

Use of rice husk in Iberian pigs during the pre-montanera period for welfare diets. Preliminary results

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SUMMARY

Before the free-ranging, acorn-feeding finishing period (montanera), Iberian pigs are feed-restricted during the so-called pre-montanera. With the aim of increasing animal welfare during this period, three different diets with increasing levels of fibre (5.0 %, 8.5 % and 12.0 %; the 2 latter including rice husk, an underutilized byproduct) were evaluated during the pre-montanera period from 9 to 13 months of age in Iberian pigs. Animal welfare was evaluated using the *Welfare Quality*® test. None of the treatment groups had diarrheic problems, despite the relatively high level of fibre in the rice husk-containing diets. Body weight at the end of pre-montanera did not vary significantly among the 3 treatments. However, body weight gain from the 2nd month of treatment up to the end of pre-montanera was significantly higher for the treatment having the highest fibre level than for the other treatments. These preliminary results suggest that supplementation with high levels of fibre (12 %) from rice husk could increase the welfare level of Iberian pigs during pre-montanera, thus providing an alternative use for this important agricultural byproduct.

Uso de cascarilla de arroz durante el periodo de pre-montanera para dietas de bienestar. Resultados preliminares

RESUMEN

En los sistemas de producción extensivos del cerdo Ibérico, la alimentación de los animales está restringida durante la pre-montanera. Con el propósito de incrementar el bienestar durante este periodo, tres dietas diferentes con niveles crecientes de fibra (5,0 %; 8,5 %; 12,0 %) procedentes de cascarilla de arroz, que es un subproducto infrautilizado, fueron evaluados en cerdo Ibérico durante la pre-montanera (desde los 9 a los 13 meses de edad). El bienestar animal fue evaluado mediante el test *Welfare Quality*®. Ninguno de los grupos de tratamientos tuvo problemas de diarrea, a pesar del contenido relativamente elevado en fibra de las dietas enriquecidas. El peso corporal al final de la pre-montanera no varió significativamente entre tratamientos. Sin embargo, la ganancia de peso desde el segundo mes del experimento hasta su conclusión fue significativamente superior en el grupo con el nivel de fibra más alto que en los otros 2 grupos. Por tanto, los resultados preliminares muestran que el uso de altos niveles de fibra (12 %) en dietas de cerdo Ibérico durante la pre-montanera podría ser usado para mejorar el bienestar animal en este periodo, lo que adicionalmente supondría un uso alternativo para este importante subproducto agrícola.

INTRODUCTION

The Iberian pig is a native breed from the South-west of the Iberian Peninsula, traditionally fed under free-ranging conditions during the finishing period (called *montanera*) in a Mediterranean forest ecosystem with acorn and grass fully available. The Spanish National quality standard of products derived from

the Iberian pig carcass (MAGRAMA, 2014) limits the weight of animals at the beginning of *montanera* to a range of 92 to 115 kg and the minimum age at slaughtering to 14 months. To meet this standard, a really low average daily gain of animals during the previous period (*pre-montanera*) is needed and, thus, feed is usually restricted during this phase. Reduction of rations increases behaviour problems and intralot variation in

Table I. Experimental treatments (Tratamientos experimentales).

Treatment	Diet	Daily feeding rations (kg feedstuff / head / day)
T1	D1	1.3
T2	D2	1.4
T3	D3	1.5

weight, and severe feed restriction leads to incomplete compensatory growth during the montanera (Daza et al. 2005). Dietary fibre has been observed to reduce behavioural problems (de Leeuw et al. 2008), although studies are scarce for finishing pigs.

On the other hand, rice husk is an important fibrous byproduct in Extremadura (Spain). Around 20% of paddy weight is husk. The main EU-28 rice producers are Italy (51.0 %) and Spain (29.0%; European Commission, 2015). Extremadura is the second Spanish producer region (0.18 million tons; MAGRAMA, 2015). Rice straw and rice husk remain unutilized, although different applications have been studied. The high silica content constitutes a limitation to the use of rice husk as an animal feed, apart from its low protein and high non-fermentable fibre content (Vadiveloo et al. 2009). The aim of the present study was to evaluate the effect of the inclusion of different levels of fibre from rice husk in diets of Iberian pigs during the premonanera period, in order to evaluate its effect on animal welfare and body weight variability, as well as the possible influence on the later fattening phase. This paper shows preliminary results of the study.

MATERIAL AND METHODS

A total of 48 pure Iberian pigs, divided in 3 lots, were used (n = 16; 2 replications for each experimental treatment). The experiment was conducted during premonanera from 9 to 13 months of age, with the animals housed in outdoor corrals with shadow areas.

Three different diets (**D1**, **D2**, **D3**), with increasing levels of fibre from rice husk (5.0, 8.5 and 12 % fibre) were evaluated. The daily feeding rations (Treatments T1, T2 and T3) of the 3 diets, respectively, were offered in pelleted form and set to provide similar amounts of energy and protein (**Table I**). Fibre-enriched diets (D2 and D3) were produced by mixing a commercial concentrate (Control diet; D1) with milled rice husk and granulated with a semi-industrial (100 kg per hour) pelletizing machine. The chemical composition of the diets and the rice husk are shown in **Tables II** and **III**, respectively. Body weight was collected at the start of the experiment (9 months of age) and at 11, 12 and 13 months of age. Body composition *in vivo* was assessed by ultrasonography at 11 and 13 months of age. Back-fat thickness and loin area at the 10th rib level were scanned using a 3.5 MHz, 12 cm-long longitudinal probe (Ayuso et al., 2013). At 13 months of age, blood samples were taken to evaluate blood cell counts (as stress indicator) and metabolic parameters. Animal welfare was

evaluated by the *Welfare Quality*® test, used by Temple et al. (2011). Data were subjected to one-way analysis of variance using the general linear models procedure of Statistix software. Statements of significance were based on P < 0.05, and significant differences between means were separated by the Tukey's test.

RESULTS AND DISCUSSION

The growth response to high fibre inclusion in the diet appeared to be analogous to the other treatment groups (**Figure 1**), and seemed to be even better from the second month of premonanera (11th month of age) up to its end. None of the treatment groups had diarrheic problems, despite the relatively high level of fibre of T2 and T3 groups. Neither the body weight at the end of the experiment nor the weight gain of the whole premonanera experimental period differed significantly among treatments. However, the rate of weight gain (WG) of the D3 group seemed to be steadier than that of the other groups (**Figure 1**). Moreover, from the second month of the experimental diet period to the end of premonanera (from 10 to 13 months of age), the WG of the D3 group was significantly higher

Table II. Chemical composition of the experimental diets (D1, D2 and D3) (Composición química de las dietas experimentales (D1, D2 and D3)).

Chemical composition	D1	D2	D3
Humidity (%)	12.1	12.0	12.2
Ash (%)	5.1	5.6	6.6
Crude protein (%)	15.7	14.2	13.0
Fat (%)	2.6	2.9	3.8
Gross fibre (%)	5.0	8.5	12.0
N.D.F. (%)	14.7	18.5	22.9
M.E. (kcal/kg)	3,053	2,775	2,528
N.M.E. (kcal/kg)	2,247	2,073	1,900

N.D.F.: Neutral detergent fibre; M.E.: Metabolizable energy; N.M.E.: Net metabolizable energy.

Table III. Chemical composition of rice husk expressed in percentage of dry matter (Composición química de la cascarilla de arroz, expresado en porcentaje de materia seca).

Composition	Percentage
Ash	11.6 ± 0.1
Protein	2.8 ± 0.1
Gross fibre	39.8 ± 0.5
Cellulose	35.6 ± 0.5
Hemicellulose	14.5 ± 0.8
Lignin	16.1 ± 0.8
Chemical composition of the ash (%)	
SiO ₂	93.3 ± 0.4
K ₂ O	3.8 ± 0.1
CaO	1.0 ± 0.02
MgO	0.4 ± 0.01

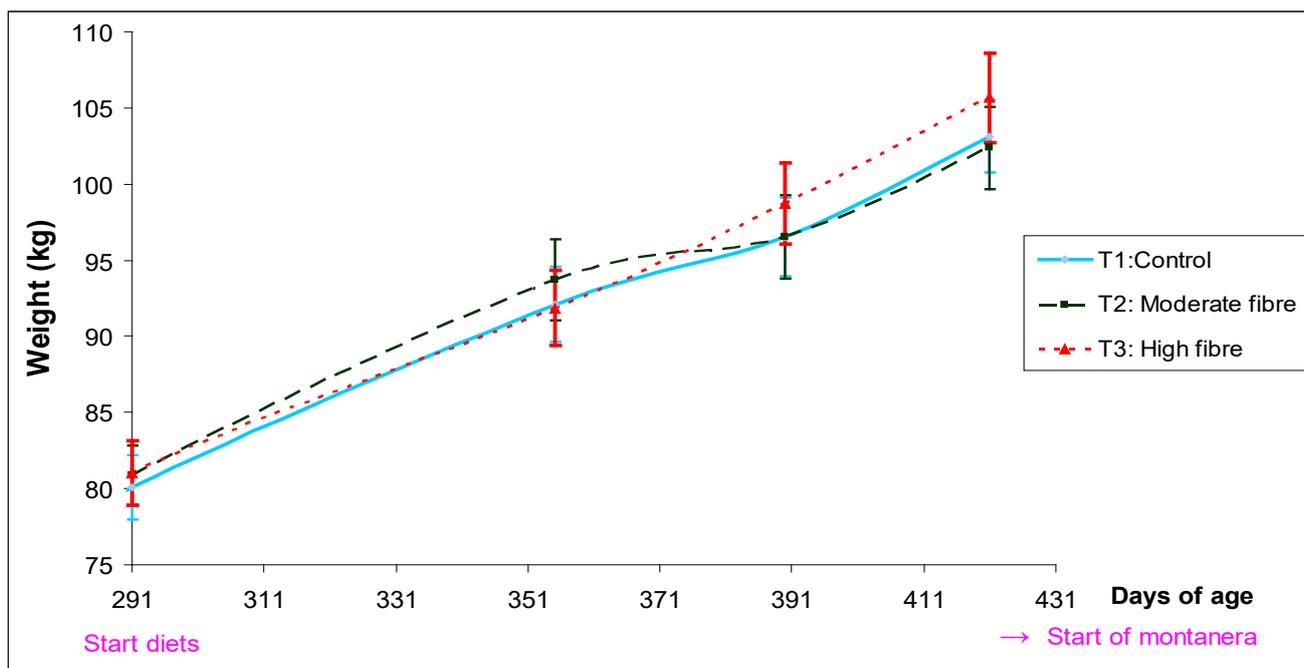


Figure 1. Body weight evolution during premontanera for each experimental treatment (T1, T2 and T3). Vertical bars are standard errors (Evolución del peso corporal durante la premontanera en función de los tratamientos experimentales (T1, T2 y T3). Las barras significan error estándar).

than that of the other treatments, as shown in **Figure 2**. Since all treatments provided similar amounts of energy and protein, one possible explanation for the higher WG achieved by the high-fibre diet group may be that animals were likely less stressed due to a higher satiety sensation induced by the fibre, as described by de Leeuw et al. (2008), thus plausibly reducing energy consumption and reaching a high level of welfare. The fact that those effects were only significant after the 2nd month of treatment (10th month of age) could suggest the existence of a period of adaptation to the high level

of fibre consumption. On the other hand, in all cases, the average body weights at the end of premontanera were within the range allowed by the Spanish National quality standard (MAGRAMA, 2014). Finally, data from welfare test, body composition and blood analysis are being processed. Taking into account the above discussed preliminary results, the inclusion of high levels of fibre (12 %) from rice husk in Iberian pigs diets during premontanera could be used to increase animal welfare, which would mean an alternative use for this important agricultural byproduct.

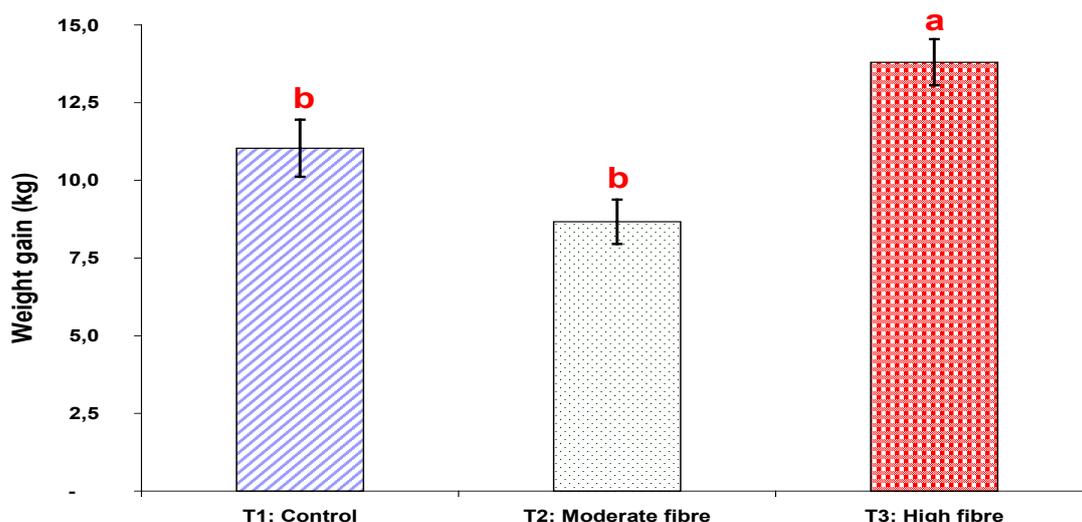


Figure 2. Body weight gain according to experimental treatments (T1, T2 and T3) from the second month of the start of the diets to the end of premontanera period (10 to 13 months of age). Vertical bars are standard errors. Different letters indicate significant differences ($p < 0.05$) (Ganancia de peso en función de los tratamientos del experimento (T1, T2 y T3) desde el segundo mes del inicio de las dietas hasta el final de la premontanera (10 a 13 meses de edad). Las barras significan error estándar. Letras diferentes indican diferencias significativas ($p < 0.05$)).

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