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An experiment involving 5 x 20 piglets was designed to examine the effects of chronic cold exposure (12°C for 3 weeks) on intermediate metabolism of lipids and plasma hormonal levels in order to assess the mechanisms involved in thermo-regulation of early-weaned piglets. The control piglets were maintained in a thermoneutral environment (24°C).

Cold-acclimated piglets fed *ad libitum* maintained a growth rate and a carcass composition similar to that of the controls, while increasing feed intake by 20% ( $P < 0.05$ ).

Lipoprotein lipase activity increased ( $P < 0.05$ ) by cold exposure in white adipose tissues (WAT) and heart. A large enhancement of lipogenesis was observed in WAT and, to a lesser extent, in the liver, while chemical composition of these tissues and fatty acid composition of the lipid extracts did not change significantly in the cold. However, a difference in the composition of internal and external WAT of control pigs was observed. These results together with the increased noradrenaline-induced lipolysis suggest an increase in fatty acid turnover in cold-acclimated piglets.

Urinary catecholamines (noradrenaline, adrenaline) and plasmatic thyroid hormones ( $T_3$ ,  $T_4$ ) gradually increase during cold acclimation and are defined as effectors of thermogenesis. No changes appeared in cortisol, ACTH and insulin levels.

Our results suggest that early-weaned piglets adapt themselves to cold conditions by their increasing thermogenic capacities (increased feed consumption and heat production) and reducing heat losses (modifications of conformation), by a stimulation of lipid metabolism (lipogenesis, lipolysis, LPL activity) in white adipose tissue and a modification of the hormonal status (catecholamines and thyroid hormones levels). Enhancement of lipid metabolism in white adipose tissue is discussed in terms of cold-acclimation mechanisms.

**Biophysical and biochemical study of the plasma membrane of pig adipose cell.** C. Lhuillery <sup>1</sup>, C. Nicolas <sup>1</sup>, N. Benmansour <sup>1</sup>, D. Lacasa <sup>2</sup>, Y. Demarne <sup>1</sup>  
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In recent years, it has been stated that many functions of living cells are membrane-associated events. In various cell types, functional alterations have been related to membrane structural modifications. Little information is yet available concerning structure—function relationships in adipose cell membranes.

The objective of this study was : 1) to define the structural characteristics of adipose plasma membrane in the pig, and 2) to investigate the effects of diet, castration and adipose tissue location on these parameters. Castrated or male pigs were fed either a control diet or a polyunsaturated fatty acid-enriched diet (sunflower diet). In the different situations, adipose cells were collected from subcutaneous (S) and perirenal (P) tissues and a plasma membrane-enriched fraction was prepared on which structural and functional analyses were performed.

It was shown that the lipid matrix constituents of plasma membrane (cholesterol (CHOL), fatty acids (FA), and phospholipids (PL) could be modified by diet, castration and the origin of adipose tissue (P or S). Thus, the CHOL/PL ratio was increased by castration (regardless of the tissue) and increased by the sunflower diet (only in P tissue).

The degree of PL fatty acid insaturation increased with the sunflower diet and decreased by castration. Major modifications of PL classes concerned phosphatidyl choline (PC), phosphatidyl éthanolamine (PE) and sphingomyelin (SM) levels.

Membrane fluidity as assessed by fluorescence polarization studies was higher in S than in P membranes in the basic situation (male pigs fed the control diet) and increased in both tissues when animals were fed the sunflower diet.

Functional studies dealing with insulin and  $\beta$ -adrenergic receptors were hampered by huge individual variations and additional studies need to be performed.

Enzyme studies revealed that 5'-nucleotidase (EC 3.1.3.5) activity did not seem to be modified by diet and castration but was always higher in S than in P ( $\sim 3$ -fold). Adenylate cyclase (EC 4.6.1.1) stimulation by various effectors increased when animals were fed the sunflower diet. Dietary effect was much more pronounced when stimulation was nearer the catalytic subunit. There was no significant tissue effect with the control diet, but stimulation became higher in P than in S with the sunflower diet.

**Genetic relationships between fat androstenone level in males and development of male and female genital tract in pigs.** P. Sellier<sup>1</sup>, M. Bonneau<sup>2</sup> and J. Gruand<sup>3</sup> (<sup>1</sup> INRA, Station de Génétique quantitative et appliquée, 78350 Jouy-en-Josas, <sup>2</sup> INRA, Station de Recherches porcines, Saint-Gilles, 35590 L'Hermitage, and <sup>3</sup> INRA, Station Expérimentale de Sélection Porcine, 86480 Rouille, France)

A single-generation selection experiment was undertaken to assess to what extent fat androstenone level in boars can be reduced by breeding while maintaining normal sexual development in boars and gilts. In Large White boars of around 114 kg live weight, the androstenone level was determined on a biopsy of fat taken in the neck region and testes size was estimated by an index combining live measurements of testes width and scrotal area. Three groups of boars (4 per group) were kept for breeding: (1) group S ('small') exhibiting low fat androstenone level (intensity of selection  $i = -1.50$  units of phenotypic standard deviation) and small testes size ( $i = -2.74$ ); group L ('large') exhibiting low fat androstenone level ( $i = -1.32$ ) and large testes size ( $i = +0.50$ ), and (3) group C ('control'). Records for fat androstenone level and testes size at 104 kg live weight and development of genital tract at slaughter (124 kg live weight) were collected on 225 male

offspring from these boars. In addition, proportion of puberal gilts and development of genital tract at slaughter (124 kg live weight) were recorded on 187 female offspring. The response to selection 'against' fat androstenone level was significant ( $P < 0.01$ ) in both groups S and L. Of particular interest is that a normal development of testes and bulbo-urethral glands was preserved in offspring from L sires, at least at 124 kg live weight, though they exhibited a large decrease ( $P < 0.01$ ) in fat androstenone level at the usual slaughter weight of 104 kg. However, a strong delay in puberty ( $P < 0.01$ ) was found in gilts from both groups S and L: only 35–37% of those gilts had reached puberty at 124 kg live weight, as compared to 79% in the 'control' group. Realized genetic parameters for fat androstenone level and testes size were derived from 'index-in-retrospect' coefficients and selection responses in S and L groups. Estimates of realized heritability were 0.88 for fat androstenone level and 0.49 for testes size. The estimate of realized genetic correlation between the two traits was positive (around 0.55), indicating that decreasing fat androstenone content and increasing testes size are genetically antagonistic.

**Influence of the degree of lipid unsaturation on sensory properties of minced meat products.** C. Touraille and J.P. Girard (Station de recherches sur la viande, INRA, Theix 63122 Ceyrat, France)

Large White pigs were fed with 4 different diets based on: 1) barley; 2) barley + copra; 3) maize; 4) maize + maize oil, in order to induce various degrees of lipid unsaturation in fat deposits. The proportion of saturated and unsaturated fatty acids were similar in the diets and in backfat deposits.

Diets had a large effect on the degree of fatty acid unsaturation; for example C18:2 content varied from 8 to 30%, which is within the range usually noted in slaughter houses.

Two minced products were prepared using the backfat: 1) a cooked product: hamburgers; 2) a dried product: dry sausages.