Effect of different sources of soy protein concentrate on performance parameters in piglets

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Abstract

Efficient utilization of the nutrients at early stage of the life of growing animals is getting even more important due to UpToDate genetics to meet the production goals. Supply of high value crude protein source can be a practical strategy to achieve this target. Soybean meal is the most abundantly used protein source, however, the level of antinutritional factors can be reduced further down to improve its utilization in young animals. There are different products derived from soybean meal are available in the market. However, there is scarcity of comparative data among these products. The present study was designed to compare the commonly available soy protein concentrate products against conventional soybean meal.
In total 384 cross bred piglets (TN70 X Piètrain) were housed in 32 pens. The comparison was based on four treatments:
T1= Standard SBM, T2 = Soycomeal (ADM), T3 = HP 300 (Hamlet protein) and T4 = X-Soy 600 (CJ), whereas each treatment contained eight repetitions.
The results indicate that soy protein concentrate provides an efficient source of high-quality protein in the pigs at young age. The present study identifies better performance in T4 (X-Soy 600) as compared to T1 - T3 (SBM, Soycomeal and HP300) ($p < 0.05$). In a commercial setup, even a small improvement in performance can translate into a large saving per fattening term.

Introduction

In order to fully unfold the genetic potential of the modern fast-growing animals, the efficient utilization of every component of the compound feed at the early age of animals' life is even more important. The major role in efficient utilization of the feed component can be achieved through the incorporation of the high value raw materials with excellent nutrient profile as well as minimized level of antinutritional factors.
The major contribution of the compound feed is by the energy and protein sources. Among protein sources the most "favorite" is the Soybean meal. It is the most common protein source in almost all kinds of animal feeds under commercial setup.
Based on evidence from the published works, even though Soybean meal *per se* is one of the abundant and efficient raw material, the antinutritional factors hampers its efficient utilization in young animals (El-Shemy et al., 2012). Further processing like ethanol extraction, enzyme treatment and heat treatments are desired to minimize the antinutritional factors of Soybean meal. This extended processing improves its further utility in animal body.
There are different products available commercially, however, there is scarcity of data showing the comparison of these products in a unified scientific experiment. This study was designed to compare the different sources of the extendedly processed soybean meals in piglets for growth parameters.

Materials and Methods

The experiment was conducted at Swine research center of KU Leuven, Belgium. In total 384 cross bred piglets (TN70 X Piètrain) were housed in 32 pens. The comparison was based on four treatments: T1= Standard SBM, T2 = Soycomeal (ADM), T3 = HP 300 Hamlet protein and T4 = X-Soy 600 (CJ), whereas each treatment was replicated in eight repetitions.

Table 1. Crude protein and anti-nutritional factors in different soy protein sources

Items	T1 (SBM)	T2 (Soycomeal P)	T3 (HP 300)	T4 (X-Soy 600)
Crude protein, %	48	63	56	60
Trypsin Inhibiting activity, mg/g	4	2.5	1.3	1
Glycinin, mg/g	217	5	-	2
Beta-conglycinin, mg/g	31	5	2	3

The piglets were weaned at the age of 22 days. The study was comprised on three dietary phases: Pre-Starter: 0 - 14 d; starter: 14 - 29 d and grower: 29 - 41 d. Feed intake, BWG and mortality corrected FCR were calculated after every period.

Dietary Composition

Typical barley, corn, wheat and SBM based diet was formulated. The treatments were created by adding the test raw materials (Soycomeal, HP 300 or X-Soy600) contributing fixed 5% of the formulation. The crude protein contents and average anti-nutritional factors are described in Table 1 whereas, the composition of the diets is described in Table 2.

Table 2. Composition of the experimental diets

Ingredients	Prestarter				Starter				Grower			
	T1 (SBM)	T2 (Soycomeal P)	T3 (HP 300)	T4 (X-Soy 600)	T1 (SBM)	T2 (Soycomeal P)	T3 (HP 300)	T4 (X-Soy 600)	T1 (SBM)	T2 (Soycomeal P)	T3 (HP 300)	T4 (X-Soy 600)
Corn	31.88	31.13	29.29	30.14	39.52	39.81	38.55	38.87	40.37	43.04	41.79	42.10
Wheat	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	15.00	15.00	15.00	15.00
Barley	20.80	25.00	25.00	25.00	22.60	25.00	25.00	25.00	20.00	20.00	20.00	20.00
Soybean meal 48%	12.41	6.12	6.43	6.73	14.47	7.21	8.30	7.88	13.14	6.03	7.12	6.70
Rape Seed Meal	3.26	1.68	2.83	1.77	-	-	-	-	-	-	-	-
Soy Oil	3.76	3.22	3.58	3.52	3.95	3.53	3.71	3.82	3.06	2.51	2.69	2.79
Sodium Chloride	0.14	0.13	0.08	0.13	0.48	0.49	0.48	0.48	0.49	0.49	0.49	0.49
DCP	2.28	2.22	2.22	2.23	2.05	2.06	2.01	2.05	1.88	1.90	1.84	1.89
Whey Powder 27% CP	9.00	9.00	9.00	9.00	-	-	-	-	-	-	-	-
Potato Protein	3.00	3.00	3.00	3.00	4.00	4.00	4.00	4.00	3.00	3.00	3.00	3.00
L-lysine	0.82	0.80	0.83	0.80	0.70	0.69	0.71	0.70	0.72	0.71	0.73	0.71
L-threonine	0.35	0.35	0.35	0.34	0.29	0.29	0.29	0.28	0.30	0.29	0.29	0.29
L-tryptophan	0.13	0.14	0.13	0.13	0.12	0.12	0.12	0.11	0.11	0.12	0.11	0.11
L-methionine	0.36	0.36	0.36	0.36	0.31	0.30	0.30	0.31	0.29	0.28	0.29	0.29
L-valine	0.25	0.23	0.24	0.24	0.16	0.15	0.15	0.16	0.17	0.16	0.16	0.17
L-isoleucine	0.11	0.10	0.11	0.11	0.06	0.05	0.05	0.05	0.07	0.06	0.07	0.07
Phytase	0.33	0.33	0.33	0.33	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34
Xylanase	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Soycomil P		5.00	-	-		5.00	-	-		5.00	-	-
HP 300			5.00	-			5.00	-			5.00	-
X-Soy 600				5.00				5.00				5.00

The diets were analyzed before the start of the experiment and very low discrepancies were found in calculated and analyzed dietary nutrient values. The nutrient requirements were met according to the recommendations of the breeding company (Topig Norsvin). The analyzed nutrient composition of the experimental diets is described in Table 3.

Table 3. Nutrient composition of the dietary treatments (Analyzed)

Nutrient	T1 (SBM)			T2 (Soycomeal P)			T3 (HP 300)			T4 (X-soy 600)		
	Pre-starter	Starter	Grower	Pre-starter	Starter	Grower	Pre-starter	Starter	Grower	Pre-starter	Starter	Grower
NE (MJ/kg)	10.35	10.36	10.24	10.35	10.36	10.24	10.35	10.36	10.24	9.98	9.99	9.87
CP, %	18.90	18.80	17.90	19.60	19.00	17.90	19.00	19.20	18.00	19.20	19.00	18.70
Crude fat, %	6.70	6.50	5.60	6.30	6.20	5.20	6.40	6.40	5.60	6.40	6.50	5.60
Ash, %	5.77	4.51	4.50	5.79	4.55	4.40	5.78	4.61	4.54	5.51	4.63	4.42
Crude fiber, %	2.10	2.40	2.20	1.90	2.30	2.10	2.00	2.40	2.30	2.30	2.30	2.30
Amino acids (%)												
Lys	1.45	1.50	1.44	1.44	1.47	1.47	1.42	1.49	1.31	1.49	1.48	1.50
Met	0.61	0.57	0.55	0.58	0.55	0.54	0.59	0.56	0.51	0.62	0.57	0.57
Thr	1.06	1.04	0.99	1.06	1.02	0.99	1.08	1.05	0.89	1.08	1.00	1.01
Trp	0.35	0.35	0.32	0.35	0.34	0.32	0.35	0.33	0.30	0.35	0.34	0.32
Val	1.15	1.11	0.94	1.04	0.97	0.94	1.03	1.01	1.00	1.17	1.11	1.09
Ile	0.89	0.84	0.80	0.89	0.83	0.78	0.88	0.83	0.78	0.90	0.84	0.86
Leu	1.55	1.57	1.41	1.54	1.52	1.41	1.54	1.55	1.51	1.58	1.60	1.56
Arg	0.89	1.02	0.96	0.93	1.03	0.97	0.90	1.03	0.93	0.94	1.02	1.01

Statistical analysis

The raw data were evaluated for normality, homogeneity of variance and outlier before being subject to ANOVA. Tukey's test was applied to identify the significant ($p < 0.05$) difference among treatments.

Results

The animals were weighed on 0, 14, 28 and 42d of experiment, at the same time the feed intake data was collected.
The piglets selected with uniform weight (6.27 kg) at 0d. All the treatments performed uniformly in the pre-starter period (0 - 14d) with small variations in feed intake and average daily gain. However, as soon as the experiment progressed to starter (14 - 28d) and grower periods (28 - 42d) the variation among the treatments started to become visible. In the starter phase (14 - 28d) the piglets in T2 - T4 gained numerically higher body weight as compared to T1 (SBM). The same trend continued till the end of experiment (42d). Whereas, among the treated soy protein concentrated the piglets in T4 (X-Soy 600) gained numerically highest body weight (21.99 kg) at the end of experiment as compared to the T2 (Soycomeal) and T3 (HP 300) Table 4.

Table 4. Performance parameters comparing different sources of the soy protein concentrates.

	T1 (SBM)	T2 (Soycomeal P)	T3 (HP 300)	T4 (X-Soy 600)	SEM (Pooled)	P value
Body weight, kg						
0d	6.25	6.28	6.28	6.28	0.36	1.00
14d	8.43	8.43	8.57	8.54	0.45	0.99
28d	13.80	14.06	14.21	14.43	0.70	0.93
42d	20.90	21.06	21.15	21.99	0.92	0.84
Average daily gain, kg						
0 to 14d	0.16	0.15	0.16	0.16	0.01	0.86
14 to 28d	0.38	0.40	0.40	0.42	0.02	0.62
28 to 42d	0.51	0.50	0.50	0.54	0.02	0.42
0 to 42d	0.35	0.35	0.35	0.37	0.01	0.63
Average daily feed intake, kg						
0 to 14d	0.21	0.21	0.22	0.23	0.01	0.74
14 to 28d	0.51	0.52	0.52	0.55	0.02	0.71
28 to 42d	0.72	0.70	0.70	0.76	0.03	0.51
0 to 42d	0.48	0.48	0.48	0.51	0.02	0.60
Feed conversion ratio, kg/kg						
0 to 14d	1.36	1.42	1.37	1.39	0.06	0.89
14 to 28d	1.35	1.29	1.31	1.31	0.03	0.69
28 to 42d	1.43	1.41	1.42	1.41	0.05	1.00
0 to 42d	1.38	1.36	1.37	1.37	0.03	0.97

Similarly, the FCR varied throughout the experiment between the treatments, but the differences were statistically ($p < 0.05$) not secured.

Conclusion

Soy protein concentrate provides an efficient source of high-quality protein in the pigs at young age. Although statistically non-significant ($p < 0.05$), the present study identifies better performance in T4 (X-Soy 600) as compared to T1 - T3 (SBM, Soycomeal and HP300). In a commercial setup, even a small improvement in performance can translate into a large saving per fattening term.

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