

Inclusion of emulsifier in the nutrition of piglets during the maternity phase

Inclusão de emulsificante na nutrição de leitões na fase da maternidade

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Submission: 26/01/2024 | Accepted: 10/05/2024

RESUMO

O estudo teve como objetivo avaliar o impacto da adição de lecitina de soja à alimentação de leitões durante a fase de maternidade e sua influência no desempenho produtivo. Foram utilizadas seis leitegadas com média de 12 leitões em cada (72 leitões), oriundas de duas linhagens distintas de matrizes suínas: Agroceres e DanBred (DB). Foram considerados diferentes números de partos, com animais da linhagem DB no quinto parto e animais da linhagem Agroceres no segundo e terceiro partos. As matrizes foram selecionadas de acordo com a data prevista para o parto, visando avaliar o uso de emulsificante na dieta pré-inicial I dos leitões. A análise de variância foi realizada utilizando-se a covariável do consumo de alimentos sob delineamento inteiramente casualizado (DIC), em um esquema de parcelas subdivididas com dois tratamentos (com e sem lecitina) ao longo de 21 dias de avaliação. Foram avaliados o consumo médio diário, o ganho de peso diário e a conversão alimentar. Foram testados dois tratamentos com três repetições, utilizando todos os leitões de uma leitegada em cada repetição. Os tratamentos consistiram em uma dieta controle (0% de lecitina de soja) e uma dieta com inclusão de 0,2% de lecitina de soja. Os resultados deste estudo indicam que a inclusão de lecitina de soja na dieta pré-inicial de leitões não teve um impacto significativo no consumo médio de ração, ganho de peso diário, conversão alimentar ou mortalidade dos animais durante a fase de maternidade. Nas condições experimentais apresentadas, a utilização da lecitina de soja na nutrição dos leitões durante a fase de maternidade não demonstrou capacidade de alterar o desempenho da leitegada

PALAVRAS-CHAVE aditivos; lecitina de soja; maternidade; suínos.

ABSTRACT

The study aimed to evaluate the impact of adding soy lecithin to piglet feed during the maternity phase and its influence on productive performance. Six litters with an average of 12 piglets each (72 piglets) from two distinct lines of sows, Agroceres and DanBred (DB), were used. Different numbers of parities were considered, with DB line animals in their fifth parity and Agroceres line animals in their second and third parities. The sows were selected according to the expected farrowing date to evaluate the use of emulsifier in the pre-starter I diet of piglets. Analysis of variance was performed using feed consumption as a covariate under a completely randomized design (CRD) in a split-plot scheme with two treatments (with and without lecithin) over 21 days of evaluation. Average daily feed intake, daily weight gain, and feed conversion were evaluated. Two treatments were tested with three repetitions, using all piglets from one litter in each repetition. The treatments consisted of a control diet (0% soy lecithin) and a diet with the inclusion of 0.2% soy lecithin. The results of this study indicate that the inclusion of soy lecithin in the pre-starter diet of piglets did not have a significant impact on average feed intake, daily weight gain, feed conversion, or mortality of the animals during the maternity phase. Under the presented experimental conditions, the use of soy lecithin in piglet nutrition during the maternity phase did not demonstrate the ability to alter litter performance.

KEYWORDS: Additives; Soy lecithin; Maternity; Swine.

INTRODUCTION

Brazil ranks fourth globally in pork production and exports (ABPA 2023). As the most consumed animal protein globally, pork production requires meticulous attention to ensure the quality of the final product (SOUZA et al. 2021). To meet these demands, producers are looking for new tools to raise more efficient animals, capable of quickly reaching slaughter weight with consistent quality (SILVA et al. 2020).

During the lactation period, piglet nutrition is a critical aspect. For the first week after birth, neonates rely solely on maternal milk for nutrition (DUARTE 2018). However, from the eighth day onwards, the introduction of solid foods becomes essential to prepare piglets for the subsequent phase, which exclusively involves solid feed provision (DIAS SILVA & MEDEIROS 2021). This transition is crucial for piglets' digestive and nutritional development.

In this context, soy lecithin emerges as a promising additive. Derived from natural soybean oil, lecithin serves as an emulsifier and enhances food palatability, encouraging piglets to consume solid feed (VALENTIM et al. 2020). Emulsifiers, such as lecithin, are employed in animal nutrition to enhance nutrient absorption efficiently, thereby reducing feed production costs and optimizing dietary energy utilization (HIGANO et al. 2020).

The importance of emulsifiers in piglet diets is reinforced by MARTINS et al. (2023), who highlight the combination of lipids and emulsifiers in digestion during the maternity phase. Due to piglets' physiologically immature digestive systems and energy deficits, incorporating these compounds into their diet is crucial for ensuring efficient and proper nutrient digestion.

Given this context, this study aims to investigate the effects of incorporating additives, such as soybean lecithin, into the diet of piglets from birth to 28 days during the lactation period. The study aims to investigate whether the consumption of emulsifiers enhances nutrient digestibility in the diet, potentially improving animal performance and contributing to more efficient, high-quality production.

MATERIAL AND METHODS

The study was carried out at the swine research unit of the Federal Institute of Minas Gerais - Bambuí Campus. Six sows from two distinct genetic lines were utilized: four DanBred (DB) and two Agroceres, with varying parities. The DB lineage animals were in their fifth parity, while those of the Agroceres lineage were in their second and third parities.

The average litter size was 12 piglets per sow, yielding a total of 72 piglets. Sows were selected based on their expected farrowing dates to evaluate the use of emulsifiers in piglets' pre-starter I diet. Piglets remained in the same pen with their dams from the day of farrowing. Solid food introduction commenced at one week of age. Litter weights were recorded at birth, one week, and four weeks of age. To assess animal performance, key metrics such as feed intake, feed conversion ratio, and average daily gain were evaluated.

Feed intake per litter was determined daily by weighing feed offered and leftovers. From the seventh day of life, daily weighing of feed and leftovers commenced. Feed conversion ratio was determined using average feed intake and weight gain of all animals at the conclusion of the experimental period.

All animals were weighed at the beginning and end of the experiment. Therefore, the average daily gain (ADG) was determined by calculating the difference between initial and final weights and dividing by the number of experimental days. The study employed two distinct dietary regimens. The basal diet comprised 42 kg corn bran, 17 kg soybean meal, 40 kg premix, and 1 kg soybean oil, with a chemical composition of 1,841.7 kcal/kg metabolizable energy and 10.6% crude protein. On the other hand, the diet incorporating soybean lecithin consisted of 41.8 kg corn meal, 17 kg soybean meal, 40 kg premix, 1 kg soybean oil, and 0.2 kg soybean lecithin. Its nutritional profile included 1,187.7 kcal/kg of metabolizable energy and 10.59% protein.

Data analysis was performed using Microsoft Excel® 2023. The study data were tabulated, converted to nominal values and percentages, and used to generate graphs. Exploratory data analysis was conducted on piglet consumption data, total weight (kg/litter), average weight (kg/animal), number of animals, and mortality. Descriptive analyses were performed using the dplyr package in R statistical software, and Student's t-tests were employed to generate tables (R Core Team, 2023). Histograms were generated using ggplot2 and barplot packages in R statistical software. Statistical significance was set at 5%.

Analysis of covariance was conducted on consumption data using a completely randomized design with a split-plot arrangement, comprising two treatments (with and without lecithin) and 21 evaluation days.

Analysis of variance was conducted using the aov function from the car package in R statistical software,

while covariate analysis was performed using the Anova function (*model, type="III"*). When significant main or interaction effects were observed, Student's t-test at 5% probability was employed, and regression analysis was used for time-related data.

RESULTS AND DISCUSSION

Average feed consumption

The average consumption of diets with or without lecithin was approximately 71.1 g with lecithin and 68.5 g without lecithin. There was no significant difference between the inclusion or not of lecithin and the interaction of lecithin inclusion \times evaluation days.

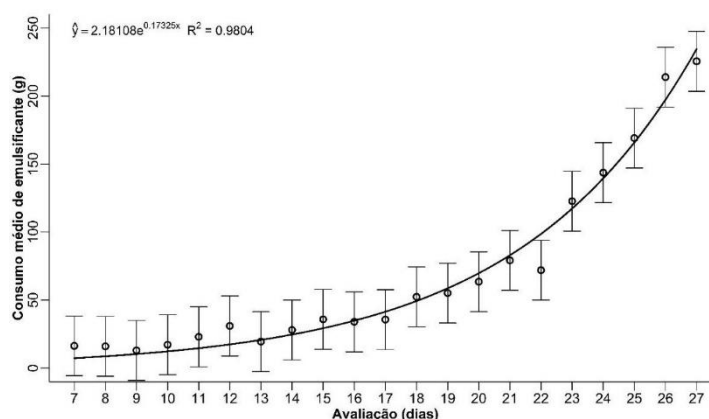


Figure 1. Consumption of piglets in the maternity phase from 7 to 28 days with or without the inclusion of soy lecithin in the diet.

Research on soybean lecithin supplementation in early-stage swine nutrition remains limited. However, the slight increase in consumption may be attributed to enhanced feed palatability. As stated by NEUMANN et al. (2024), diets containing lecithin enhance fatty acid digestibility and absorption, potentially explaining increased feed intake in soy lecithin-supplemented diets.

Average birth weight

There was no statistically significant difference in birth weight among treatments at 0, 7, and 28 days (Figure 2).

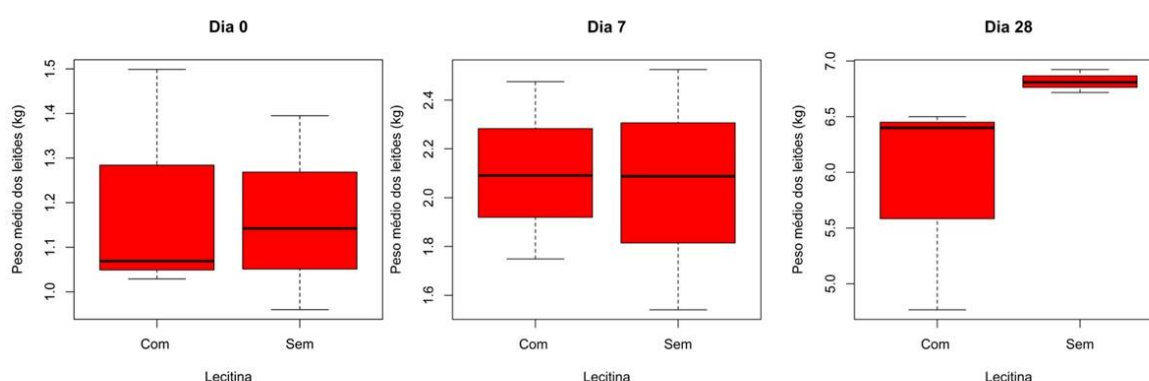


Figure 2. Average weight of piglets in each treatment on day zero, seventh, or twenty-eighth day, fed with a diet containing or not containing lecithin.

When comparing swine production performance indicators, the average birth weight of the animals in this case study ranges from 0.960 kg to 1.499 kg, which is below the expected average for their age. According to JÚNIOR et al. (2022) It is recommended that the optimal weight during this stage range from approximately 1.3 to 1.6 kg. Increased birth weight in animals is associated with reduced neonatal mortality.

Litter weight during the lactation phase: No significant differences were observed in mean total litter

weights at 0, 7, and 28 days between diets with or without lecithin, as shown in Figure 3.

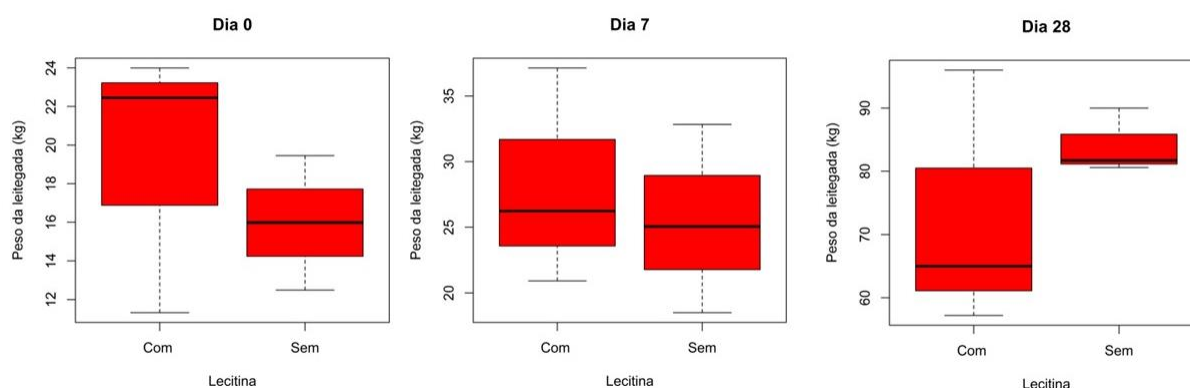


Figure 3. Total litter weight in each treatment on day zero (birth weight), on the 7th day of evaluation, and on the 28th day of evaluation.

Although lecithin is an emulsifier that aids in lipid digestion, it does not appear to affect weight gain in early-stage piglets, as noted by JÚNIOR et al. (2022) piglets exhibit low digestibility due to their primary reliance on maternal milk, resulting in the predominance of lactase enzyme during this period. The development of additional enzymes is triggered exclusively by the introduction of solid foods, reaching optimal production efficiency around 21 days of age.

Although stimulation begins from the seventh day of life, it appears to have no significant effect on increasing consumption in a way that would promote greater weight gain. Regarding weaning weight, VERUSSA et al. (2015) emphasize that the ideal weight ranges from 5.4 kg to 8 kg on average. The results obtained here align with these authors' findings, with average weaning weights ranging from 4.766 kg to 6.923 kg at 28 days.

Piglet mortality from birth to weaning (0 - 28 days)

There was no significant difference in piglet mortality between treatments from birth to 28 days of age (Figure 4).

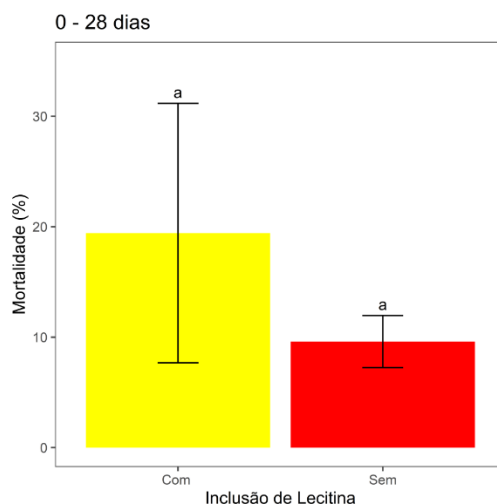


Figure 4. Average piglet mortality in each treatment from 0 to 28 days.

The mortality rate ranged from 0.1% to 14.3%. This phenomenon may be attributed to litter size, resulting in teat competition during nursing, which can lead to nutritional deficits in some piglets. As observed by ABRAHÃO et al. (2004), pig mortality rates can be high from birth to weaning, and can reach 15% to 18%. In this context, piglet mortality rates during farrowing range from 2.4% to 10%, primarily due to complications such as dystocia, asphyxia, hypothermia, emaciation, diarrhea, and injuries, contributing to persistently high mortality rates during the first week of life. The findings of this investigation suggest that incorporating soybean lecithin into the pre-starter diet of piglets did not significantly affect average feed intake, daily weight gain, feed

conversion ratio, or mortality rates during the nursing phase.

Although lecithin may enhance nutrient digestibility and absorption, the observed effects were insufficient to significantly improve piglet performance. These findings align with existing literature, emphasizing piglets' reliance on maternal milk during early life stages. The introduction of solids, even with emulsifiers such as lecithin, does not significantly alter initial performance. Further research is warranted to investigate additional nutritional strategies that may enhance piglet performance during early developmental stages.

CONCLUSION

Nas condições experimentais apresentadas, a utilização da lecitina de soja na nutrição dos leitões durante a fase de maternidade não demonstrou capacidade de alterar o desempenho da leitegada

REFERENCES

- ABPA - Associação Brasileira de Proteína Animal. Relatório anual 2018. Disponível em: <https://abpa-br.org/wp-content/uploads/2023/04/Relatorio-Anual-2023.pdf>. Acesso em: 10 mar. 2023.
- ABRAHÃO AAF et al. 2004. Causas de mortalidade de leitões neonatos em sistema intensivo de produção de suínos. *Brazilian Journal of Veterinary Research and Animal Science* 41: 86-91.
- DIAS SILVA AH & MEDEIROS SLS. 2021. Utilização do fermentado de mandioca na alimentação de suínos em fase inicial. *Brazilian Journal of Development* 07: 119729 – 119742.
- DUARTE EL. 2018. Uso de aminogut® e enzimas na dieta de suínos durante a lactação e creche. Tese (Doutor em Zootecnia) – Universidade Federal do Ceará, 85 p.
- HIGANO LM et al. 2020. Utilização de própolis para leitões desmamados. *Ciência Animal* 30: 97-108.
- JÚNIOR JMO et al. 2022. Acidifiers blend on digestibility, blood metabolites and performance of nurse piglets. *Arquivos Brasileiros de Medicina Veterinária e Zootecnia* 74: 184 – 194.
- MARTINS AA et al. 2023. Uso de ácidos orgânicos e óleos essenciais em dietas para leitões. *Revista Eletrônica NutriTime* 20: 9229 - 9236.
- NEUMANN M et al. 2024. Whole soy lecithin on productivity and carcass quality of feedlot cattle. *Ciência Animal Brasileira* 25: 1 – 13.
- R CORE TEAM. 2023. R: A Language and Environment for Statistical Computing. Vienna, Austria: R Foundation for Statistical Computing. Disponível em: <http://www.R-project.org/>. Acesso em: 10 mar. 2023.
- SILVA AFC et al. 2020. Colaboração da seleção genômica na produção de suínos no Brasil. *Revista Sinapse Múltipla* 9: 115-116.
- SOUZA MCM et al. 2021. Consumo de carne suína e derivados pela população de Juiz de Fora, Minas Gerais, Brasil. *Brazilian Journal of Animal and Environmental Research* 4: 4436 – 4449.
- VALENTIM JK et al. 2020. Aditivos emulsificantes em dietas de aves de produção. *Research, Society and Development* 9: 1-22.
- VERUSSA GH et al. 2015. Uso de lipídios na nutrição de suínos. *Revista eletrônica Nutritime* 15: 1-25.