

*Review Article*

## **EFFECT OF LEPTIN IN DAIRY CATTLE**

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**Abstract:** Leptin is synthesized from adipocytes regulation of feed intake, energy expenditure and energy balance in animals. It also plays a major role in hematopoiesis and anorexia accompanying an acute cytokine challenge. Plasma leptin was measured between during the period from 35 days before to 56 days after parturition. The plasma concentration of leptin was reduced by 50 per cent after parturition and remained during lactation and gradual improvement in energy balance.

**Keywords:** Animals, Energy balance, Leptin.

### **Introduction**

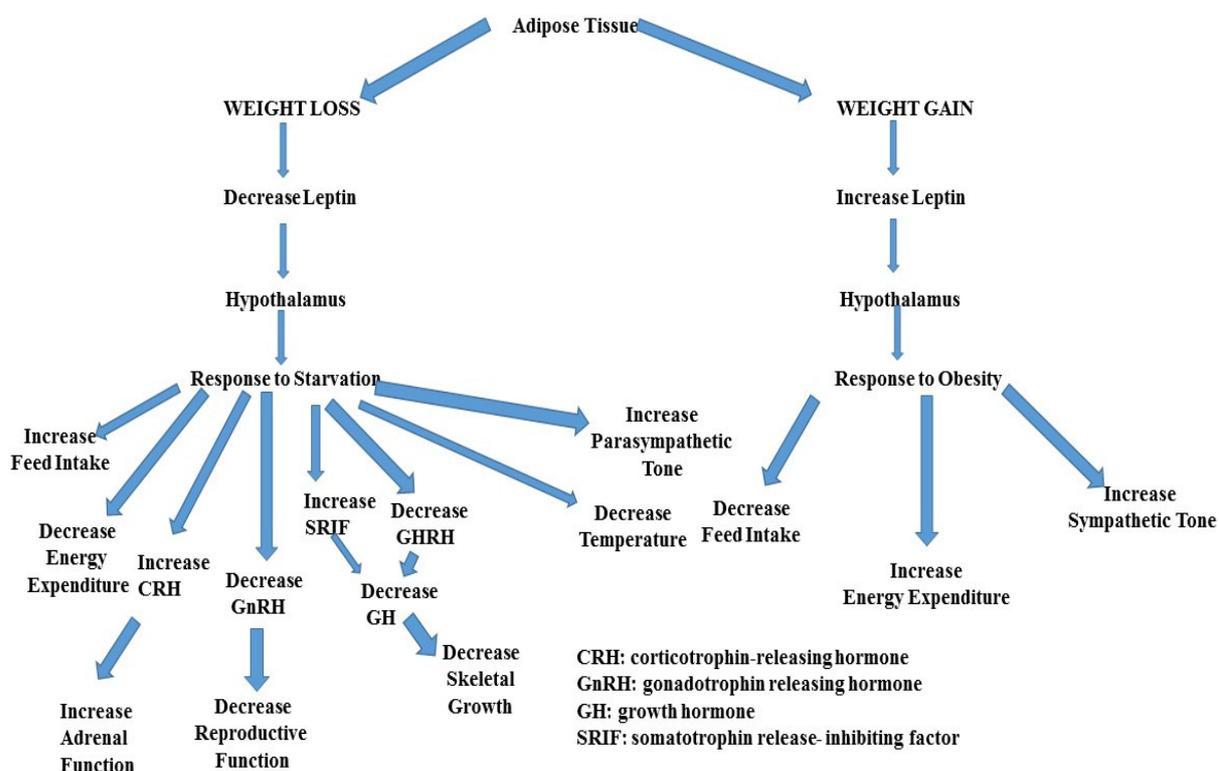
Leptin derived from the Greek word 'leptos' means 'thin'. Leptin, a 16-k Da protein hormone consists of 167 amino acids is synthesized from white adipose tissues and secreted into the peripheral circulation. It regulation of control feeding behaviour, metabolism, endocrine function to maintain energy homeostasis, ovarian activity, fertility and immune function (Fruhbeck et al., 1998). In dairy cattle, elevated leptin production due to negative energy balance (NEBAL) during early lactation and impaired in fertility. In animals, concentration of leptin varies in body weight and body fat deposition (Delavaud et al. 2002). During early lactation reduction of leptin concentration due to negative energy balance because plasma leptin remained high in cows not milked after parturition (Block et al. 2001). Increased leptin production to lead increased level of triglyceride store in adipose tissue could serve as a signal to the brain, to decrease food intake and to increase energy expenditure and resistance to obesity.

### **Plasma/ Serum Circulatory Leptin**

Wathes et al.(2007) observed increased level of leptin present in well-fed after puberty heifers and non-lactating late- pregnant cows, whereas the lowest values observed during early weeks of lactation when animals experienced negative energy balance (NEBAL). After

calving plasma leptin level declined by approximately 50 per cent (Block et al. 2001). Leptin concentration influence various metabolic functions such as NEBAL, homeostasis, lactation, pregnancy, heat stress (Singh et al. 2012).

**Figure 1: Function of Leptin (adopted from Friedman, 2002)**



### Leptin and Negative Energy Balance

During periparturient period, high yielders experience major changes in energy metabolism. During lactation, circulating leptin concentration associated with body condition score (BCS). Animals experienced under feeding alleviate leptin levels, which results in increased cortisol (Chillard et al. 2001) contributing to metabolic adaptations and feeding behavior.

### Growth and Energy Balance

Increased plasma leptin to cause reduces the appetite and dry matter intake. Effect of leptin decreases insulin and glucocorticoids hormone but stimulates growth hormone, catecholamine and thyroid hormone secretions. Leptin plays a major role regulating body weight and growth in mammals. Leptin has observed the direct effect on proliferation, differentiation, mineralization and to induce prolonged life span of osteoblasts by inhibiting apoptosis and helps in wound healing. Effect of leptin on central nervous system (CNS) and endocrine glands are

- i) Increases the insulin sensitivity, glucose utilization and energy expenditure in muscles
- ii) Enhances the fatty acid oxidation in muscles and liver
- iii) Stimulates the lipolysis
- iv) Inhibits the lipogenesis

### **Leptin and Lactation**

During pregnancy, leptin level remains high and declines rapidly towards parturition (Singh et al. 2012). Eliminating the energetic cost of lactation by milk delivery in cows could cause an increase in plasma leptin levels together with an increase in energy balance (Block et al. 2001).

### **Leptin in Reproduction**

Leptin receptors found within CNS, pituitary gland, and ovary. Metabolic perturbations altered endocrine functions, delayed onset of puberty and interfere the normal estrus cycles in heifer (Houseknecht et al. 1988). Leptin plays a major role Circulating serum/plasma leptin elevated from early and mid-pregnancy and until late pregnancy in sheep (Forehead et al. 2002). Decreased leptin concentration during postpartum period exhibited delayed onset of reproductive functions (Liefers et al. 2003).

### **Conclusion**

Leptin stimulant for growth as well as a reproductive tract. Leptin will act as an indicator of the animal energy requirement for potential growth and survival. Leptin appears to have a function as a growth factor in a range of different cell types.

### **References**

- [1] Block, S.S., Butler, W.R., Ehrhardt, R.A., Bell, A.W., VanAmburgh, M.E. and Boisclair, Y.R. 2001. Decreased concentration of plasma leptin in periparturient dairy cows is caused by negative energy balance. *J. Endocrinol.* 171: 339-348.
- [2] Chilliard, Y., Bonnet, M., Delavaud, C., Faulconnier, Y., Leroux, C. and Djiane, J. (2001). Leptin in ruminants. Gene expression in adipose tissue and mammary gland, and regulation of plasma concentration. *Domest. Anim. Endocrinol.* 29: 3-22.
- [3] Delevalud, C., Ferlay, A., Faulconnier, Y., Bocquier, F. and Chilliard, Y. (2002). Plasma leptin concentration and adult cattle: effect of breed, adiposity, feeding level and meal intake. *J. Anim. Sci.* 80: 1317-1328.
- [4] Forehead, A.J., Thomas, L., Crabtree, J., Haggard, N., Gargne, S., Giussani, A. and Fowden, A.L. (2002) Plasma leptin concentration in fetal sheep during late gestation: ontogeny and effect of glucocorticoids. *Endocrinol.* 143: 1166-1173.

- [5] Friedman, J.M. (2002) The function of leptin in nutrition, weight, and physiology. *Nutrition Reviews*. 60(10): S1-S14.
- [6] Fruhbeck, G.S., Jebb, A. and Prentice, A.M. (1998). Leptin: physiology and pathophysiology. *Clin. Physiol*. 18: 399-419.
- [7] Houseknecht, K.L., Boggs, D.L., Campion, D.R., Sartin, J.L., Kiser, T.E., Rampacek, G.B. and Amos, H.E. (1988) Effect of dietary energy source and level on serum growth, insulin-like growth factor-1, growth and body composition in beef heifers. *J. Anim. Sci.* 66: 2916-2923.
- [8] Liefers, S.C., Veerkamp, R.F., Pas, M.F., Delavaud, C., Chilliard, Y. and Vander, L.T. (2003) leptin concentrations in relation to energy balance, milk yield, intake, live weight and estrus in dairy cows. *J. Dairy Sci.* 86: 733-807.
- [9] Singh, S.V., Upadhyay, R.C., Kundu, S.S., Vaidya, M.M and Singh, A.K. (2012). Leptin as a metabolic and energy homeostatic hormone in dairy animals: a review. *Indian J. Anim, Nutr.* 29(2): 109-116.
- [10] Wathes, D.C., Cheng, Z., Bourne, N., Taylor, V.J., Coffey, M.P., and Brotherstone, S. (2007) Differences between primiparous and multiparous dairy cows in the interrelationships between metabolic traits, milk yield and body condition score in the periparturient period. *Domest. Anim. Endocrinol.* 33: 203-225.