CARCASS FAT AND INTRAMUSCULAR FAT DISTRIBUTION IN PIGS

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Summary

The quality and quantity of intramuscular fat (IMF) were determined in 31 muscles from Eight Duroc Jersey barrows of each of two lines, lean (L) and fat(F) at similar live-weight. Differences in IMF distribution were detected between lean and fat pigs. The total amount of IMF was almost identical (0.43 and 0.41 kg, respectively) in spite of big differences in total dissected fat (26.6 and 42.9 kg, respectively) or % total dissected fat (32.6 and 52.9%, respectively). The IMF% were higher in the fat pig muscles compared with the lean except for Mm Vastus lateralis, Semimembranosus, Adductor, Sartorius, Obliquus internus abdominis and Transversus abdominis. The fatty acid composition of IMF shows a strong tendency for a higher percentage of linoleic fatty acid in muscles for the L pigs.

Introduction

Intramuscular fat makes a positive contribution to the palatability characteristics of pork. Selection towards a maximum of muscularity is related to a strong reduction of the amounts of fatty tissues and intramuscular fat and has led to general decline in meat quality (Desmoulin, 1983). It might be possible that the amount of intramuscular and the quality of the fatty tissues become the limiting factors in breeding extremely lean pigs.

In several studies low correlations have been found between the concentration of lipid in muscle and carcass fatness (Duniec et al., 1961; Hiner et al., 1965). This suggests that fat deposition in muscle is not part of the fattening process which occurs in the other fat depots of the body.

This research was undertaken to determine the differences in the quality and quantity of intramuscular fat from Duroc Jersey pigs with different fat carcass levels but similar carcass weights.

Materials and Methods

Eight barrows Duroc Jersey of each of the two lines, lean (L) and fat (F), reared at the Pergamino Experimental Station of INTA were used as experimental animals. They were allocated to individual pens with water and a standard diet supplied ad libitum. Both lines at the end of the trial were similar in carcass weight (80.2+-3.18 and 81.2+-3.44 kg respectively for the L and F lines) but they were different in carcass fat % (32.9+-2.95 and 52.9 +-4.50 respectively).

The right side of the carcasses were kept at -15 C and 31 muscles dissected as soon as possible. Each muscle was weighted, minced and aliquot samples extracted with the method of Folch et al., (1957). Aliquot samples from the chloroform extract were used to determine the total weight of chemical fat (IMF) and for fatty acid analysis. TLC and GLC were used for the lipid separation and methyl ester analysis respectively as was previously reported (Garcia et al., 1986). The muscles studied were: Proximal pelvic limb (G1): Tensor fascia latae (TLF), Biceps femoris(BFE), Glutaeus medius, accessorius et profundus (GLU),Vastus lateralis (VLA), Vastus medialis (VME), Vastus intermedius (VIN), Rectus femoris (RFE), Semitendinosus (STE), Gracilis (GRA), Semimembranosus (SME), Adductor (ADD), Pectineus (PEC) and Sartorius (SAR). Distal pelvic limb (G2): Gastrocnemius et soleus (GAS), Fibularis tertius et extensor digitorum longus & Extensor digitorum lateralis (EPL) and Flexor digitorum Superficialis et profundus & Fibularis longus (FPL). Spinal (G3): Psoas major (PMA) and Longissimus dorsi (LDO). Abdominal (G4): Obliquus externus abdominis (OEA), Obliquus internus abdominis (OIA), Transversus abdominis (TRA) and Rectus abdominis (REA). Proximal thoracic limb (G5): Deltoides (DEL), Infraspinatus (INF),Triceps brachii (TBR), Teres major (TEM), Supraspinatus (SUP), Biceps brachii (BIB) and Subcapularis (SUB). Dis thoracic limb (G6): Extensor carpi radialis, Ulnaris lateralis, Abductor digiti I longu Extensor digitorum communis et lateralis (ETL) and Flexor carpi radialis et Ulnaris Flexor digitorum profundus et superficialis (FTL).

The data were processed statistically by the NWASTATPAK Program Northwest Analytic Inc. Portland Oregon USA.

Results and Discussion

The individual IMF content as a percent of total IMF in each anatomical muscle gr for L and F pigs are given in Figures 1, 2, 3 and 4. Significant differences in IMF di tribution between the L and F pigs were detected. A significant accumulation (p < .05) IMF fat occurs in Mm BFE and GLU in F pigs and in GRA, SME and ADD in L pigs in the proxi pelvic limb muscle group (Fig. 1). In spite of the big SD in the abdominal muscle group fat content shows the most important changes, specially in Mm OIA and REA (p < .05) (Fig. Differences in the other muscle groups were less significant. The total IMF fat weight each anatomical muscle group as a percentage of total IMF in the L and F pigs is shown Figure 5. Statistical differences (p <.05) in the distribution of IMF between the groups are shown for groups 1, 2 and 3. The total amount of IMF fat was almost ident 0.43 and 0.41 kg in spite of big differences in carcass fat. This results explain the correlation found between total body fat and IMF for many authors (Duniec et al., 196 Hiner et al., 1965) a and the difficulties in the estimation of the effects of variab like breed, sex, diet on the IMF content fat in a given muscle taking in account carc fatness or any predictor indicator of carcass fatness as a back fat thickeness. increasing incidence of meat quality problems requires new methods of meat IMF con prediction (Kempster et al 1986).

The IMF% in the muscles from the two lines are given in Figure 1, 2, 3 and 4. The I were higher in the F pigs compared with the L ones except for the Mm VLA, SME and (Group 1); OIA and TRA (Group 4) and extensor muscles (Group 6).

The levels of linoleic acid (18:2) in the muscle lipids were always higher in the than in the fat pigs (Fig.6). The values were from 6.3 to 13.4% in the lean pigs and 4.9 to 10.9% in the fat pigs. The % of 18:2 was related negatively to the IMF % in muscle but also at similar IMF% the F pigs have less 18:2 in total lipids than the L p No differences in the average daily gain between the two lines were detected (0.970 0.929 g for L and F pigs) and then the difference may be due to the different contribu of the lipid classes to the total muscular lipids. At similar diet the firmest fat observed when growth rate and fat thickness were high (Wood, 1983).

Conclusions

Differences in the distribution of intramuscular fat between lean and fat pigs w found. The total amount of intramuscular fat was similar in both lines. The fatty acid c position of intramuscular lipids showed a strong tendency for a higher percentage linoleic acid in the lean pigs.

References

DESMOULIN B., 1983. Sex Effects on the Deposition and Quality of Fat in Lean Pigs. In M Research Institute. Special Report No 2. 130-144 pp.

DUNIEC H., KIELANOWSKI J. & OSINSKA Z., 1961. Heritability of chemical fat content in loin muscle of baconers. Anim. Prod., 3,195-198.

FOLCH J., LEES M. & SLOANE S.G.H., 1957. A simple method for the isolation and purifica of total lipids from animal tissues. J. Biol. Chem., 226,497-509.

GARCIA P.T., CASAL J.J., OLSEN C. & BERRA G., 1986. A comparison of distribution and

...sition of intramuscular fat in Duroc Jersey and Hampshire pigs at 100 kg live-weight. ...eat Sci., 16,283-295.

...MPSTER A.J., DILWORTH A.W., EVANS D.G. and FISHER K.D., 1986. The effects of fat thickness ...d sex on pig meat quality with special reference to the problems associated with overlean-...ss. Anim. Prod., 43,517-533.

...NER R.L., THORNTON J.W. & ALMEYER R.H., 1965. Palatability and quantity of pork as in-...uenced by breed and fatness. J. Food Sci., 30,550-555.

...OD, J.D. 1983. Fat quality in pigmeat- U.K. In Meat Research Institute Special Report No. ..., 9-14 pp.

Fig. 1. IMF% and IMF weights as a % of total IMF in the anatomical muscle group.

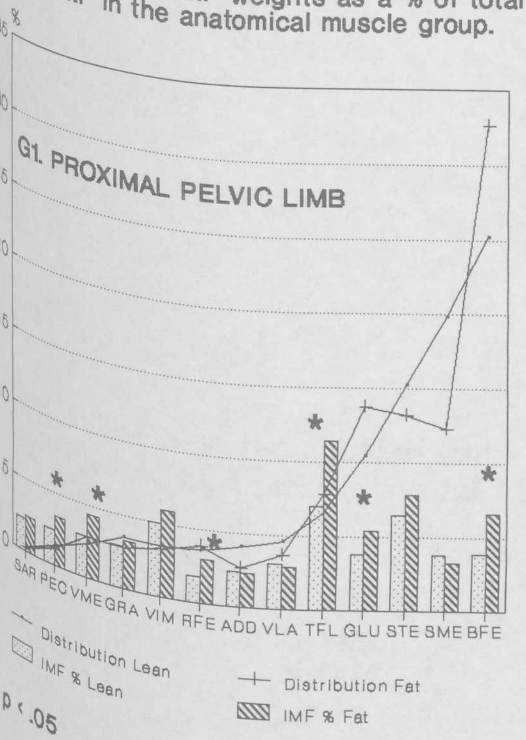


Fig. 2. IMF% and IMF weights as a % of total IMF in the anatomical group.

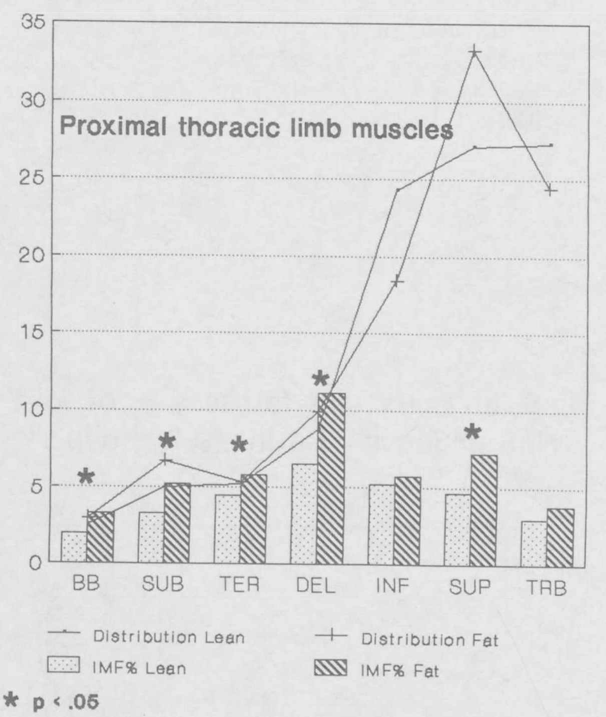
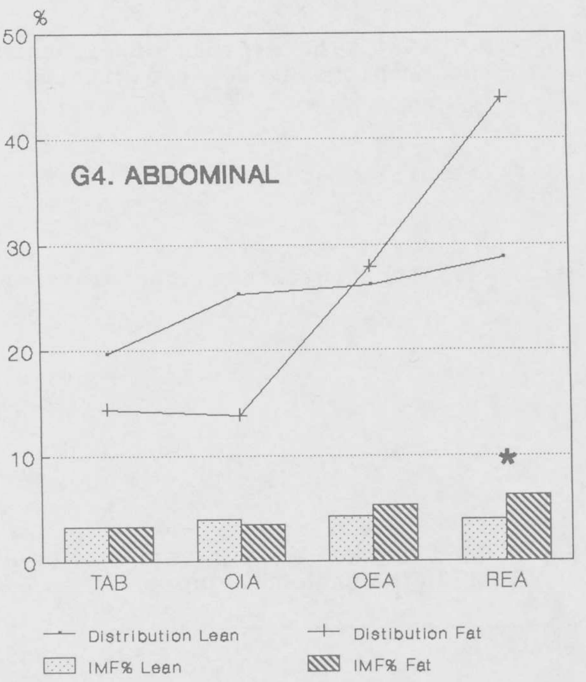
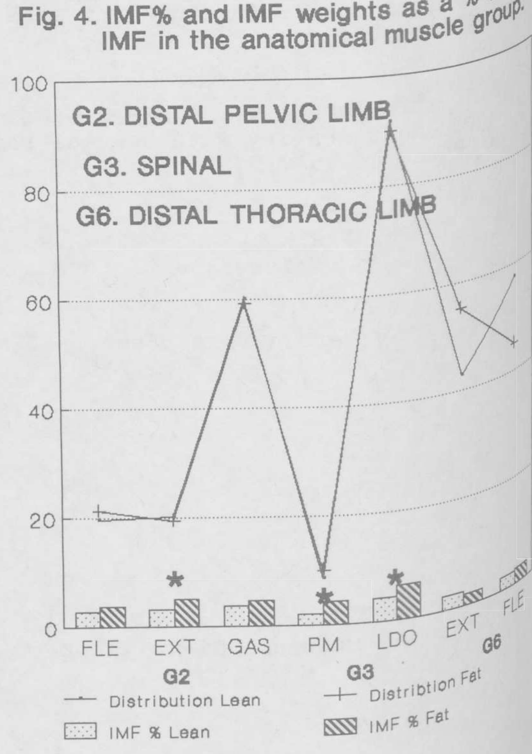


Fig. 3. IMF% and IMF weights as a % of total IMF in the anatomical group.



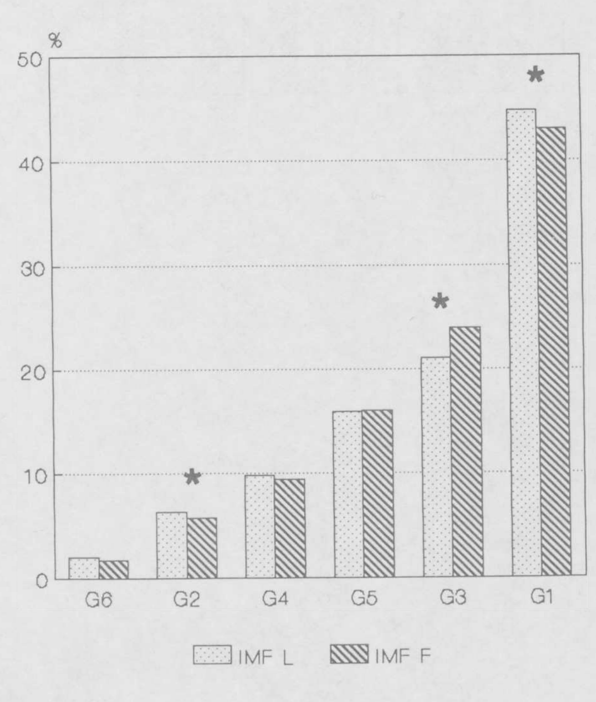
* p < .05

Fig. 4. IMF% and IMF weights as a % of total IMF in the anatomical muscle group.



* p < .05

Fig.5 Intramuscular fat as a % of total intramuscular fat in each group.



* p< .05.

Fig.6 Relation between intramuscular fat and linoleic acid percentages.