise methods and technics to animal adaptation for zootechnical indexes maintenance (LIMA et al., 2020).

Some researches about alternative feeds inclusion and additives used on animal diet have been developed on animal nutrition. These studies' main objective is to prevent some diseases, mainly the gastroenteric, promoting the animal health benefits and solving the major weaned phase challenges (MEHDI et al., 2018).

The sugar cane by-products like yeast, vinasse, cane filter cake, cane tip and marc cane, have been studied by several researchers (BARROS et al., 2020; HIDALGO et al., 2009; PATIÑO et al et al., 2012; SARMENTO et al., 1999). The

brimmed sugar cane juice when distilled to alcohol produces the vinasse. To each alcohol litter distilled, 12 vinasse litters are produced and used to biofertilization (ALVES et al., 2019). However, sugar cane vinasse can also be used as animal feed.

Due to this, this study aimed to assess the sugar cane vinasse inclusion on weaned piglet phase feeding, matching this alternative feeding method with big reduction on environmental impact and animal feed costs.

2 Material and Method

The experiment was realized on Experimental Swine Unit of Federal Institute of Minas Gerais (MG) - Bambuí College. The animals were selected after farrowing and taken to experimental unit composition. These piglets were attended during all nursery phase to prevent problems that could damage the research performance. Research on animals was conducted according to the institutional committee on animal use (Registration Protocol: 17/2019). The genetic animal line used was a cross between Agroceres Camborough 25 female and Biribas BM500 male. 36 weaned piglets with 10.5 kg of liveweight and 30 days old were used.

The first procedures followed the protocol used on animal sector aiming to maintain the animal health according to animal welfare rules. The males were castrated when 10 days old. All piglets were housed on the same stalls and started the feed intake when 7 days old. The sugar cane vinasse was provided by Bio-energy Factory situated in Bambuí City - MG.

The experimental design was entirely randomized, with 3 treatments and 6 repetitions with 2 animals/repetition. The treatments were: T1 - control; T2 - 5% of vinasse inclusion; T3 - 10% of vinasse inclusion. The inclusion levels of vinasse are shown in Table 1.

Table 1 – Vinasse inclusion levels on weaner piglet initial feed

Initial Feed	100%	95%	90%
Vinasse	---	5%	10%

Source: research data.

The vinasse analysis occurred in agricultural laboratory. The total calcium level, electric conductivity on 25ºC, biochemical oxygen demand and chemical oxygen demand, total phosphor, total magnesium, oils and greases, pH on 25ºC, total potassium, sedimental solids, total suspended solids, surfactants and environmental and sample temperature were verified.

The experiment started when the animals reached 45 days old, with 15 days of adaptation. Each treatment was organized in mixed genders and similar weight batches. The weight of animals was measured on the beginning (45 days old) and the end (70 days old) of the experiment, totalizing a period of 25 days for the collection of performance variables. These variables were Final Weight (FW), Feed Intake (FI), Weight Gain (WG) and Food Conversion (FC). The diet components were corn, soybean meal, sugar and initial kernel, according to Table 2.

Table 2 – Feed composition for weaned piglets

Ingredients	Quantity of Inclusion (%)
Corn	61.5
Soybean meal	28.5
Sugar	5.0
Initial Kernel*	5.0
Total	100
Bio-chemical composition	Quantity of inclusion
ME (kcal/kg)	3,193
Protein (%)	16.1

*Composition by kg of initial kernel: Folic acid 12.5 mg/kg; Pantothenic acid 375 mg/kg; Alpha Galactosidase 1.36 u/g; Beta Glucanase 387.6 u/g; BHT 100 mg/kg; Biotina 10 mg/kg; Calcium 160 to 185 g/kg; Cobalt 5 mg/kg; Copper 3,750 mg/kg; Colin 2,500 mg/kg; Iron 2,500 mg.kg; Phytase 12.5 FTU/kg; Phosphor 73 g/kg; Halquinol 3,000 mg/kg; Iodine 25 mg/kg; Manganese 1,750 mg/kg; Niacin 750 mg/kg; Selenium 7.5 mg/kg; Sodium 39 g/kg; Vitamins A 250,000 UI/kg, B1 37.5 mg/kg, B12 500 mcg/kg, B2 150 mg/kg; B6 25 mg/kg, D3 50,000 UI/kg, E 2,000 UI/kg, K3 50 mg/kg; Xylanase 248 u/g; Zinc 2,500 mg/kg.

Source: research data.

2.1 Data Analysis

The vinasse was introduced on feed during the pressmen and this ratio was stocked in an airy local to prevent brew. The feed was provided in rubble trough and the substitution method by Sibbald et al. (1963) was adopted. The ANOVA was realized using the Randomized Blocks Lineation pack of ExpDes.pt by R software Core (2017). The means test used was the Tukey by C pack of R software.

3 Results and Discussion

The vinasse laboratory analysis was provided by Bio-energy Power Plant to the determination of bromatological and nutritional composition and the results are shown in Table 3.

Table 3 – Vinasse nutritional composition.

Composition	Results/Unit
Total calcium (ac)	50.61 mg/L
Eletric conductivity at 25 ºC (ac)	5,500 µS/cm
BOD (ac)	11,785.32 mg/L O2
BQO (ac)	33,987 mg/L
Total phosphor (ac)	28 mg/L
Total Magnesium (ac)	44.55 mg/L
Oils and greases (ac)	<10
pH at 25 ºC	3.96
Total potassium (ac)	403,77 mg/L
Sedimentable solids (ac)	8,00 mg/L
Total suspended solids (ac)	3,220 mg/L
Buffers (ac)	0.20 mg MBAS/L
Environmental temperature (ac)	19,70 ºC
Sample temperature (ac)	50.30 ºC

(ac): By ABNT NBR ISSO/IEC 17.025:2005 over the CRL 0354 with validity certified until 20/04/2017 credit.

Source: research data.

When compared to other analysis, resembling results of some minerals were found similar to Core (2017) and the mineral with greater volume between macro elements was potassium. The composition can vary according to the soil, topography and cultivated crop.

According to Table 3, the vinasse calcium and phosphor percentage results were high, making vinasse an alternative substitute factor for animal diet when included in small quantities. In weaner piglets, due the small capacity of gastroenteric, the gastric pH is the diet power buffering, according to Savón (2015).

The use of acidifying ingredients on piglets during the weaner phase is appliable because piglets have low capacity of maintaining the acid gastric production. This low capacity of piglet occurs due to the dependence on sow milk lactose by bacteria's that produce the lactic acid. With the diet change from milk to dry feed, other bacteria were produced and some negative results occurred on piglet performance. Facts like this enable the vinasse diet use, due to its acidic pH.

For feed composition and feed quality assess, some tests were realized on Animal Nutrition and Bromatologic Laboratory of Federal Institute of Education, Science and Technology of Minas Gerais - Bambuí Campus, that are shown in Table 4.

Table 4 – Ration bromatologic composition and pH

Nutrients (%)	**Values (%)**		
	0%	**5%**	**10%**
CB*	16.71	16.74	16.98
Ca*	0.81	1.07	1.05
P*	0.45	0.36	0.60
pH**	6.00	5.97	5.82

*Calculated according to Brazilian Animal Feed Compendium.
Source: research data.

The estimated data to ratio chemical composition of treatments were realized according to Rostagno et al. (2011). The values were estimated following the average requirement between castrated male and female with high genetic potential and average performance. With obtained values, it can be observed that they were smaller than average energy requirement on the initial phase, almost 3230 kcal/kg of metabolizable energy and 18.31% of crude protein (ROSTAGNO et al., 2011). Therefore, these values were estimated and their results were 3193 kcal/kg of metabolizable energy and 16.1% of crude protein, without the initial nucleus used during the experience.

By the ANOVA applied on the vinasse inclusion levels it was observed that the difference of weight gain in each treatment was not statistically significant. These results are shown on Table 5 below. With results like these, the vinasse uses on piglets' diet is viable because the animal performance was maintained.

Table 5 - Daily weight gain (GPD), feed intake (FI) and ratio conversion (RC) of piglets fed diets containing vinasse inclusion levels

Vinasse inclusion				
Productive parameters	0%	5%	10%	CV
Daily weight gain (Kg)	0.651	0.713	0.667	3.00%
Feed intake (kg)	1.240	1.296	1.308	15.7%
Ratio conversion	1.924	1.824	1.963	8.28%

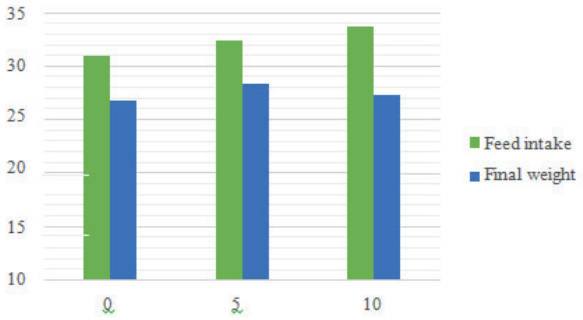
Source: research data.

In a study realized by Gordini et al. (1987), similar results were found, although with different vinasse inclusion levels: 4%; 8%; 12%. The ANOVA applied on Gorni's study showed that the daily weight gain and ratio conversion of piglets in lactation phase and nursery phase, also were not statistically significant.

Silva et al. (2021) assert that the nursery piglet feed intake represents 2.6% of total solid feed used until the slaughter. However, this feed needs a meticulous selection on diet formulation and the correct blend of ingredients. The search of alternative ingredients, as the vinasse, to the cost's reduction has been frequent.

The feed intake was not affected by vinasse inclusion, but this variable was upper than other treatments. This result showed that vinasse inclusion didn't affect the feed palatability (Figure 1).

Figure 1 - Animal Final weight and intake on experimental treatments



Source: research data.

One of the problems of the weaner piglet is the low intake during first days that result in intestinal villus atrophy and the reduction of nutrient absorption, according to Molino et al. (2010). This condition occurs because the piglets are in a feed shift between sow milk and dry food. The vinasse is an acid additive and its pH is benign to piglet intestine, besides being accepted by piglets because of its great organoleptic characteristics.

Barros et al. (2020) checked the impact of vinasse addition as an acidifying on lactating sow diet and its effect on litters and concluded that the vinasse sow intake didn't influence the piglet's performance.

However, on the study of Barros et al. (2020), the volume of feed intake was higher than on the females that did not receive the vinasse. In general, the vinasse inclusion on swine diet is an useful strategy to solve problems as the sugar

cane industry waste that is discarded on the environment. Furthermore, this environmental solution offers an animal performance resembling the diets with conventional feed to the weaner piglet, besides the feed costs reduction for swine farmers.

Results as of this study showed the requirement of more researches, mainly to comprehend the direct influences of addictive's use, as vinasse, on piglets' diet and how this strategy can be affecting the weaner piglet's performance.

4 Conclusion

The use of vinasse on weaner piglet diet is relevant to swine production, because this strategy enables that the pig farmer can use good products on weaner piglet diet contributing to low costs and environmental impact reduction

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