



## Effects of dietary vitamin A supplementation or restriction and its timing on retinol and $\alpha$ -tocopherol accumulation and gene expression in heavy pigs

M. Ayuso<sup>a,\*</sup>, C. Óvilo<sup>b</sup>, A. Fernández<sup>b</sup>, Y. Nuñez<sup>b</sup>, B. Isabel<sup>a</sup>, A. Daza<sup>c</sup>, C.J. López-Bote<sup>a</sup>, A.I. Rey<sup>a</sup>

<sup>a</sup> Departamento de Producción Animal, Facultad de Veterinaria, Universidad Complutense, 28040 Madrid, Spain

<sup>b</sup> Departamento de Mejora Genética, Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria, Ctra. Coruña Km. 7.5, 28040 Madrid, Spain

<sup>c</sup> Departamento de Producción Animal, Escuela Técnica Superior de Ingenieros Agrónomos, Universidad Politécnica, 28040 Madrid, Spain

### ARTICLE INFO

#### Article history:

Received 10 October 2014

Received in revised form 13 January 2015

Accepted 14 January 2015

#### Keywords:

Dietary vitamin A  
 $\alpha$ -tocopherol  
Gene expression  
Dose-response  
Heavy pigs

### ABSTRACT

Vitamin supplementation is a widely extended practice in swine nutrition. Certain vitamins such as vitamins A and E are related to meat quality and have been reported as antagonists. Thus, their tissue levels are of interest for swine producers and consumers. This experiment was undertaken to study the effect of dietary vitamin A supplementation or withdrawal duration and timing on the evolution of vitamin A deposition in tissues,  $\alpha$ -tocopherol accumulation and gene expression in heavy pigs. Eighty weaned Iberian piglets ( $16.3 \pm 2.5$  kg) were either fed a vitamin A-enriched diet (10,000 IU vitamin A/kg) (**CONTROL**) or given a diet without added vitamin A applied from the beginning of the trial at 16.3 kg (early restriction group, **ER**) or from an average weight of 35.8 kg (late restriction group, **LR**). Pigs fed ER and LR had lower ADG and worse feed efficiency than those from the CONTROL group at 101.4 kg ( $P=0.001$  and  $P=0.034$ , respectively). However, final weight, average daily gain, average daily intake and feed conversion efficiency were not statistically affected by dietary treatment during the starter (<35.8 kg), fattening period (101.4–157.9 kg) or overall (16.3–157.9 kg). Retinol concentration in tissues reflected the dietary vitamin A level. Retinol and retinyl palmitate accumulation in hepatic and fat depots of control animals was more marked during the growing than during the finishing period. Retinol depots decreased in restricted groups and showed different sensitivity for mobilization between tissues, with faster retinol mobilization from the liver. The ER group had a higher hepatic  $\alpha$ -tocopherol increase than the LR group ( $P<0.0001$ ). However, in fat the increase in  $\alpha$ -tocopherol levels were more marked in the LR than in the ER group ( $P<0.0001$ ). *ADH1C* gene expression was higher ( $P=0.0237$ ) in CONTROL than in ER at 101 kg and *LRAT* gene expression showed a dose-dependent decrease in the ER group at 101 and 158 kg LW ( $P<0.0001$ ). There were no differences in *RBP4*, *ALDH1A1*, *MTTP* and *TTP* gene expression as affected by dietary treatment. Growth time influenced gene expression, with *ADH1C* and *RBP4* genes being mainly expressed at 101 kg LW compared to pigs at 36 or 158 kg LW ( $P<0.05$ ). Relative expression of *MTTP* and *TTP* was also affected by time and showed an opposite pattern to that observed

**Abbreviations:** ER, early restriction group; LR, late restriction group; LW, live weight; ADG, average daily gain.

\* Corresponding author. Tel.: +34 91 394 38 89; fax: +34 91 394 38 89.

E-mail address: [mayuso@ucm.es](mailto:mayuso@ucm.es) (M. Ayuso).