

EXOGENOUS PROTEASE IN PIGLET DIETS AS A STRATEGY TO MITIGATE THE NEGATIVE EFFECTS OF TRYPSIN INHIBITORS

DÉBORA REOLON, CARLOS BERETTA; HILLA P. HOFFMANN; DEJANIR PISSININ; BRUNO N. FRAGA; VLADIMIR DE OLIVEIRA

Novus do Brasil Com. e Imp. Ltda, Indaiatuba, SP, Brasil, Universidade Federal de Santa Maria, RS, Brasil.
Contato: debora.reolon@novusint.com / Apresentador: DÉBORA REOLON

Resumo: A study was conducted to determine whether the addition of protease (PROT) mitigates the negative effects of trypsin inhibitors (TI) on piglet performance during the nursery phase. Ninety-six piglets were assigned to four treatments using a randomized block design with a 2x2 factorial arrangement (two levels of TI and two levels of PROT, with eight replications). The TI levels were 0.82 (pre-starter), 0.96 (starter), 1.71 (pre-starter), and 1.83 (starter) mg/g in low and high TI diets, respectively. The PROT levels were 0 and 500g/MT. Average daily feed intake (ADFI), average daily gain (ADG), and feed conversion ratio (FCR) were evaluated. The data were subjected to analysis of variance. In the first 14 days, the high level of TI reduced ($P<0.05$) ADG and final weight, with a tendency to reduce ($P<0.08$) ADFI. In the starter phase, PROT reversed ($P<0.05$) the negative effects of high TI levels on ADG and FCR. The weight was lower ($P<0.05$) in diets with high TI levels and higher ($P<0.053$) in diets containing PROT. The addition of PROT to diets with high TI resulted ($P<0.067$) in an FCR similar to groups with moderate TI levels. It is concluded that soybean meal TIs negatively impact piglet performance and that the addition of PROT mitigates these effects.

PalavrasChaves: Zootechnical additive; Piglet performance; Anti-nutritional factor; trypsin inhibitor.

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Abstract: A study was conducted to determine whether the addition of protease (PROT) mitigates the negative effects of trypsin inhibitors (TI) on piglet performance during the nursery phase. Ninety-six piglets were assigned to four treatments using a randomized block design with a 2x2 factorial arrangement (two levels of TI and two levels of PROT, with eight replications). The TI levels were 0.82 (pre-starter), 0.96 (starter), 1.71 (pre-starter), and 1.83 (starter) mg/g in low and high TI diets, respectively. The PROT levels were 0 and 500g/MT. Average daily feed intake (ADFI), average daily gain (ADG), and feed conversion ratio (FCR) were evaluated. The data were subjected to analysis of variance. In the first 14 days, the high level of TI reduced ($P<0.05$) ADG and final weight, with a tendency to reduce ($P<0.08$) ADFI. In the starter phase, PROT reversed ($P<0.05$) the negative effects of high TI levels on ADG and FCR. The weight was lower ($P<0.05$) in diets with high TI levels and higher ($P<0.053$) in diets containing PROT. The addition of PROT to diets with high TI resulted ($P<0.067$) in an FCR similar to groups with moderate TI levels. It is concluded that soybean meal TIs negatively impact piglet performance and that the addition of PROT mitigates these effects.

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Introdução: Soybean meal (SBM) is rich in proteins with a good amino acid balance and is economically competitive. However, it contains anti-nutritional factors (ANFs) that limit its inclusion in diets, especially for young animals. Among the ANFs present, trypsin inhibitors (TI) are significant, particularly Kunitz and Bowman-Birk. Although heat-sensitive, a significant proportion of TIs can withstand thermal processing. Recent surveys indicate that TI levels in SBM have been increasing, possibly because these compounds are associated with desirable agronomic characteristics (LIU et al., 2021). The ingestion of diets with high TI levels reduces digestibility and negatively impacts piglet performance. The addition of protease has proven effective in reducing the undesirable effects of TI in piglets (WEDEKING, 2020). Therefore, an experiment was conducted to assess whether the addition of protease to piglet diets during the nursery phase can reverse the negative effects of TI in SBM.

Material e Métodos: Ninety-six uncastrated commercial piglets were used, with an average initial age and weight of 21 days and 6.5 kg, respectively. The animals were divided into groups of three and housed in 32 pens with plastic flooring, equipped with nipple drinkers and semi-automatic feeders. The barn temperature was maintained within the thermal comfort zone, and the animals were handled according to guidelines for good agricultural practices. The animals were distributed across four treatments using a randomized block design in a 2x2 factorial arrangement (TI level x protease level), with eight replications. The TI levels in the diets were 0.82 (pre-starter), 0.96 (starter), 1.71 (pre-starter), and 1.83 (starter) mg/g in the low and high TI diets, respectively. The protease levels were 0 and 500g/MT. A two-phase feeding program was used: pre-starter (0-14 days) and starter (15-28 days). The diets were formulated to meet the nutritional levels recommended by Rostagno et al. (2017) and provided as mash feed. Feed and water were available ad libitum. Performance variables including average daily feed intake (ADFI), average daily gain (ADG), and feed conversion ratio (FCR) were determined by collecting and weighing feed leftovers and waste, as well as weighing the animals at housing and at seven-day intervals until the end of the experiment. The collected data were subjected to the Shapiro-Wilk normality test and subsequently to analysis of variance at a 5% significance level.

Resultado e Discussão: Performance results are presented in Table 1. During the first 14 days, a high level of trypsin inhibitors (TI) reduced ($P<0.05$) average daily gain (ADG) and body weight (BW). There was a tendency ($P<0.08$) for a decrease in average daily feed intake (ADFI) in piglets fed diets with high TI content. Similar results have been observed in

other studies (WOYENGO et al., 2017; YUA et al., 2020). In the starter phase, it was observed that the addition of protease (PROT) was able to mitigate ($P<0.05$) the negative effects of high TI levels on ADG and feed conversion ratio (FCR). At the end of the phase, piglet BW was lower ($P<0.05$) in diets with high TI levels and higher ($P<0.053$) in diets containing PROT. The improvement in piglet performance in the nursery due to PROT addition has also been confirmed in previous studies (MUNEZERO and KIM, 2022; MOTURI et al., 2023). Over the entire period, it was found that diets with a high level of TI reduced ($P<0.05$) ADG and increased ($P<0.05$) FCR. The addition of PROT to diets with high TI levels resulted in a trend ($P<0.067$) of FCR similar to that of groups consuming low TI levels. Finally, BW at 28 days was lower ($P<0.05$) in diets with high TI levels and without PROT ($P<0.053$). The results can be explained by the action of TIs in inactivating intestinal trypsin, reducing amino acid digestibility and impairing piglet performance (YU et al., 2020). Additionally, the role of PROT in hydrolyzing dietary proteins (WEDEKING et al., 2020) may explain the beneficial effect of this additive on piglet performance.

Table 1 - Performance of piglets consuming diets with different levels of trypsin inhibitors and exogenous protease.

	Trypsin inhibitor				SEM	P value		
	Normal		High			TI	PROT	TI x PROT
	Protease							
	Absence	Presence	Absence	Presence				
Number of animals	24	24	24	24	-	-	-	-
Performance 1 - 14 d								
BW 0, kg	6,162	6,114	6,186	6,189	-	-	-	-
ADFI, kg/d	0,441	0,444	0,390	0,417	0,021	0,074	0,480	0,553
ADG, kg/d	0,378	0,402	0,330	0,361	0,020	0,044	0,189	0,856
FCR, kg/d	1,161	1,105	1,202	1,16	0,430	0,273	0,266	0,860
BW 15 d, kg	11,447	11,784	10,775	11,217	0,290	0,044	0,189	0,856
Performance 15 - 28 d								
BW 15 d, kg	11,447	11,784	10,775	11,217	0,290	0,044	0,189	0,856
ADFI, kg/d	0,860	0,834	0,835	0,881	0,025	0,668	0,691	0,152
ADG, kg/d	0,589	0,577	0,494	0,598	0,023	0,120	0,055	0,002
FCR, kg/d	1,48	1,469	1,721	1,483	0,047	0,013	0,015	0,025
BW 28 d, kg	19,697	19,870	17,695	19,594	0,506	0,037	0,053	0,103
Performance 1 - 28 d								
ADFI, kg/d	0,651	0,639	0,612	0,649	0,,019	0,483	0,538	0,228
ADG, kg/d	0,484	0,490	0,412	0,48	0,018	0,037	0,053	0,103
FCR, kg/d	1,321	1,287	1,462	1,322	0,027	0,004	0,005	0,067

BW = Body weight, kg; ADFI = Average Daily Feed Intake; ADG = Average Daily Gain; FCR = Feed Conversion Rate; P = Probability . TI = Trypsin inhibitor; PROT = Protease

Conclusão: The results confirm that high levels of TIs negatively impact piglet performance during the nursery phase and that the addition of PROT mitigates the harmful effects of TIs, present in soybean meal, on piglet performance.

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