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The effects of sire line, sex, weight and marketing day on carcass fatness of non-castrated pigs

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ABSTRACT

In the context of non-castrated pig production in the EU, it is important to quantify the different factors that affect carcass composition. In this study, a large-scale database was analyzed to assess the effect of two different lean sire lines (SL), sex, carcass weight (CW) and marketing day (MD) on carcass fatness of non-castrated pigs. Marketing day was introduced as a variable to quantify the effect of different growth rates within a farm on carcass composition. Thus, first pigs leaving the farm had a MD of 0. The results showed that the synthetic SL had a higher feed intake and average daily gain than the Pietrain SL, which lead to fatter carcasses. Females were fatter than males in both SL analyzed. For all SL and sexes there was a positive relationship between CW and carcass fatness variables, which was modified by SL and sex. Regarding MD, the results showed a negative relationship between MD and carcass fatness, which was also modified by SL and sex. Summarizing, there are relevant differences in productivity and carcass composition between lean SL, which might be related to changes in feed intake. Additionally, carcass fatness increases with CW and decreases with MD.

1. Introduction

Carcass weight and composition uniformity is an important requirement to reduce costs in the meat industry. In recent years, the production of entire pigs has increased in Europe at the expense of castrated animals, as a measure to improve animal welfare. Avoiding castration represents an opportunity to reduce carcass fatness and improve feed efficiency. However, it is necessary to quantify how different factors, both inter- and intra-genetically, influence carcass leanness. Sex is probably the most important intra-genetic factor that affects carcass fatness, with many studies reporting that castration increases carcass fatness (Carabús et al., 2017; Gispert et al., 2010; Trefan et al., 2013). Inter-genetic differences are also very important. The choice of a specific sire line (SL) partially determines the carcass composition of the progeny. For instance, Duroc SL are known to be fatter than Pietrain, whereas Landrace and Large White show intermediate fatness (Edwards et al., 2003; Gispert et al., 2007). Additionally, nutrition, mainly as the relation between ideal protein and energy content, also plays a role in the modification of the carcass composition (Rodríguez-Sánchez et al., 2011; Szabó et al., 2001).

Within the same herd, variability in weight is an important challenge in all-in-all-out systems. In order to slaughter all pigs at the same marketing weight, there can be differences of more than 30 marketing days (MD) between fast and slow growing pigs (López-Vergé et al., 2018; Patience et al., 2004). Variability in slaughter weight also modifies carcass composition, with a positive relationship between slaughter weight and carcass fatness (Beattie et al., 1999; Latorre et al., 2004). Finally, differences in growth rates have been reported to modify carcass composition. Correa et al. (2006) showed that fast-growing pigs have fatter carcasses than slow-growing pigs, although this effect has not been broadly studied. Therefore, it is hypothesized that MD as a measure of intra-farm growth could have an effect on carcass fatness.

In the European context of non-castration, it is therefore necessary to quantify which differences in carcass composition can be expected due to factors as SL, sex, CW and MD. This study sought to: (1) determine the effect of two lean SL in the productive performance, (2) analyze their differences in carcass composition, the effect of sex and how the effect of CW is influenced by SL and sex, and (3) evaluate the effect of MD on carcass composition as affected by SL and sex.

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2. Materials and methods

All the procedures described in this work followed the EU Directive 2010/63/EU for animal experiments.

2.1. Dataset

The effects of SL, sex, CW and MD were analyzed in an observational study with 191,658 non-castrated growing pigs from 162 farm batches integrated in a Spanish company (*Vall Companys Group*), which were slaughtered at the same slaughterhouse (Cárnicas Cinco Villas, Ejea de los Caballeros, Spain). Two SL were evaluated: a Pietrain 100% (PNN) and a Synthetic mix (SYN; 40% Pietrain, 30% Duroc, 25% Large White and 5% Landrace). Both crossbred to Large white x Landrace sows.

Animals were managed within the same farm as a single farm batch (all-in all-out), which was composed of different marketing groups. Each marketing group consisted of pigs that reached the target slaughter weight at the same time and were transported in the same truck to the slaughterhouse. Within the same farm batch, the average period of time between the first marketing group and the last one averaged 33 ± 8 days. To analyze the differences in carcass composition between marketing groups, a variable called MD was calculated. It was the amount of extra growing days in relation to the day when the first marketing group left to the slaughterhouse, which had a MD equal to 0.

The average size of a farm batch was 1932 ± 797 pigs, and the average number of pigs per marketing group was 190 ± 33. In the farm, both sexes, males and females, were housed in the same farm (50:50%). Therefore, it was not possible to differentiate the productive performance of males and females. Nevertheless, that differentiation was possible at the slaughterhouse level. After arrival at the slaughterhouse, pigs rested into lairage pens between 1 and 2 h. They were stunned with CO_2 (88%) for 150 s and subsequently scalded and peeled. Afterwards, pigs were eviscerated and splitted using an automatic robotic system with manual supervision.

From the initial dataset (264,520 pigs), only the data that fulfilled the following criteria was finally analyzed: (1) at least three marketing groups for each farm batch, (2) a minimum of 50 pigs for each marketing group and (3) for each marketing group, >70% of individually pigs with carcass composition measurements. Three datasets were created, one for each level analyzed, which was used as observational unit: farm batch, marketing group and individual carcass.

2.2. Live performance measurements

After the last marketing group left the farm, close-out data was obtained for each farm batch (all-in all out system). The measurements included average initial body weight (BW) and the amount of feed consumed by the whole herd. Also, the average final BW for each marketing group and the number of days that those pigs had been in the growing farm was measured. With those data, average daily gain (ADG), average daily feed intake (ADFI) and feed conversion ratio (FCR) were calculated. The marketing interval was calculated per farm batch as the difference between the minimum and maximum MD of the marketing groups in that batch. Carcass yield was calculated on a marketing group base, using the final BW and the average carcass weight of that group.

2.3. Slaughterhouse measurements

Carcass composition was individually measured in each pig by AutoFom III (Frontmatec Food Technology). The analyzed measurements were carcass leanness (CL), backfat thickness at P2 (BFT) and ham fat thickness at *gluteus medius* (HFT). Ham measurements were included in the analysis for their relevance in Spanish production for the dry-cured industry (Masferrer et al., 2018). Once splitted, paired half-carcasses were weighed together. The sex of the animals, entire males or females, was determined by an operator from the slaughterhouse. No control of boar taint was performed although the pigs were not castrated as it is not a marketing problem for fresh meat at the present slaughter weight in commercial conditions.

2.4. Statistical analyses

Live performance data was analyzed by comparing PNN and SYN farm batch data with a t-test for unequal variances. A two-way ANOVA was used to analyze the effect of sex and SL on individual carcass composition. The effect of CW on carcass composition was analyzed in a multiple regression with CW, SL and sex as main factors. The effect of MD in different productive and slaughterhouse measurements was analyzed by performing a multiple linear regression with MD and SL as main effects with marketing group as observational unit. Finally, the effect of MD on carcass composition was analyzed in a multiple regression model with MD, SL and sex as main factors. In both multiple regression models, only the significant interactions were included in the models. Most of the analyses were carried out using the stats package in R 3.4.1 (Core Team, 2017). However, slopes from the multiple regressions were calculated per SL or sex using the lsmeans package (Core Team, 2017). Statistical significance was considered at an alpha level of 0.05. Finally, the multiple regressions were used to produce a regression equation for each SL and sex combination to produce figures of BFT as influenced by CW or MD.

3. Results

3.1. Sire line and sex effects

The live performance of the two SL studied is summarized in Table 1. Synthetic pigs had a greater ADG than the PNN (+11.7%; $p<0.001$). This result was related to a greater ADFI (+10.0%, $p<0.001$) and a smaller improvement in the FCR (−1.5%; $p<0.01$). Initial average BW was slightly different, but there were no differences in final BW. As SYN grew faster and had a higher initial BW than PNN, the average growing days for SYN pigs was 13 days lower. As expected PNN had a greater carcass yield than SYN (−1.0%; $p<0.001$). The marketing interval was greater for SYN than PNN (+9.3%; $p<0.05$).

Table 2 provides the SL and sex effect on individual carcass composition. As hypothesized, PNN was leaner than SYN both for the whole carcass and the ham ($p<0.001$). This result was related to a higher BFT and HFT for SYN (15.4 ± 3.0 and 10.6 ± 2.7 mm, respectively) compared to PNN (14.2 ± 2.7 and 9.6 ± 2.4, respectively). Regarding sexes, there were significant differences for all the studied variables. Generally, female carcasses were heavier (90.0 vs 89.0 kg; $p<0.001$) and fatter than males ($p<0.001$) for all the variables analyzed. The

Table 1
Productive performance of the evaluated sire lines (Pietrain and Synthetic).

	Pietrain	Synthetic	RMSE	p-value	% difference
n (farm batches)[a]	93	69			
Initial BW (kg)	19.0	19.9	10.5	<0.001	4.9
Final BW(kg)	111.5	112.5	5.0	0.215	0.9
Growing days (d)	129	116	5	<0.001	−10.4
ADG (g/d)	717	801	47.9	<0.001	11.7
ADFI (g/d)	1699	1869	119	<0.001	10.0
FCR	2.371	2.334	0.082	<0.01	−1.5
Carcass yield (%)	79.9	79.1	0.6	<0.001	−1.0
Marketing interval (d)[b]	30	33	8	<0.05	9.3

BW, body weight; ADG, average daily gain; ADFI, average daily feed intake; FCR, feed conversion ratio; RMSE, root-mean-square error.

[a] The experimental unit was the average calculation for each farm batch.

[b] Average interval of days between first and last truck leaving the farm.

Table 2
Effect of sire line (SL) and Sex on individual carcass weight and composition.

	SL		Sex				
	Pietrain	Synthetic	Male	Female	RMSE	SL	Sex
n (carcasses)	109,840	81,046	95,011	95,875			
Carcass weight (kg)	89.6	89.3	89.0	90.0	8.1	< 0.001	< 0.001
Carcass leanness (%)	64.5	62.6	64.1	63.3	2.6	< 0.001	< 0.001
Ham leanness (%)	77.1	74.9	76.5	75.8	2.6	< 0.001	< 0.001
Back fat thickness (mm)	14.2	15.4	14.4	15.0	2.8	< 0.001	< 0.001
Ham fat thickness (mm)	9.6	10.6	9.3	10.8	2.4	< 0.001	< 0.001

RMSE, root-mean-square error.

Table 3
The effect of carcass weight (CW) on carcass composition as affected by sire line and sex.

	Carcass leanness (%)		Back fat thickness (mm)		Ham fat thickness (mm)	
	$\beta_i \pm$ SE	p-value	$\beta_i \pm$ SE	p-value	$\beta_i \pm$ SE	p-value
Intercept (β_0)[a]	70.7 ± 0.11	< 0.001	0.02 ± 0.10	0.857	−4.43 ± 0.09	< 0.001
SYN	0.48 ± 0.13	< 0.001	−0.59 ± 0.13	< 0.001	−0.32 ± 0.10	< 0.01
Male	−1.78 ± 0.13	< 0.001	1.36 ± 0.13	< 0.001	1.41 ± 0.10	< 0.001
SYN * Male	0.11 ± 0.02	< 0.001	0.09 ± 0.01	< 0.001	–	–
CW effect (kg)[a]	−0.073 ± 0.001	< 0.001	0.160 ± 0.001	< 0.001	0.164 ± 0.001	< 0.001
SYN	−0.027 ± 0.001	< 0.001	0.020 ± 0.001	< 0.001	0.015 ± 0.001	< 0.001
Male	0.027 ± 0.001	< 0.001	−0.020 ± 0.001	< 0.001	−0.031 ± 0.001	< 0.001
SYN * Male	–	–	–	–	–	–
R^2	0.17		0.26		0.36	
p-value (F-test)	< 0.001		< 0.001		< 0.001	

SYN, synthetic sire line; SE, standard error.
$\mu_{Sire\ Line,\ Sex} = \beta_0 + \beta_{SYN} + \beta_{Male} + \beta_{SYN*Male} + CW*(\beta_{CW} + \beta_{SYN} + \beta_{Male} + \beta_{SYN*Male})$.
[a] Reference was Pietrain female.

difference between both sexes was of 1.5 and 0.6 mm for HFT and BFT, respectively.

3.2. Carcass weight effect

The effects of CW on carcass fatness are reported in Table 3. As expected, carcass weight showed a negative relationship to CL, whereas a positive relationship with BFT and HFT. The effect was greater in magnitude for HFT than BFT. The relationship between CW and carcass fatness was modified by both SL and sex in the 3 variables analyzed ($p < 0.001$). In Fig. 1 the BFT regressions lines for each SL and sex combination are plotted. The increase in HFT related to CW was higher in SYN than PNN (0.164 vs. 0.149 mm HFT/ kg CW) and in females than in males (0.172 vs. 0.141 mm HFT/ kg CW). The omission of the triple interaction in the three models for not being significant suggested that the relation between CW and carcass fatness was not affected in a synergistic way by SL and sex. Therefore, the difference in slopes between sexes was equal in both SL. For CL and BFT the interaction of CW with SL and with sex were the same. But for HFT the difference of CW effect was greater for sex than for SL. The carcass composition variable which could be better predicted was HFT ($R^2 = 0.36$) followed by BFT ($R^2 = 0.26$).

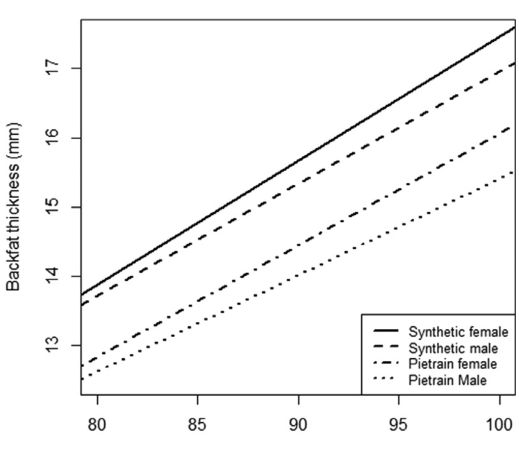

Fig. 1. Effect of carcass weight on backfat thickness in different sire lines and sexes.

3.3. Marketing day effect

The effect of MD on productivity and carcass composition is shown in Table 4. As expected, the growing days increased and the calculated ADG decreased when MD increased ($p < 0.001$). Regarding carcass composition, HFT decreased ($p < 0.001$) with increasing MD and consequently leanness increased ($p < 0.001$). Final BW also decreased when MD increased ($p < 0.001$), and as there was no effect on carcass yield ($p = 0.509$), the same effect was shown for CW ($p < 0.01$). However, MD had a significant effect on carcass fatness, independently of CW reduction. Percentage of females was greater at greater MD ($p < 0.001$). The numeric difference in ADG between marketing groups in *Week 1* and > *Week 4* was 221 and 162 g/d for SYN and PNN, respectively, as supported by the interaction of MD and SL ($p < 0.001$).

The outputs of the multiple regressions on individual carcass composition as affected by MD, SL and Sex are presented in Table 5. Regarding fat thickness variables, MD had a negative effect on both BFT and HFT ($p < 0.001$), which was significantly influenced by sex and SL ($p < 0.001$). The relationship between MD and BFT as affected by SL and sex is plotted in Fig. 2. The decrease for PNN was 0.021 and 0.028 mm/day for BFT and HFT, respectively. But the effect of MD was greater in SYN pigs, decreasing 0.030 and 0.037 mm/day for BFT and HFT, respectively. The differences were slightly greater for sex in BFT than HFT. The negative effect of MD on BFT was 0.021 and 0.030 mm/day and on HFT at 0.029 and 0.035 mm/day, for females and males, respectively. Thus, the effect was greater for males compared to females. Finally, there was a positive relationship between MD and CL

Table 4
Effect of marketing day (MD) on productivity and carcass composition for two sire lines (SL).

Item	Pietrain Week 1[c]	Week 2	Week 3	Week 4	> Week 4	Synthetic Week 1	Week 2	Week 3	Week 4	> Week 4	RMSE	MD[d]	SL	MD * SL
n (marketing group)[a]	169	125	126	108	109	139	116	87	90	99				
Final BW (kg)	112.7	113.0	111.5	110.9	110.6	113.0	113.4	114.1	112.1	111.2	6.1	< 0.01	0.235	0.580
Growing days (d)	117	126	131	137	143	103	111	116	124	132	6.7	< 0.001	< 0.001	< 0.05
ADG (g/d)	823	769	725	691	661	934	866	833	766	713	61	< 0.001	< 0.001	< 0.001
Carcass yield (%)	79.9	80.1	79.9	80.0	79.8	79.2	79.0	79.0	79.0	79.0	0.9	0.509	< 0.001	0.620
Carcass weight (kg)	90.0	90.5	89.1	88.6	88.5	89.5	89.6	90.2	88.6	87.9	5.0	< 0.01	0.438	0.662
Carcass leanness (%)	64.2	64.3	64.7	64.7	64.6	62.5	62.4	62.4	63.0	62.9	1.0	< 0.001	< 0.001	0.814
Ham fat thickness (mm)	9.9	9.9	9.4	9.2	9.4	10.8	10.8	10.7	10.2	10.1	1.1	< 0.001	< 0.001	0.561
Females (%)[b]	45.5	50.4	52.9	54.5	57.3	39.4	46.8	52.6	55.6	61.1	26.0	< 0.001	< 0.05	< 0.05

BW, body weight; ADG, average daily gain; RMSE, root-mean-square error.
[a] The experimental unit was the average calculation per each marketing group.
[b] Percentage of females in each truck reaching the slaughterhouse.
[c] The table shows the results as numerical means per week, however the effect is analyzed with the MD continuous variable.
[d] Linear effect of the extra days that those pigs stayed in the growing farm compared to the first marketing group leaving the farm.

($p < 0.001$). But this relationship was different for all sex and SL combinations, showed by a significant triple interaction between CW, sex and SL ($p < 0.001$). SYN females were the most affected by MD on the CL (0.026%/MD; $p < 0.001$). Generally, the decrease in carcass fatness due to increasing MD was greater in SYN pigs and in males. And the effect of MD was greater on HFT than in BFT.

4. Discussion

4.1. Sire line effect

The results showed that SYN pigs had a higher performance in terms of ADFI, ADG, and even a better FCR than PNN pigs. Those results are in agreement with Augspurger et al. (2002), who reported that a synthetic sire line that included Large white, Landrace, Duroc and Pietrain could grow faster, without differences in FCR, due to a higher ADFI compared to a Pietrain SL. In that study, the higher ADFI was explained by a higher feed intake per visit, and not for a higher number of visits to the feeder. Similarly, Pietrain pigs have been reported to have lower feed intake per visit compared to other sire lines (Quiniou et al., 1999). The lower FCR of SYN reported in this study can be explained by 13 days less to reach the same slaughter weight, which represent less energy needs for maintenance. However, maintenance requirements may differ depending on SL (Noblet et al., 1999). Finally, the lower carcass yield for SYN could be explained by the 60% of the SL which is composed by Duroc, Large white and Landrace breeds. Previous works have shown that those genetic lines have a lower conformation than Pietrain lines (Gispert et al., 2007).

Consistent with the literature, this study found that there are

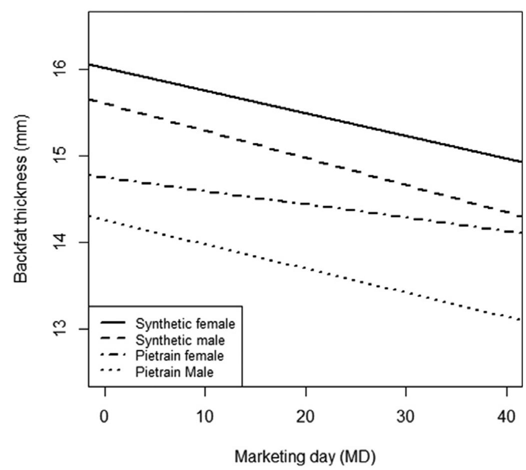

Fig. 2. Effect of marketing day on backfat thickness in different sire lines and sexes.

important differences in carcass composition between the SL studied. The BFT difference of 1.2 mm between SYN and PNN can be explained by the higher ADFI of SYN. Due to a limit in protein deposition capacity, a high ADFI can be related to a higher fat deposition, as a sink of the nutrients which are not used for protein deposition (Hermesch et al., 2000). The differences reported in the present study were similar to previous research, which found BFT differences of 1.0 mm in the last rib when comparing pure Pietrain and pure Duroc boars (Edwards et al., 2003). Therefore, the 30% of Duroc in the SYN SL

Table 5
The effect of marketing day (MD) on carcass fatness as affected by sire line (SL) and sex.

	Carcass leanness (%) $\beta_i \pm$ SE	p-value	Back fat thickness (mm) $\beta_i \pm$ SE	p-value	Ham fat thickness (mm) $\beta_i \pm$ SE	p-value
Intercept (β_0)[a]	63.94 ± 0.02	< 0.001	14.77 ± 0.02	< 0.001	10.77 ± 0.02	< 0.001
SYN	−2.15 ± 0.03	< 0.001	1.21 ± 0.03	< 0.001	1.07 ± 0.02	< 0.001
Male	0.61 ± 0.03	< 0.001	−0.55 ± 0.02	< 0.001	−1.50 ± 0.02	< 0.001
SYN * Male	0.34 ± 0.04	< 0.001	0.19 ± 0.03	< 0.001	0.09 ± 0.02	< 0.001
MD effect (d)[a]	0.011 ± 0.001	< 0.001	−0.017 ± 0.001	< 0.001	−0.025 ± 0.001	< 0.001
SYN	0.015 ± 0.002	< 0.001	−0.007 ± 0.001	< 0.001	−0.008 ± 0.001	< 0.001
Male	0.012 ± 0.001	< 0.001	−0.009 ± 0.001	< 0.001	−0.007 ± 0.001	< 0.001
SYN * Male	−0.016 ± 0.00	< 0.001	–	–	–	–
R^2	0.13		0.06		0.14	
p-value (F-test)	< 0.001		< 0.001		< 0.001	

SYN, synthetic sire line; SE, standard error.
$\mu_{\text{Sire Line, Sex}} = \beta_0 + \beta_{SYN} + \beta_{Male} + \beta_{SYN*Male} + MD*(\beta_{MD} + \beta_{SYN} + \beta_{Male} + \beta_{SYN*Male})$.
[a] Reference was Pietrain female .

could explain that SYN carcasses were fatter than PNN. Similarly, Gispert et al. (2007) compared 5 different SL, and showed that Duroc was the second fattest, only surpassed by Meshian SL, whereas Pietrain was the leanest. Landrace and Large white SL were intermediate between Pietriain and Duroc. As a summary, the inclusion of Duroc, Landrace and Large white breeds in a synthetic SL increases carcass fatness as a consequence of a higher feed intake. According to the literature, this increase in feed intake may be related to differences in the feeding behavior.

4.2. Sex effect

As expected, entire males were leaner than females (0.6 mm less BFT and 0.8% greater CL). Previous studies had reported BFT differences greater than 2 mm (Andersson et al., 2005; Sather et al., 1991). In our study, the difference was smaller probably because the analyzed SL's (SYN and PNN) were leaner than in those studies. The study from Cámara et al. (2014) also showed a significant difference for BFT of 1.3 mm but not for CL, although a numerical difference between sexes of 0.3%. Those results are probably the most comparable to this study as the SL used was a crossbred of SYN and a PNN. Regarding HFT, Gispert et al. (2010) reported significant ($p < 0.05$) differences in the minimum HFT over the *gluteus medius* between entire males and females (14.17 vs. 10.02 mm, respectively). However, that study could not report significant differences between females and entire males in BFT and CL, although there were numerical differences.

It may be the case that the low consistency of the sex differences in CL is related to the use of different equations to predict CL from AutoFom measurements (Schinckel and Rusk, 2012). Therefore, comparisons between different slaughterhouses should be carefully considered. It is worth to mention that the difference in subcutaneous fat thickness between sexes was greater in the ham than in P2. However, when comparing SL's, the difference was greater for BFT than for HFT. It can thus be suggested that the increase in fat deposition in females compared to entire males is more important in the ham than in the back. The work of Gispert et al. (2010) would support this hypothesis. As a summary, this study showed that females are fatter than entire males for BFT, HFT and CL.

4.3. Carcass weight effect

The positive relationship between slaughter weight and carcass fatness reported in the results has been previously described in different studies (Beattie et al., 1999; Cisneros et al., 1996; Latorre et al., 2004). However, the magnitude of the effect is quite different depending on SL, castrating the males, and the range of slaughter weight studied. In the present paper, the effect on BFT and HFT averaged 1.6 and 1.5 mm/10 kg CW, respectively. Latorre et al. (2004) reported a greater increase for both BFT and HFT of 3.1 and 2.9 mm/10 kg of CW, respectively. That could be explained because the SL studied were fatter, males were castrated, and the range of slaughter BW in that study was from 116 to 133 kg, whereas in the present study was 112 ± 6 kg. The slope reported by Cisneros et al. (1996) for castrated pigs in a BW range of 100–160 kg was 1.8 mm BFT/10 kg CW, more similar to our results. The hypothesis that the relationship between CW and carcass fatness is not linear along all slaughter weights would be in agreement with the meta-analysis from Trefan et al. (2013), with the effect of CW being greater at heavy weights.

No other work was found on this subject for entire pigs. However, for castrated animals, Latorre et al. (2004) did find the same effect of CW on carcass fatness for females and castrated animals. In our study, the difference between females and entire pigs was greater at heavy weights in accordance to the growth curves for each sex (Giles et al., 2009). Summarizing, the results indicate that within a specific BW range, there is linear effect of CW on carcass fatness, which is greater in fatter animals (SYN vs PNN, and females vs entire males).

4.4. Marketing day effect

The main result of the current study was that carcass fatness decreased at greater MD. The observed decrease in BFT and HFT with MD might be explained by the different growth rates within a farm. This results are in accordance with Correa et al. (2006), who reported that fast growing pigs were fatter than the slow growing ones. In our study, the differences in growth rate between fast and slow growing pigs were 221 and 162 g/d for SYN and PNN, respectively. Those differences were similar to Magowan et al. (2007), reporting a difference of 170 g/d between the top and bottom quartiles from 12 to 20 weeks of age. In addition, Patience et al. (2004) showed that the distribution of BW at the end of the growing period was almost normal, but there was a slight skewing towards the lower BW's. This may explain the decreased BW and CW at greater MD.

In the present study, the effect of MD on carcass leanness was different depending on SL and sex. HFT was more affected by MD than BFT in all SL and sexes. It shows that MD had a greater effect in SYN than in PNN, and in males than in females. For HFT, the decrease in SYN was 0.037 mm/day compared to 0.028 mm/day for BFT in PNN. The decrease in males was 0.035 mm/day compared to 0.029 mm/day in females. That yields a maximum decrease in HFT between fast and slow growing pigs (*Week 1* vs. > *Week 4*) of 0.7 mm. Correa et al. (2006) also reported that HFT was affected by growth rate, sex, and slaughter weight, with a difference of 1.8 mm between fast and slow growing pigs. The difference between the two studies can be explained by the sex, as barrows were used in that study whereas entire males in our work.

Carcass composition is known to be related to nutrient provision and growth potential (Kerr et al., 1995; van Milgen et al., 2000). Therefore, the differences in carcass composition related to MD in this study raises the possibility that pigs with different growth rates currently fed with the same feed have probably different requirements. Feeding them with different feeds according to their specific requirements could increase the efficiency of use of resources. However, these hypotheses should be checked in future research and analyze the potential benefits and drawbacks of a commercial application of split-feeding according to growth potential. As a summary, the current study indicates that there are important differences in carcass composition related to SL, sex, CW and MD in non-castrated pigs.

5. Conclusion

This research showed that there are important differences in productive performance between PNN and SYN lines. Synthetic pigs had a higher ADFI and ADG which lead to an increase in carcass fatness. Regarding sex, the study confirmed that females are fatter than entire males in lean SL. As expected, there was a positive relationship between carcass fatness and carcass weight. However, this effect was different for each SL and sex, being greater for SYN compared to PNN, and for females compared to males. The most obvious finding to emerge from this study is that carcass fatness decreases when MD increases, used as a measure of growth variability intra-farm. This effect was also different depending on the specific sire line and sex, with the effect being greater in males than in females.

Conflict of interest

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

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