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Changes in tissue amino acid composition & protein metabolism in piglets due to a limiting supply of total sulphur amino acids

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Introduction & Objective

In pigs, the amino acid requirements are usually evaluated through body weight gain or N retention, which assume that the amino acid composition of the total body protein is constant. However, there are doubts on the validity of this hypothesis. A deficient total sulphur amino acids (Met+Cys) supply has been shown to modify the amino acid profile of tissue proteins (Conde-Aguilera et al., 2010), but mechanisms are still unknown.

The objective of this study was to evaluate the response of piglets to a deficient total sulphur amino acid supply in terms of protein synthesis, activities of proteolytic enzymes, and the amino acid composition of body tissues.

Materials & Methods

Piglets were divided in 2 groups and received a diet either deficient (TSAA–) or sufficient (TSAA+) in total sulphur amino acids for 10 d. Diets were formulated to meet the nutritional recommendations except for the Met and total sulphur amino acid supplies in TSAA–, which were 31 and 28% below requirements, respectively. Selected samples were collected for analysis.

Results & Discussion

Performance and muscle protein metabolism

	TSAA+	TSAA–	P-value
Final BW (kg)	13.0	12.3	0.24
Weight gain (g/d)	375	292	<0.001
Feed conversion (g gain/g feed)	0.99	0.78	<0.01
Protein synthesis (%/d)			
Longissimus dorsi	6.35	4.33	<0.01
Rhomboideus	3.85	4.20	0.39
Semitendinous	4.95	4.11	0.10
Efficiency of protein synthesis ¹			
Longissimus dorsi	4.91	2.95	<0.001
Rhomboideus	4.06	4.38	0.43
Semitendinous	3.80	2.98	0.03
Proteasome activity ²			
Longissimus dorsi	1,959	2,170	0.39
Rhomboideus	2,788	2,741	0.88
Semitendinous	1,914	2,284	0.05

BW, body weight; ¹g of protein synthesized per day per mg of RNA;
²relative fluorescence units per min per mg of protein

Relative weight and protein content of tissues

	TSAA+	TSAA–	P-value		TSAA+	TSAA–	P-value
Weight (g/kg BW)				Protein (g/kg tissue)			
Longissimus dorsi	17.1	15.4	0.09	Longissimus dorsi	176	176	0.94
Rhomboideus	0.42	0.42	0.93	Rhomboideus	154	156	0.51
Semitendinous	3.43	3.45	0.88	Semitendinous	162	165	0.48
Liver	24.1	24.6	0.60	Liver	169	174	0.31
Proximal jejunum	11.2	11.7	0.67	Proximal jejunum	131	135	0.15
Distal jejunum	10.8	13.2	0.01	Distal jejunum	122	126	0.53
Ileum	12.4	13.5	0.51	Ileum	119	131	0.07
Kidneys	5.45	5.55	0.78	Kidneys	135	136	0.64
Skin	2.67	2.50	0.91	Skin	186	194	0.44

BW, body weight

Amino acid composition of longissimus dorsi (LM), rhomboideus (RM) and semitendinous (SM) muscles, liver, proximal and distal jejunum, ileum, kidney and skin

Conclusion

The animal shows a certain plasticity of tissues to respond to a limiting total sulphur amino acid supply. This questions the use of a constant amino acid profile to establish amino acid requirements. The functional consequences of these changes remain to be studied.

References

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