Digestibilidade da proteína verdadeira solúvel de coprodutos de trigo para suínos em crescimento [1]

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Resumo: O objetivo foi avaliar a digestibilidade da proteína verdadeira solúvel (PVS) de coprodutos de trigo na dieta de 18 suínos em crescimento e a correlação entre PVS e proteína digestível (PD) dos ingredientes. A dieta padrão, à base de milho e farelo de soja, foi substituída em 27% pelos ingredientes testados: farinheta de trigo, farelo de trigo grosso, farelo de trigo fino, farinha de trigo e gérmen de trigo A farinha de trigo resultou em maior digestibilidade da proteína bruta (PB) embora o gérmen fosse o ingrediente com maior teor de PB. Os farelos de trigo resultaram em menor digestibilidade da PB e o farelo de trigo grosso em menor digestibilidade do nitrogênio não proteico. Não houve diferença significativa na digestibilidade do nitrogênio solúvel e da PVS entre os ingredientes. Não houve regressão significativa entre PVS dos ingredientes e a PD. Os coprodutos de trigo não interferem na digestibilidade da PVS, mas o farelo de trigo grosso prejudica a digestibilidade da proteína bruta e do nitrogênio não proteico de suínos em crescimento. A PVS dos coprodutos não contribuiu como indicador da PD dos ingredientes em suínos em crescimento.

Palavras–chave: farinha de trigo, farinheta de trigo, gérmen de trigo

Digestibility of soluble true protein of wheat byproduct for growing pigs

Abstract: The objective was to evaluate the digestibility of soluble true protein (STP) of wheat byproducts on diets for 18 growing pigs and the correlation between STP and digestible protein (DP) of ingredients. The standard diet, based on corn and soybean, was replaced at 27% by the tested ingredients: wheat middlings, coarse wheat bran, fine wheat bran, wheat flour and wheat germ. The wheat flour diet resulted higher crude protein digestibility although the wheat germ was higher crude protein. The wheat bran resulted lower crude protein digestibility and the coarse wheat bran showed lower non proteic nitrogen digestibility. There was no difference in digestibility of soluble nitrogen and STP. The significant regression was not detected between ingredients STP and DP. The wheat byproducts did not interfered in STP digestibility but the wheat bran damaged the crude protein digestibility and the non proteic nitrogen digestibility. The byproducts STP did not contribute as an indicator for ingredients DP in growing pigs.

Keywords: wheat flour, wheat germ, wheat middlings

Introduction

The use of wheat byproducts is still limited in the nutrition of poultry and pigs due to the high fiber content and low fermentative capacity of these animals. On the other hand, the study of protein utilization of the byproduct can aggregate information about its inclusion in the diet of these animals due to the presence of soluble nitrogen fraction, composed of amino acids, peptides, proteins and non proteic nitrogen fractions. The objective was to evaluate the digestibility of soluble true protein of five wheat byproducts on diets for growing pigs, and verify if the soluble true protein can be an indicator of digestible protein in pigs.

Material e Methods

Eighteen male pigs, castrated, of commercial line were used, with average weight of 50.9 kg ± 5.1 kg, housed in individual metabolic cage in a room with water *ad libitum*. Six treatments were formulated: 1 – standard diet (SD), based on corn and soybean (Rostagno et al., 2011); 2 – 73% SD e 27% wheat middlings, 3 - 73% SD e 27% coarse wheat bran, 4 - 73% SD e 27% fine wheat bran, 5 - 73% SD e 27% wheat flour, 6 - 73% SD e 27% wheat germ. The experiment was divided into two periods of nine days each, with four days of adaptation of animals to the experimental diets and five days for total collection of faeces. It was offered, daily, 2.2 kg and 2.4 kg of diet/animal in the first and second period, respectively, to supply 2.6 times the maintenance of 250 kcal.kg^{-1} of metabolic weight (live wight$^{0.6}$). A randomized block design was used, with six treatments and six replications per treatment.

In the ingredients, the diets and faeces, were analyzed of dry matter and crude protein (CP) (AOAC, 1997), soluble nitrogen (SN) and non proteic nitrogen (NPN) as Prates (2007). The total nitrogen (TN) was determined in CP analysis. The soluble nitrogen (SN) and non proteic nitrogen (NPN) were determined by the residual nitrogen (RN) and the insoluble nitrogen (IN), obtained after distillation by the Kjeldhal method, of the residue samples digested in borate-phosphate buffer and sodium azide 10%, and trichloroacetic acid, respectively. The SN was calculated as TN – IN and the NPN as TN – RN. The soluble true protein (STN) was calculated by the equation: STP = CP – IN*6.25 – NPN (table 1). By the substitution method, the digestibility of nitrogen fractions of the ingredients was calculated (Sakomura & Rostagno, 2007).

Analysis of variance was performed by the GLM procedure (SAS, 1999), and the means were tested by the Tukey test at 5% of probability. It was made the Pearson correlation analysis by the CORR procedure between the digestibility coefficients of crude protein, digestible and true soluble both diet as the ingredients and the true soluble protein of the ingredients. Regression analysis was performed, using the REG procedure, between the soluble true protein ingredients and the digestible protein ingredients for pigs, using the absolute and relative values for crude protein ingredient.

Table 1. Average chemical composition, in dry matter basis, of wheat byproducts included in the experimental diets for growing pigs.

Byproduct	DM (%)[a]	CP (%)[a]	SN (%)[a]	NPN (%)[a]	STP (%)[a]
Wheat middlings	89.16	19.57	1.06	1.02	5.61
Coarse wheat bran	88.36	18.83	0.89	0.82	4.76
Fine wheat bran	88.39	18.96	0.97	0.86	5.19
Wheat flour	87.93	15.24	0.58	0.86	2.79
Wheat germ	88.54	31.41	2.12	1.63	11.62

[a]DM = Dry matter; CP = Crude protein; SN = Soluble Nitrogen; NPN = Non proteic nitrogen; STP = Soluble true protein

Results and Discussion

There was a significant difference between the digestibility coefficients of diets and byproducts. The standard diet and the wheat flour diet presented better digestibility of crude protein, being similar to the wheat germ diet (table 2). The diets with inclusion of middlings, fine bran and coarse bran had a lower digestibility, indicating that the fiber increase interfere with the digestibility of crude protein diets. According to Gomes et al. (2007), there is a loss in digestibility with increasing the crude fiber content in the diet of growing pigs. The digestibility of non proteic nitrogen was also significantly lower for coarse wheat bran. There was no significant difference between the digestibility of soluble nitrogen and soluble true protein in the tested diets.

Table 2. Digestibility coefficient of crude protein (DCCP), soluble nitrogen (DCSN), non proteic nitrogen (DCNPN) and soluble true protein (DCSTP) of the diets with 27% substitution of wheat byproducts for growing pigs and ingredients.

		DCCP	DCSN	DCNPN	DCSTP
Diet	Standard	89.34a	76.56a	86.56a	78.42a
	Standard + Wheat middlings	86.32b	73.09a	82.03a	71.44a
	Standard + Coarse wheat bran	81.44c	59.25a	67.93b	69.13a
	Standard + Fine wheat bran	85.40b	77.06a	85.02a	75.11a
	Standard + Wheat flour	89.87a	72.81a	87.48a	68.97a
	Standard + Wheat Germ	88.14ab	79.73a	81.23a	79.08a
	Coefficient of variation (%)	2.26	9.31	10.64	9.92
	Probability	***	NS	**	NS
Wheat byproducts	Wheat middlings	78.26b	55.87a	69.97a	52.84a
	Coarse wheat bran	60.22c	41.64a	18.03b	44.23a
	Fine wheat bran	74.82b	70.36a	80.94a	66.23a
	Wheat flour	91.29a	54.68a	90.02a	43.53a
	Wheat germ	84.90ab	78.89a	66.92a	80.87a
	Coefficient of variation (%)	9.18	42.37	48.33	46.76
	Probability	***	NS	**	NS

** = P<0.01; *** = P<0.001; NS = not significant

The wheat flour was the ingredient with higher digestibility of crude protein in the diets, although the germ was the ingredient with higher crude protein content. The wheat bran resulted in lower digestibility coefficient of crude protein, and the coarse bran was also significantly lower for the digestibility of non proteic nitrogen. There was no significant difference between the digestibility of soluble nitrogen and soluble true protein in the tested ingredients.

The correlation between the absolute value of soluble true protein (STP) of the ingredients and the digestible protein (DP) of the ingredients by the pigs was significantly positive (r = 0.734). There was a positive linear regression (DP = 6.3872 + 1.6932*STP, R2 = 0.945, P<0.001). Significant regression between the STP of the ingredients and the DP of the ingredients on the crude protein was not detected. This suggests that there is a strong influence of crude protein value of the ingredient on the correlation between STP and DP, and, therefore, the soluble true protein does not seem to be an indicator *in vitro* of digestible protein *in vivo*.

Conclusions

The wheat byproducts in the diet for growing pigs does not interfere with the digestibility of soluble true protein.

The substitution of 27% of coarse wheat bran prejudice the digestibility of crude protein and non proteic nitrogen for growing pigs.

The soluble true protein of wheat byproducts did not contribute as an indicator of digestible protein of the ingredients in growing pigs.

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