Livestock Science 136 (2011) 216–224

Contents lists available at ScienceDirect

Livestock Science

journal homepage: www.elsevier.com/locate/livsci

Effect of dietary regime and group structure on pig performance and the variation in weight and growth rate from weaning to 20 weeks of age

E. Magowan [a,*], M.E.E. Ball [a,b], K.J. McCracken [b], V.E. Beattie [c], R. Bradford [e], M.J. Robinson [d], M. Scott [c], F.J. Gordon [d], C.S. Mayne [a,b]

[a] Agri-Food and Biosciences Institute, Large Park, Hillsborough, Co. Down, Northern Ireland BT26 6DR, United Kingdom
[b] The Queen's University of Belfast, Newforge Lane, Belfast BT9 5PX, United Kingdom
[c] Devenish Nutrition Ltd., 96 Duncrue Street, Belfast BT3 9AR, United Kingdom
[d] John Thompson & Sons Ltd., 35–38 York Road, Belfast BT15 3GW, United Kingdom
[e] Preferred Capital Management, 96 Duncrue Street, Belfast BT3 9AR, United Kingdom

ARTICLE INFO

Article history:
Received 21 June 2010
Received in revised form 13 September 2010
Accepted 16 September 2010

Keywords:
Pigs
Diet
Group structure
Performance
Variation

ABSTRACT

This study aimed to improve lifetime pig performance and reduce variation in growth rate between pigs using managerial and nutritional practices. The experiment (2×2×2 factorial) compared uniform and mixed weight grouping (SD of weight in group at weaning 0.7 kg and 1.6 kg respectively), offering pigs a high (12 kg) or low (6 kg) allowance of starter diets post weaning and either a special (DE 14.5 MJ/kg, total lysine 11 g/kg) or normal (DE 13.5 MJ/kg, total lysine 9.5 g/kg) finishing diet. Over six time replicates, 960 pigs (Landrace×Large White) were randomly allocated at weaning (28±2 days of age) into groups of 20 according to weight and sex and these groups were split at 10 weeks of age (transfer to finishing accommodation) into two groups of 10. Finishing diet was offered from 11 weeks of age. The FCR of pigs (wean–7 weeks of age) was significantly ($P<0.001$) improved when a high allowance of starter diets was offered (1.25) compared with a low allowance (1.34). However, between 7 and 10 weeks of age a high allowance of starter diets only improved the FCR of pigs in uniform groups. A special finishing diet improved ($P<0.05$) the ADG of pigs during finish (11–20 weeks of age) (860 g/day) compared with a normal finishing diet (827 g/day). The coefficient of variation (CV) of weight at 10 and 15 weeks of age was significantly lower (both $P<0.001$) for pigs in uniform weight groups compared with that of pigs in mixed weight groups. A three-way interaction was observed on the CV of ADG (weaning–20 weeks of age) ($P<0.05$) and FCR (11–20 weeks of age) ($P<0.01$). The lowest CV of ADG (weaning–20 weeks of age) and lowest FCR (11–20 weeks of age) were achieved when uniform grouped pigs were offered a high allowance of starter diets post weaning and a special finishing diet (0.117 and 2.43 respectively) whereas the highest values were observed when mixed weight groups of pigs were offered a low allowance of starter diets post weaning and a normal finishing diet (0.162 and 2.70 respectively). In conclusion, although uniform grouping appears to aid the reduction in slaughter weight variation and improve FCR, its effect is dependent on dietary regime. Overall, from weaning to 20 weeks of age, uniformly grouped pigs offered a high allowance of starter diets post weaning and a special finishing diet had a low CV of ADG and the most efficient FCR.

1. Introduction

The variation in growth rate between pigs on commercial herds can have major financial implications (King, 1999;

* Corresponding author. Tel.: +44 28 9268 2484; fax: +44 28 9268 9594.
E-mail address: elizabeth.magowan@afbini.gov.uk (E. Magowan).

1871-1413/$ – see front matter.
doi:10.1016/j.livsci.2010.09.013

Patience and Beaulieu, 2006). Large variation in growth rate within an herd is related to poor average herd growth rate and decreased profitability (Magowan et al., 2007; Roberts and Deen, 1995). Variability in weight and growth rate is a fact of life from birth, and research suggests that, for the porcine species, the position of the foetus in the uterus has a role to play in birth weight and subsequent growth performance of the pig (Milligan et al., 2001, 2002; Wise and Christenson, 1992). Practices such as fostering, creep feeding and split weaning have been used to reduce variation in the weaning weight of pigs with the ultimate goal of reducing variation in slaughter weight. However, the beneficial effects of these practices as observed at weaning, often disappear during the growing period (Milligan et al., 2002; Lawlor et al., 2002; Mahan, 1993). Attempts have also been made to reduce the variation in weight of pigs at various ages by offering diets varying in nutrient density and offering these diets for different time periods post weaning (Lawlor et al., 2002). Furthermore, grouping pigs in uniform weight groups during the growing and finishing periods has been investigated (O'Connell et al., 2005). Higher density diets improved production performance in the studies reported by Lawlor et al. (2002) and pens were cleared at slaughter more efficiently when pigs were uniformly grouped at the start of the finishing period in the studies reported by O'Connell et al. (2005). However, neither of the aforementioned practices, when carried out separately, significantly influenced the variation in growth rate between pigs.

Nyachoti et al. (2004) noted that the three main aspects which affect the voluntary feed intake of pigs and hence growth rate, are genetics, environmental stressors and nutrient density. They suggested that, in commercial practice, these three aspects are impossible to separate and often influence voluntary feed intake at the same time. Therefore, research focussing on the combination of environmental and dietary factors influencing pig growth and feed intake is potentially more commercially beneficial. The aim of the current study was to reduce the variation in growth rate between pigs, and hence variation in weight of pigs at various ages, by grouping pigs in either uniform or mixed weight groups at weaning, and offering these groups of pigs superior or normal dietary regimes during the post weaning and finishing periods.

2. Materials and methods

2.1. Pre weaning management

Piglets received creep feed (DE 15.8 MJ/kg fresh, CP 200 g/kg fresh, lysine 16 g/kg fresh; Devenish Nutrition Ltd, Belfast) *ad libitum* from 18 ± 2 days of age. The creep feed was offered on the floor of the heated forward creep area, and was the same as the starter 1 diet used in the trial (Table 1). Pigs were vaccinated for *Mycoplasma hyopneumoniae* at weaning. At the time of the trial, Porcine Circovirus 2 (PCV2) was identified at high levels in some pigs and it was suspected that Post weaning Multi-systemic Wasting Syndrome (PMWS) was apparent at a low level in finishing pigs within the herd (mortality = 6%). Zinc Oxide and Tylan® (Elanco) were included in all diets.

2.2. Housing

At weaning, pigs were transferred to growing accommodations (0.38 m^2/pig) with plastic slatted floors. Temperature was 28 °C on the first day of treatment, and this was reduced by 0.5 °C/day to a minimum of 18 °C. In the growing accommodation, pigs were offered feed via a 'dry' multi space feeder (Etra Feeders, Northern Ireland). Two feeders were placed along the front of the pen, 0.5 m apart. At 10 weeks of age, pigs were transferred to finishing accommodations (0.61 m^2/pig) with fully slatted concrete flooring, where they remained until slaughter (105 kg). In the finishing accommodation pigs were offered feed via a 'wet and dry' single space verba feeder (Verba, Verbakel™, The Netherlands). One feeder was used per pen i.e. per 10 pigs. During the trial, all pigs were offered water from bowl drinkers (10 pigs per drinker). They were exposed to natural lighting through windows and artificial lighting during feeding.

2.3. Experimental design and treatments

The experiment was designed as a 2 × 2 × 2 factorial (group structure (uniform vs mixed) × post weaning starter diet allowance (high vs low) × finishing diet (special vs normal)). Pigs in uniform groups all had a similar weight whereas pigs in mixed weight groups spanned the full range of weights which can be observed at weaning. Post weaning starter diet allowance treatments compared the practice of offering post weaned pigs a 'High' allowance of starter diets (12 kg/pig) or a 'low' allowance (6 kg/pig). The 12 kg included 4 kg of 'starter 1' diet followed by 8 kg of 'starter 2' diet. The 6 kg included 2 kg of 'starter 1' diet followed by 4 kg of 'starter 2' diet. In practice, each pen of 20 pigs was allocated 20 times the required allowance. For example, for the 4 kg of starter 1 diet, in the 'high' allowance treatment, each pen of 20 pigs was offered 80 kg of starter 1 diet. When pens of pigs finished their allocation of starter diets they were offered a grower diet to 11 weeks of age. The finishing diets differed in energy and lysine content creating a 'special' (S) and 'normal' (N) finishing diet. All diets were offered *ad libitum* and their compositions are reported in Table 1. Dietary treatments in the finishing period were balanced across the treatments from the post weaning period, so that carryover effects could be tested. Pigs were on experiment from weaning to 20 weeks of age.

2.4. Post weaning period

Over six time periods (replicates) a total of 960 pigs (1/4 Landrace × ¾ Large White) were weaned at 28 ± 2 days of age and randomly allocated into groups of 20 according to their weight and sex (groups were balanced for sex (entire boars and gilts)). Within each replicate, eight groups were formed at weaning. Six represented uniform weight groups while the remaining two represented mixed weight groups. Therefore two groups of light weight pigs (average weight 7.1 kg, SD 0.85 kg), two groups of medium weight pigs (average weight 8.9 kg SD 0.50 kg), two groups of heavy weight pigs (average weight 10.4 kg, SD 0.75 kg) and two groups of mixed weight pigs (i.e. light, medium and heavy pigs grouped together,