ENERGY BALANCE AND OVARIAN FOLLICLES

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INTRODUCTION

Ovarian follicles have multiple roles in successful reproduction of dairy cattle. From several months before puberty in heifers to aged cows, follicles grow continuously in successive waves. Pituitary and ovarian hormones regulate follicular growth. Most follicles that initiate growth degenerate and die by a process of atresia. Few follicles actually experience growth that proceeds to ovulation. Follicles that ovulate, avoid atresia by achieving dominance. Dominant follicles have the greatest function and largest size of all other follicles in the same growth group or cohort. These dominant follicles also suppress growth and function of other follicles in the same cohort and ultimately cause their atresia. Function of follicles, measured by estradiol secretion, is critical to growth, survival and ovulation opportunity of follicles. All follicles contain an oocyte that remains dormant until the follicle is committed irreversibly to ovulation. So, if a follicle survives to ovulate, there is no current evidence that the welfare of the oocyte is affected by the hormonal or metabolic circumstances before ovulation.

At least 80 percent of dairy cows experience negative energy balance **(NEB)** in early lactation. The magnitude and duration of NEB is highly variable among cows. Negative energy balance extends the interval from calving to first ovulation, increases the number of medium but decreases the number of large follicles, and reduces function of corpora lutea **(CL)**. Thus, energy balance affects follicular growth and function. However, there is no evidence that energy balance affects fertilizability of oocytes.

Compared to positive energy balance, the metabolic and hormonal status of cows is altered substantially during NEB. Among the differences due to NEB, luteinizing hormone **(LH)** is a likely mediator of the effects of NEB on follicles.

To resolve the adverse effects of NEB on follicles, the major challenges are:

1) understand regulation of follicles independent of energy balance,
2) identify the factors that mediate the adverse effects of NEB on follicles, and
3) minimize the magnitude and duration of NEB without limiting yield of milk in early lactation.

WHY ARE FOLLICLES IMPORTANT?

Ovarian follicles have multiple but critical roles in successful reproduction. In non-pregnant cows follicles are the major source of estradiol, which is imperative for the physical and behavioral signs of estrus. Thus, function of follicles is necessary for detection of estrus and the opportunity for insemination. In addition, growth and function of follicles capable of ovulation determines the interval from calving to ovulation. After ovulation, the recently ovulated follicle differentiates to form a CL. Subsequent development and function of the CL is affected positively by the size and function of the follicle that ovulated, which becomes the parent tissue to the CL. If the ovulatory follicle has limitations, these limit the CL (Villa-Godoy et al., 1988) and presumably reduce fertility by increasing embryonic death. Another reason follicles are important is that follicles control their resident oocyte. The current model explaining oocyte maturation is that oocytes remain dormant until the associated follicle commits irreversibly to ovulation. Based on available evidence, oocytes are protected or shielded from the hormonal and metabolic environment in and around the follicle. Except for aging of females, factors that might affect fertility of oocytes or survival of subsequent embryos have not been examined rigorously. Whether hormones or metabolites that characterize NEB have direct effects on oocytes is not known.