CHAPTER I

INTRODUCTION AND AIMS

The problems of dairy farming in Thailand are the low milk production and short lactating period of crossbred cattle. Many factors can effect milk production e.g., nutrition, high environment, genetics, disease and management. However these factors can effect the physiological signals received by the mammary gland. The lactating mammary gland receives signals from the rest of body in forms of nutrient and hormones from blood to sustain milk synthesis. It is known that during lactation, dairy cattle consume more of water to make up the largest portion of milk and waste products including many bodily functions are altered. An increase in water intake during lactation closely matched to increase in water secreted in milk (Woodford et al., 1984), which milk composition has about 87% of water (Murphy, 1992). Cows in early lactation have more body weight in water (69%) than cows in late lactation (62.4%) while late-gestation dry cows have intermediate in body water content (64.7%) (Andrew et al., 1995). Lactating dairy cows metabolize large amounts of water and are affected rapidly by water deprivation. A study on the regulation of body fluids and mammary circulation in crossbred Holstein Friesian cattle (HF) has been shown some differences in the distribution of body fluids and mammary circulation between 50%HF and 87.5%HF animals during late pregnancy and different stages of lactation. The lower total body water as a percentage of body weight of 87.5%HF animals has been shown lower efficiency in water retention mechanism as compared to 50% HF animals in all periods of lactation (Chaiyabutr et al., 1997). Water turnover rate and total body water as percentage of body weight of 50% HF animals were significantly higher than those of 87.5% HF animals indicating a poor adjustment of 87.5%HF animals to the tropical environment and poorer lactation persitency

(Chaiyabutr et al., 1999). However, the control mechanism for body water regulation in crossbred dairy cattle in the tropics has to be elucidated.

An alteration in many bodily functions during lactation is apparent; for example, blood volume and cardiac output are increased (Chaiyabutr et al., 1997; Hanwell and Peaker, 1977). These changes may effectively alter body fluid and thus circulatory distribution including the blood supply to the mammary gland. Mammary blood flow is a major parameter controlling milk production in a way to carry milk precursors to the mammary gland at the process of milk synthesis. Specifically, examining the pattern nutrient uptake by glands or quantifying the dependency of nutrient uptake on arterial nutrient concentration should provide a basis for determining the contribution of blood metabolites to and energy costs association with milk synthesis (Miller et al., 1991). It has been reported that mammary blood flow and milk secretion of 87.5% HF animals were significantly higher in early lactation and markedly declined when lactation advances in comparison with those of 50% HF animals. The levels of plasma growth hormone of 87.5% HF also markedly rose in early period of lactation and markedly reduced in mid and late lactation (Chaiyabutr et al., 2000). However, little is known on the control mechanism involved in regulating mammary blood flow and milk synthesis in responses to bST treatment in crossbred animals.

Differences between animals partitioning ability during lactation are known to be inherited and are thought to be under endocrine control with homeorhetic principle in bovine lactation. Bovine somatotropin (bST) is known as a homeorhetic hormone connected with both growth and lactation. The importance of bST for maintaining milk output in ruminant is well established (Etherton and Bauman, 1998). Increased milk secretion in respond to the treatment of bST requires partitioning of nutrients to accommodate the increase in rates of milk synthesis (Peel and Bauman,

1987). In this manner, nutrients are partitioned from peripheral tissue (e.g. adipose) to the mammary gland to support the requirements for milk synthesis especially at peak lactation (Miller et al., 1991). However, the mechanism of action for growth hormone on milk production remains unclear. Several lines of evidence indicate that administration of growth hormone does not act directly on mammary gland. Since the receptors for growth hormone has not been demonstrated on epithelials cells of mammary tissue (Akers, 1985).

The effects of growth hormone are indirect, mediated either via nutrient partitioning effects or via insulin-like growth factor-1 (IGF-1). A few research in crossbred dairy cattle have been conducted to study effects of exogenous bovine somatotropin on the changes of body fluid relating to mammary function during early to mid lactation. Although nutrient partitioning relating to body fluid and circulatory distribution undoubtedly makes a contribution of resources to the mammary gland, particularly during early lactation. Furthermore, reduction in extracellular fluid and total body water has been noted in both human and animals during growth hormone deficiency (Janssen et al., 1997). It is important to understand the mechanism of physiological adjustments of body water during declining of milk yield with time in mid lactation in crossbred dairy cattle in the tropics. Therefore, the objective of the present study was to evaluated the effect of administration of recombinant bovine somatotropin on mammary function in relation to water metabolism and other physiological parameters in early lactation of crossbred Holstein cattle.