= experimental treatments (castration method or dietary FA composition as fixed effect), β_j = litter (random effect) and ε_{ijk} = error). In both models, the individual pig served as the experimental unit. Due to extremely low growth a C17 pig was excluded from the trial.

Results and discussion

Comparison of barrows and IC fed the same grower-finisher diet

Compared to the barrows (C17), IC17 pigs tended to grow slower (976 vs. 934 g/d; $P < 0.10$), consumed less feed (210 vs. 202 kg; $P < 0.04$), were more feed efficient (2.65 vs. 2.50 kg/kg; $P < 0.01$) and their carcasses were leaner (54.0 vs. 56.2%; $P < 0.01$). These findings are in agreement with previously published results (Pauly et al., 2009). In the AT of IC17, the n-6 and n-3 FA concentration expressed as g/100 g total FA was greater (18:2 = 15.74 vs. 13.98; 20:2 = 0.65 vs. 0.61; 20:4 = 0.34 vs. 0.30; 18:3 = 1.17 vs. 1.04; 20:3 = 0.16 vs. 0.14; $P \leq 0.06$), whereas the saturated FA (39.39 vs. 40.56) and MUFA (42.39 vs. 43.21) level was only numerically lower ($P \geq 0.12$) than in the AT of barrows. In the IMF, the total lipid content, the 16:0 and 20:0 concentrations were lower (total lipid = 9.2 vs. 10.9 g/100 g dry matter; 16:0 = 24.98 vs. 25.46; 20:0 = 0.07 vs. 0.12; $P \leq 0.08$) and the levels of n-6 and n-3 FA were greater in IC17 than C17 (18:2 = 9.21 vs. 7.67; 20:4 = 1.93 vs. 1.60; 22:4 = 0.36 vs. 0.29; 18:3 = 0.41 vs. 0.35; 22:5 = 0.24 vs. 0.19; $P \leq 0.03$). These findings can be partly explained by the well described relationship between intake of unsaturated FA and carcass leanness (Bee and Wenk 1994; Warnants et al., 1999; Wood et al., 2008). However, it is interesting to note that although total feed intake was lower and, hence, a lower amount of dietary PUFA was ingested, the decrease in deposited AT and IMF was still more important resulting in a more unsaturated fat in IC17 than C17 pigs.

Comparison of varying PMI levels of the diet on the tissue FA composition in IC

Except for the linear decrease (P_l = 0.04) in total feed intake with decreasing dietary PMI level (202.0 < 195.5 < 191.2 kg), diet had no (P_l > 0.18) effect on growth rate, feed efficiency or carcass leanness. With decreasing dietary PMI level, the 16:0 (24.08 > 24.22 > 24.82) and 18:0 (13.32 > 13.89 > 14.17) concentrations in the AT linearly increased ($P_l \leq 0.05$) and the n-6 (18:2 = 15.74 < 14.84 < 13.30; 20:2 = 0.65 < 0.61 < 0.58) and n-3 (18:3 = 1.17 < 1.11 < 1.04; 20:3 = 0.16 < 0.14 < 0.14) concentrations, as well as the total FA tissue content (894.4 < 879.3 < 861.3 g/kg AT) linearly decreased ($P_l \leq 0.02$). The FA profile of the IMF was not ($P_l \geq 0.15$) affected by the dietary FA composition except for a linear decline (P_l = 0.03) in the 20:1 (0.59 > 0.58 > 0.54) and a linear rise ($P_l \leq 0.06$) in the 20:4 (1.93 < 2.03 < 2.22) and 22:4 (0.36 > 0.38 > 0.40) levels with decreasing dietary PMI. In agreement with findings of previous studies (Bee 2001; Bee and Wenk 1994;

Warnants et al., 1996; Warnants et al., 1999), IMF FA composition was less affected by the dietary FA than the FA of the AT.

In conclusion, average daily gain was similar between IC pigs and barrows. Due to the greater anabolic potential of IC pigs compared to barrows, overall average daily feed intake was lower and feed efficiency was greater in IC pigs. The leaner carcasses of IC pigs resulted in a more unsaturated AT. However, the results of the study showed that by applying a specific feeding strategy the FA composition of the AT could be adjusted: the lowest dietary PMI level compensated for the 14% lower deposition of AT as the FA profile was comparable in the AT of IC13 and C17 pigs. Thus, in production systems where quality of the AT affects the economic value of the carcasses, the PMI level of diets for IC pigs needs to be reduced to maximize economic return.

Literatur

Bee, G. (2001): Dietary conjugated linoleic acids affect tissue lipid composition but not de novo lipogenesis in finishing pigs. Anim. Res. 50: 1-17.

Bee, G., Jacot, S., Guex, G. and Biolley, C. (2008): Effects of two supplementation levels of linseed combined with CLA or tallow on meat quality traits and fatty acid profile of adipose and different muscle tissues in slaughter pigs. animal 2: 800-811.

Bee, G. and Wenk, C. (1994): Effect of soybean oil and beef tallow supplementation to pig diets on the fatty acid profile of body lipids. J. Anim. Physiol. Anim. Nutr. 71: 277-288.

Hadorn, R., Eberhard, P., Guggisberg, D., Piccinali, P. and Schlichtherle-Cerny, H. (2008): Effect of fat score on the quality of various meat products. Meat Sci. 80: 765-770.

Pauly, C., Spring, P., Doherty, J.V., Ampuero Kragten, S. and Bee, G. (2009): Growth performance, carcass characteristics and meat quality of group-penned surgically castrated, immunocastrated (Improvac) and entire male pigs and individually penned entire male pigs. animal 3: 1057-1066.

Scheeder, M. R. L., Bossi, H. and Wenk, C. (1999): Kritische Betrachtungen zur Fettzahl-Bestimmung. Agrarforschung 6: 1-8.

Stoll,P. and Bee, G. (2002): Fütterung und Fettqualität beim Schwein. Eidgenössische Forschungsanstalt für Nutztiere (RAP). RAPaktuell 7.

Stoll, P., Kessler, J., Gutzwiller, A., Bee, G., Chaubert, C., Gafner, J.-L., Bracher, A., Jost, M., Pfirter, H.P., and Wenk, C. (2004): Fütterungsempfehlungen und Nährwerttabellen für Schweine. Landwirtschaftliche Lehrmittelzentrale, Zollikofen, Switzerland.

Warnants, N., Van Oeckel, M.J. and Boucque, C.V. (1996): Incorporation of dietary polyunsaturated fatty acids in pork tissues and its implications for the quality of the end products. Meat Sci. 44: 125-144.

Warnants, N., Van Oeckel, M.J. and Boucque, C.V. (1999): Incorporation of dietary polyunsaturated fatty acids into pork fatty tissues. J. Anim. Sci. 77: 2478-2490.

Wood, J.D., Enser, M., Fisher, A.V., Nute, G.R., Sheard, P.R., Richardson, R.I., Hughes, S.I. and Whittington, F.M. (2008): Fat deposition, fatty acid composition and meat quality: A review. Meat Sci. 78: 343-358.

The fatty acid composition of the adipose and lean tissues of immunocastrated male pigs can be modulated by specific feeding strategies

C. Pauly[2], P. Spring[2] and G. Bee[1]
[1]Agroscope Liebefeld Posieux, Research Station ALP, rte de la Tioleyre 4, 1725 Posieux, Switzerland, [2]Swiss College of Agriculture, Länggasse 85, 3052 Zollikofen, Switzerland

Introduction

At a given supply of unsaturated dietary fatty acids (**FA**) the degree of unsaturation of adipose tissue (**AT**) lipids increases with decreasing carcass fat deposition. Because carcasses of immuno-castrated male pigs (**IC**) fed standard grower-finisher diets are leaner than those of barrows, one can expect higher levels of unsaturated FA in the AT, which then might negatively affect its oxidative stability and firmness. To insure a good processing quality of the pig's backfat, which is determined in Swiss abattoirs with the fat score (Hadorn et al., 2008; Scheeder et al., 1999), the dietary supply of monounsaturated (**MUFA**) and polyunsaturated fatty acids (**PUFA**) needs to be limited. Thus, a PUFA-MUFA Index [**PMI** = 1.3 × MUFA (g/MJ DE) + PUFA (g/MJ DE)] for feed ingredients was introduced in the Swiss feeding recommendations (Stoll et al., 2004). The PMI, which is recommended to be < 1.7 g/MJ DE, takes the dietary concentrations of PUFA and MUFA and their relationship to the fat score into account (Stoll and Bee 2002). The PMI recommendations were defined for barrows and gilts but not for the leaner IC. Therefore, the goal of this study was to determine the effects of castration method and dietary MUFA and PUFA supply (PMI of the diet) on lipid composition of the AT and intramuscular fat (**IMF**).

Materials And Methods

Animals and treatments

In the present study a total of 48 Swiss Large White male pigs originating from 12 litters (10 litters with 4 male piglets/litter; 1 litter with 8 male piglets/litter) were used. From weaning until the start of the experimental period (mean ± s.e. body weight [BW] = 28.0 ± 0.5 kg; age = 76.7 ± 1.3 d) pigs were group-penned and had *ad libitum* access to the same standard starter diet formulated according to Swiss feeding recommendations (Stoll et al., 2004). At an average BW of 13.7 ± 0.5 (age = 49.8 ± 0.01 d), the littermates were allocated according to BW to 4 experimental groups (12 pigs/group): one group of barrows [C17] and 3 groups of IC pigs [IC17, IC15 and IC13]. At an average BW of 28.0 ± 0.5 kg, all pigs were moved to the grower-finisher barn. Aiming to vary the dietary supply of MUFA and PUFA, the grower-finisher diets were formulated to contain a PMI of 1.7, 1.5 or 1.3.

During the grower-finisher period, C17 and IC17, IC15 and IC13 pigs had *ad libitum* access to the diets with the respective PMI of 1.7, 1.5 and 1.3, respectively. Pigs were reared in semi-slatted pens (12 animals/pen; 1.5 m^2/animal) with the laying area slightly covered with sawdust and straw in environmentally controlled buildings (22°C and 60 - 70% relative humidity). Each pen was equipped with 2 drinkers and 2 single-space computerized feeders (Mastleistungsprüfung MLP-RAP; Schauer Agrotronic AG, Sursee, Switzerland) as described previously (Bee et al., 2008).

Vaccination with Improvac®

The IC pigs were vaccinated twice with 2 ml of Improvac® (Pfizer Ltd., Zurich, Switzerland), which contains a modified form of GnRF (200 µg GnRF-protein conjugate/ml) in an aqueous adjuvant system. Pigs were vaccinated subcutaneously behind and below the base of the ear. The first injection was carried out when the heaviest IC pig reached BW of 25 kg (mean ± s.e. of all IC pigs: BW = 20.7 ± 0.9 kg; age = 64.5 ± 0.1 d); all pigs were injected the same day. The second injection was carried out individually the week the animal reached 68 kg BW (mean ± s.e. of IC pigs: BW = 71.6 ± 0.7 kg; age = 126.2 ± 1.9 d). All IC pigs were slaughtered 4 to 5 wk after the second injection.

Slaughter procedure, carcass measurements and sample analysis

Animals were slaughtered the day after reaching 103 kg BW. Feed was withdrawn from the pigs 12 h before transportation to a nearby commercial abattoir (approx. time of transport 15 min.). During transport and lairage, pigs from different pens were not mixed. At the abattoir, animals were electrically stunned, exsanguinated, scalded, mechanically de-haired and eviscerated. Internal organs were removed and hot carcass weight was determined. The weight of the testes and bulbourethral glands were assessed. Thirty minutes after exsanguination, the carcasses entered the air-chilling system (3°C) for 24 h. Within 30 min. after exsanguination, samples of the *longissimus* muscle (LM) at the 12^{th}-rib level and backfat (both layers) in the region of the 10^{th}-12^{th} rib level were collected from each carcass, vacuum-packaged and stored at -20°C until determination of the FA composition as described previously (Bee 2001). One day after slaughter, the left side of each carcass was weighed and dissected according to the meat cutting standards applied by the Swiss Performance testing Station (MLP, Sempach, Switzerland), as described previously (Bee, 2001).

Statistical analysis

The data on growth performance, carcass characteristics and FA composition were analyzed with the MIXED procedure of SAS (v. 8.02; SAS Institute, Cary, NC, USA). The effects of castration method (C17 and IC17) and dietary FA composition (IC17, IC15 and IC13) were analyzed separately using the model: $X_{ijk} = \mu + \alpha_i + \beta_j + \varepsilon_{ijk}$, ($X_{ijk}$ = observed parameter, μ = overall mean, α_i,