



Effects of nutrition on digestion efficiency and gaseous emissions from slurry in growing pigs: II. Effect of protein source in practical diets



A. Beccaccia^a, A. Cerisuelo^b, S. Calvet^c, P. Ferrer^c,
F. Estellés^c, C. De Blas^a, P. García-Rebollar^{a,*}

^a Departamento de Producción Agraria, Universidad Politécnica de Madrid, E.T.S. Ingenieros Agrónomos de Madrid, Ciudad Universitaria s/n, 28040 Madrid, Spain

^b Centro de Investigación y Tecnología Animal, Instituto Valenciano de Investigaciones Agrarias, Pol. La Esperanza 100, 12400 Segorbe, Castellón, Spain

^c Instituto de Ciencia y Tecnología Animal, Universitat Politècnica de València, Camino de Vera s/n, 46022 Valencia, Spain

ARTICLE INFO

Article history:

Received 20 January 2015

Received in revised form 14 July 2015

Accepted 19 July 2015

Keywords:

Ammonia emission
Digestion efficiency
Growing-finishing pigs
Methane emission
Slurry
Protein source

ABSTRACT

This research aimed to investigate effects of protein source in practical diets on nutrient excretion and potential emissions of ammonia (NH₃) and methane (CH₄) in pigs. Three experimental feeds were designed to substitute a mixture of soybean meal and soybean hulls (SB diet) with sunflower meal (SFM) or wheat DDGS (WDDGS). The proportion of other ingredients was also modified in order to maintain similar nutrient contents across diets. Changes in protein source led to differences in dietary content of neutral detergent insoluble crude protein, soluble fibre (SF) and acid detergent lignin. Twenty-four pigs (8 per diet), weighing 52.3 or 60.8 kg at the first and second batch, respectively, were housed individually in metabolic pens to determine during a 7-day period dry matter (DM) balance, coefficients of total tract apparent digestibility (CTTAD) of nutrients, and faecal and urine composition. Representative slurry samples from each animal were used to measure NH₃ and CH₄ emissions over an 11 and/or 100-day storage period, respectively. Neither DM intake, nor DM or energy CTTAD differed among experimental diets, but type of feed affected ($P < 0.001$) crude protein (CP) digestibility, which was highest for SFM (0.846) than for SB (0.775) diet, with WDDGS-based diet giving an intermediate value (0.794). Faecal DM composition was influenced ($P < 0.001$) accordingly, with the lowest CP concentration found for diet SFM and the highest for SB. The ratio of N excreted in urine or faeces decreased from SFM (1.63) to SB diet (0.650), as a consequence of both lower urine and higher faecal losses, with all the faecal N fractions increasing in parallel to total excretion. This result was parallel to a decrease of potential NH₃ emission (g/kg slurry) in diet SB with respect to diet SFM (from 1.82 to 1.12, $P < 0.05$), giving slurry from WDDGS-based diet an intermediate value (1.58). Otherwise, SF and insoluble neutral detergent fibre (aNDFom) CTTAD were affected ($P < 0.001$ and $P = 0.002$, respectively) by type of diet, being lower for SFM than in SB-diet; besides, a higher content of aNDFom (491 vs 361 g/kg) on faecal DM was

Abbreviations: ADFom, acid detergent fibre without residual ash; ADL, acid detergent lignin; BEDN, bacterial and endogenous debris nitrogen; B₀, biochemical methane potential; CH₄, methane; CEL, cellulose; CP, crude protein; CTTAD, coefficient of total tract apparent digestibility; DE, digestible energy; DM, dry matter; HEM, hemicellulose; aNDFom, stable amylase neutral detergent fibre without residual ash; NDICP, neutral detergent insoluble crude protein; NH₃, ammonia; OM, organic matter; SB, soybean; SF, soluble fibre; SFM, sunflower meal; TAN, total ammonia nitrogen; TKN, total Kjeldahl N; UDN, undigested dietary nitrogen; WDDGS, wheat DDGS; WSN, water soluble nitrogen.

* Corresponding author.

E-mail address: paloma.grebollar@upm.es (P. García-Rebollar).