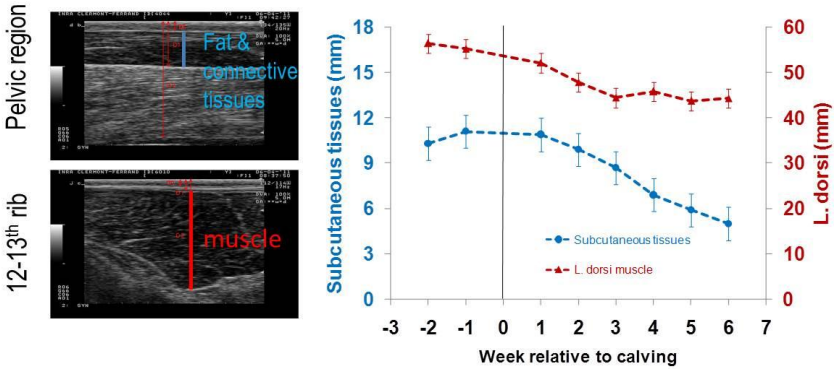
UMR1213 Herbivores

Nutrition - Genomics - Lactation Team (AGL)

Monitoring the adaptations of periparturient dairy cows to husbandry practices: Fat and protein mobilization

Mobilization of body reserves by periparturient dairy cows is a key adaptation for lactation. It was monitored via ultrasonography, milk and blood composition. Indicators of body protein and fat mobilization show that lean (vs. fatter) cows decrease milk protein secretion, despite more intense mobilization of protein postpartum (as shown by 3-methylhistidine: creatinine ratio), which is likely due to low availability of body fat.

The adaptability of dairy cows to production systems depends on a balanced management of body reserves throughout the lactation cycles. The periparturient cow experiences profound physiological and metabolic changes. Adipose tissue and muscle are mobilized, but the ability to use body protein is limited in quantity and duration. The emphasis of selection on milk yield has led to chronic low body condition score (BCS), especially in grass-based dairy systems, and to a decline in reproductive performance. Cows that do not become pregnant may be maintained in extended lactations and thus gradually increase their BCS. The variability of BCS needs to be managed because extreme BCS increases the risk of metabolic disorders postpartum. Precise indicators of body reserve mobilization and accretion are needed to assess how dairy ruminants cope with production systems. We have validated the use of ultrasonography for the assessment of adipose and muscle mobilization, and applied this method together with blood indicators to study body reserve mobilization of early lactation Holstein and Montbéliarde cows under two low-input systems.



Holstein cows calving with High BCS (BCS ≥ 3.75, 0 to 5 scale) experienced intense mobilization of body fat and negative energy balance. Conversely, cows with Low BCS (≤ 2.5) had low plasma nonesterified fatty acids, decreased concentration and secretion of long-chain fatty acids in milk, and decreased protein secretion. Nevertheless, Low BCS cows had an increased concentration of plasma indicators of body protein mobilization (3-methylhistidine: creatinine ratio). These results may be explained by low availability of body fat in lean cows. There are important site differences for ultrasound measures of subcutaneous tissues and muscle. The thickness of subcutaneous adipose and connective tissues of the sacral region was well correlated with BCS and physiological state, but this may not be the case after excessive mobilization of body reserves postpartum. For instance, Holstein-Friesian cows produced more milk and lost more BCS than Montbéliarde cows under low input grass-based systems, but breed effects could not be detected by ultrasonography.

These approaches will be employed to study the adaptative mechanisms of dairy cows to different production systems, namely in relation to indicators of metabolic health such as blood or milk ketone bodies.

Publication/patent

Pires, J.A.A., D. Bany, J. Rouel, J.-M. Giraud, and Y. Chilliard. 2012. Mesures échographiques pour étudier la mobilisation des tissus sous-cutanés et du muscle chez la vache laitière peripartum. In : 19th Renc. Rech. Ruminants, Paris, France, p193

Pires, J.A.A., C. Delavaud, Y. Faulconnier, D. Pomies, and Y. Chilliard. 2013a. Effects of body condition score at calving on indicators of fat and protein mobilization of periparturient Holstein-Friesian cows. J. Dairy Sci. 96:6423-6439.

Pires, J.A.A., J. Rouel, D. Bany, O. Trocquier, D. Pomiès, and Y. Chilliard. 2013b. Etude de la mobilisation des réserves corporelles par la note d'état corporel et des mesures échographiques chez des vaches Prim'Holstein et Montbéliarde en systèmes d'élevage à faibles intrants. In : 20th Renc. Rech. Ruminants, Paris, France, p114.

Contact : Pires Jose, jose.pires@clermont.inra.fr, Chilliard Yves, yves.chilliard@clermont.inra.fr, UMR1213 Herbivores, F-63122 Saint-Genès-Champanelle, France.