

*Review Article*

## **NUTRITIONALLY MEDIATED EFFECTS ON REPRODUCTION IN DAIRY CATTLE**

**R. Yasothai**

Veterinary University Training and Research Centre,  
Erode – 638004, Tamilnadu, India

**Abstract:** Selection of dairy cattle for milk yield has linked the endocrine and metabolic controls of nutrient balance and reproductive events in early lactation. The energy costs to synthesize and secrete hormones, to ovulate a follicle, and to sustain an early developing embryo are probably minimal compared to the energy needs for maintenance and lactation. However, the metabolic and endocrine cues associated with negative energy balance (NEB) impair resumption of ovulatory cycles, oocyte quality and embryo quality, and establishment and maintenance of pregnancy in dairy cattle.

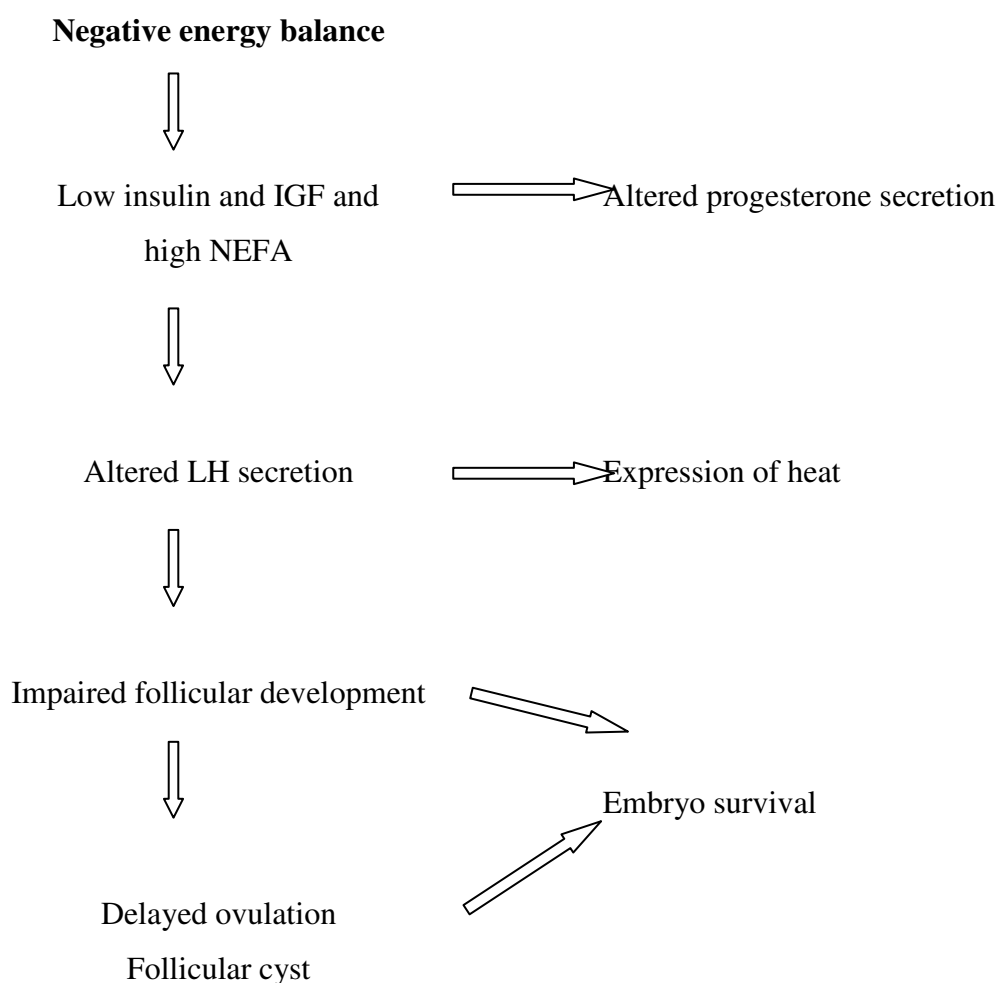
### **INTRODUCTION**

Nutrition has an important impact on the reproductive performance of dairy cattle. Energy is the major nutrient required by adult cattle and inadequate energy intake has a detrimental impact on reproductive activity of the female bovine. Cows under negative energy balance have lowered plasma glucose, insulin, and insulin - like growth factor-I (IGF-I); reduced peak frequency of LH pulses; lowered plasma progesterone; and impaired ovarian activity. Incidence of postpartum an ovulation and anestrous, as well as reduced fertility, is magnified by losses of body condition during the early postpartum period. Resumption of ovulatory cycles is associated with energy balance, but seems to be mediated by a rise in plasma IGF-I; which is linked to nutritional status and concentrations of insulin in blood.

### **MECHANISM OF NUTRITIONALLY MEDIATED EFFECTS ON REPRODUCTION**

Reproduction is controlled by complex neuro-hormonal mechanisms built around the hypophyseal-pituitary-gonadal axis. GnRH is released in a pulsatile manner from the nerve terminals in the hypophyseal stalk-median eminence. These nerve endings impinge upon the hypophyseal portal blood system which supply the pituitary gland, and stimulate a pulsatile release of luteinizing hormone (LH) and follicle stimulating hormone (FSH) from the latter. Both LH and FSH stimulate the gonads which release steroids and exert stimulatory and inhibitory effects on the pituitary (anterior), hypothalamus and high neural centres, to

complete the neuro-hypophyseal-pituitary-gonadal axis. Thus in the post-partum period, a rapid decrease in oestradiol after parturition removes the negative feedback on the hypothalamo-pituitary axis, promoting the synthesis/release of GnRH followed by increase in LH pulses, as well as release of oestradiol from ovarian follicles detectable in peripheral circulation. Nutrition could modify these changes, and according to Robinson (1990), a common feature of these changes in all species, is the alteration in the frequency of the episodic release of LH. Day *et al.* (1986) examined the effects of restricted energy intake in prepuberal heifers, Short and Adams (1988) concluded that the restricted energy prevents or slows the maturational process at the pituitary-hypothalamus level.



Evidence for a direct gonadal effect have been reported, however, by several workers who reported lower serum progesterone and/or reduced *in vitro* production by CL tissue of underfed animals (Imakawa *et al.*, 1986). Hence it is concluded that the steroid production are reflected back on the ability of the hypothalamus-pituitary to release gonadotropins,

although there is some evidence that feed acts directly on the hypothalamus-pituitary (Short and Adams, 1988).

## **CONCLUSION**

Inadequate intake of nutrients and inadequate body reserves during early lactation are the major factors affecting reproductive performance of dairy cows. A period of severe NEB may affect fertility through a variety of mechanisms. NEB reduces the ability of the uterus to recover after calving and may result in persistent inflammatory mediated damage. In ruminants, circulating leptin concentrations are positively correlated with body fatness, feed intake, nutrients and hormones (especially glucose and insulin), LH pulse. In short, this hormone is responsible for the linkage between nutritional status and reproductive function.

## **REFERENCES**

- [1] Robinson, J.J., 1990. Nutrition in the reproduction of farm animals. *Nutrition Research Reviews*, 3: 253-276.
- [2] Day, M.L., K. Imakawa, D.D. Zalesky, R.J. Kittok, J.E. Kinder, 1986. Effects of restriction of dietary energy intake during the prepubertal period on secretion of luteinizing hormone and responsiveness of the pituitary to luteinizing hormone – releasing hormone in heifers. *J.Anim.Sci.*, 62: 1641-1648.
- [3] Short, R.E. and D.C. Adams, 1988. Nutritional and hormonal interrelationships in beef cattle reproduction. *Can. J. Anim. Sci.*, 68: 29-39.
- [4] Imakawa, K.M., M.C. Day, D.D. Zalesky, M. Garcia-Winder, R.J. Kittok and J.E. Kinder, 1986. Influence of dietary – induced weight change on serum luteinizing hormone, estrogen and progesterone in the bovine female. *Biol. Reprod.*, 35: 377.