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Session 02

Theatre 4

Cellular and molecular basis of adipose tissue development: from stem cells to adipocyte physiology

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White adipose tissue plays a key role in the regulation of energy balance in vertebrates. Its primary function is to store and release energy. It is also recognized to secrete a variety of factors called adipokines that are involved in a wide range of physiological and metabolic functions. Unlike other tissues, adipose tissue mass has large capacity to expand and can be seen as a dynamic tissue able to adapt to a variety of environmental and genetic factors. The aim of this review is to update the cellular and molecular mechanisms associated with adipose tissue growth and development in domestic animals, with a special focus on the pig. In contrast to other tissues, the embryonic origin of adipose cells remains the subject of debate. Among the variety of cell types contained in adipose tissue, we highlight recent data dealing with adipose-derived stromal stem cells that contribute to tissue homeostasis. The relationships between the proportions of the different stem cells and other molecular indicators of adipose tissue functions are investigated. The current knowledge on the dynamic expression of genes involved in cell cycle arrest, differentiation, and physiology during fetal development is summarized to determine how these changes may be linked to newborn survival. Both genetics and nutrients can affect these processes; they also influence the postnatal growth of adipose tissue. In brief, a better understanding of the developmental biology of adipose tissue is of great importance for targeting this tissue in the animal production field.

Session 02

Theatre 5

Effects of dietary methionine deficiency on adipose tissue growth and oxidative status in piglets

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Adipose tissue plays a crucial role in energy balance, but excessive fat deposition may be linked to systemic oxidative stress. Methionine (Met) is the second limiting amino acid (AA) for growth in pigs and a precursor for cysteine, one of the three AA of the antioxidant glutathione, so that the Met supply could modify the antioxidant status. This study aimed to determine the effects of dietary Met deficiency on the development of adipose tissue and redox metabolism. Weaned piglets (9 kg BW) received a diet providing either an adequate (CTRL) or a deficient supply in Met (-33%, REST) during 10 days (n=6 per group). At a similar BW, the dietary Met restriction led to a 29% increase in perirenal fat proportion, an 11% increase in lipid content in subcutaneous adipose tissue, and greater activities of lipogenic enzymes in both sites. These changes were associated with greater expression levels of genes involved in glucose uptake (GLUT4), lipogenesis (FASN, ME1) and lipolysis (HSL, ATGL and PLIN2) in the two adipose tissues. The activities of the anti-oxidative enzymes superoxide dismutase (SOD), catalase and gluthatione reductase (GRX) were increased in both adipose tissues of REST piglets compared to CTRL piglets. The oxidized glutathione content in adipose tissues was also greater in REST piglets, but the reduced form did not vary between groups. The total antioxidant activities in plasma (as assessed by free radical scavenging and ferric reducing ability) were lower in REST piglets. In conclusion, a dietary Met deficiency changed the partitioning of energy towards a greater adiposity and modified the redox status of adipocytes with consequences on the antioxidant capacity of piglets.