

Tissue Distribution of Leptin and Leptin Receptor Gene Expression in Holstein Cattle

P.K. Chelikani*, D.R. Glimm, F. Dong**, and J.J. Kennelly.

Dairy Research and Technology Centre, University of Alberta, *University of Nebraska Medical Center, Omaha, Nebraska, U.S.A., and **Duke University Medical Centre, Durham, North Carolina

Leptin, a hormone synthesized and secreted primarily from adipose (fat) tissue, plays a role in various physiological functions such as energy homeostasis, reproduction, cardiovascular, renal, immune and stress responses, and bone formation. Leptin elicits its biological effects on tissues and cells through interaction with a specific receptor molecule - the leptin receptor. Knowledge about leptin and the leptin receptor, and the regulation of their corresponding genes, in tissues in dairy cattle is crucial to an understanding of leptin physiology in dairy production.

The objective of the current study was to develop methods to measure leptin and leptin receptor gene expression in dairy cattle. Twenty-seven different tissues were collected from each of 12 male Holstein calves (196.7 ± 15.62 kg BW). The leptin gene was expressed in mammary tissue and in adipose tissue (similar expression observed in subcutaneous, pericardial, perirenal, and mesenteric adipose locations). The situation with the leptin receptor turns out to be a little more complicated in that there are two slightly different forms of the receptor. We detected expression corresponding to the long-form of the leptin receptor in all four adipose tissue locations, as well as mammary parenchyma, semitendinosus muscle, liver, adrenal cortex, spleen, kidney, testis, mesenteric lymph node, lung, aorta, abomasum, duodenum, jejunum, ileum, hypothalamus, pituitary, brain stem, cerebral cortex, cerebellar cortex, pons, and pineal gland. Expression corresponding to the short-form of the leptin receptor was observed in the liver, adrenal cortex, spleen, pituitary, and brain stem, but not in the other tissues surveyed. In conclusion, our finding of a wide spectrum of tissues expressing the leptin and leptin receptor genes provides evidence for involvement of leptin in multiple physiological functions in dairy cattle. Future studies that measure gene expression of leptin and leptin receptors in various tissues in response to nutritional and (or) hormonal manipulations should prove useful in delineating the functional significance of leptin and its receptors in various tissues in dairy cattle.

Implications of the Research for the Dairy Industry: Recent studies have provided evidence that leptin may have a role in regulation of feed intake, energy balance, body condition, milk production, milk components, fertility, reproductive performance, and immune function in cattle. A better understanding of how leptin exerts its effects in dairy cattle may allow improvements in health, production efficiency, and profitability.