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Review Article

TYPE OF ENERGY FED ON REPRODUCTION IN DAIRY CATTLE

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Abstract: There are many different reports which indicate that the type of energy fed has a significant influence on dairy cow fertility. An energy deficiency before calving (below maintenance) should be avoided as well because this leads already at this stage to metabolic stress with subclinical ketosis and liver damage, followed by a higher incidence of retained placenta, endometritis and low conception rates in the following lactation.

INTRODUCTION

It has been reported that feeding diets which result in a relatively high supply of glucogenic nutrients (mostly ruminal propionate and glucose) results in less mobilization of adipose tissue as measured by blood metabolites (Rizos *et al*., 2004). In addition, there are some reports that such diets improve fertility in dairy cattle (Gong *et al*., 2002). Similarly, Beever (2006) concluded that cows fed glucogenic (in this case, starch-based) diets mobilized less adipose tissue than those fed on high protein or high fat diets. Supply of glucogenic nutrients is limited, especially as feeding high starch supplements at pasture may lead to lower than desired rumen pH (although this impact may be reduced if the correct type of starch, effective fibre and appropriate buffers are used). The use of supplements such as propylene glycol have been shown to alter. However, these diet types often increase circulating levels of insulin and IGF-1 and reduce indices of body fat mobilization, they do not always increase fertility.

Effect of propylene glycol supplementation on indices of negative energy balance in grazing cows at 15 days in milk

Plasma metabolite	Propylene glycol	Control
Glucose (mmol/l)	4.0	3.0
BHB (mmol/l)	0.5	1.5
NEFA (mmol/l)	0.55	0.95

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The BHB and NEFA concentrations observed for the control cows are indicative of excessive NEB.

Many experiments have reported beneficial effects of supplemental fat on fertility indices in dairy cattle (Staples *et al*., 1998). However, in some cases detrimental effects on dairy cow fertility were realized (Gardener *et al*., 1999). Fat supplements based on calcium salts of palm fatty acids improved first service conception rates, in comparison to controls, for grazing dairy cows (McNamara *et al*., 2003). However, no effect of treatment on overall pregnancy rate was observed in this experiment. There are several potential mechanisms by which polyunsaturated fatty acid (PUFA) supplements may improve fertility in dairy cattle (Staples *et al*., 1998). These include; i) a glucose sparing effect at the mammary gland which may improve circulating concentrations of glucose, with a positive effect on LH release pattern; ii). Increased circulating concentrations of cholesterol, a precursor of progesterone; and iii) inhibition of PGF2α and oestradiol- 17β in order to improve the lifespan of the corpus luteum and potentially improve the survival of the embryo.

Supplementation with flax seed (a rich source of linolenic acid, an omega-3 PUFA) significantly reduced embryo mortality in comparison to other fat supplemented groups (Petit and Twagiramungu, 2006). This is consistent with other reports, which indicate that fatty acids from the omega-3 family reduce ovarian and endometrial synthesis of PGF2α and may result in reduced embryo mortality (Mattos *et al*., 2004). There are currently several supplemental fat or PUFA products for sale in Ireland that claim to enhance dairy cow fertility. Short and Adams (1988) reported that glucose is a specific mediator for the effects of energy intake on reproduction. Indirect experimental evidence come from the feeding of monensin, an ionophore that increases feed efficiency in ruminants by increasing the production of propionate, the glucogenic fatty acid, in relation to acetate and butyrate. Thus, feeding monensin has been reported to decrease age at puberty (Moseley *et al*., 1982); and to reduce post-partum interval in thin cows (Randell, 1990).

According to Rutter *et al*., (1983), these effects can be mimicked by infusing propionate into the rumen. Moreover, Randell (1990) suggested that increased gluconeogenesis resulting from increased propionate absorption is detected at the hypothalamic-pituitary-ovarian axis, leading to an increased release of GnRH and LH. The use of 2-deoxy-glucose, a metabolic inhibitor of glucose to block oestrus and ovulation (Randel, 1990) constitutes another indirect evidence of the mediating role of glucose. Direct evidence has been presented by others (Garmendia, 1986; Richards *et al*., 1987) through glucose challenge or infusion experiments.

Lemenager *et al*. (1991) identified some other neural transmitters including amino acids, insulin and insulin-like growth factors, and neuro peptides that may interact at higher centres to regulate reproduction.

CONCLUSION

There are many different reports which indicate that the type of energy fed has a significant influence on dairy cow fertility. An energy deficiency before calving (below maintenance) should be avoided as well because this leads already at this stage to metabolic stress with subclinical ketosis and liver damage, followed by a higher incidence of retained placenta, endometritis and low conception rates in the following lactation.

REFERENCES

[1] Beever, D.E., 2006. The impact of controlled nutrition during the dry period on dairy cow health, fertility and performance. Animal Reproduction Science, 96: 212- 226.

[2] Gardener, N.H., C.K. Reynolds, R.H. Phipps, A.K. Jones and D.E. Beever, 1999. Effects of different diet supplements in the pre and postpartum period on reproductive performance in the dairy cow. In: Diskin, M.G. (Ed.), Fertility in the high producing dairy cow. BSAS Occasional Symposium, 26: 313-322.

[3] Garmendia, J.C., 1986. Secretion of luteinizing hormone in postpartum cows infused with glucose. PhD dissertation. Oklahoma State University, Stillwater, Okla.

[4] Gong, J.G., W.J. Lee, P.C. Garnsworthy and R. Webb, 2002. Effect of dietary – induced increases in circulating insulin concentrations during the early postpartum period on reproductive function in dairy cows. Reproduction, 123: 419-427.

[5] Lemenager, R.P., R.N. Funston, and G.E. Moss. 1991. Manipulating nutrition to enhance (optimize) reproduction. In: F.T. McCollum and M.B. Judkins (eds.) Proc. 2nd Grazing Livest. Nutr. Conf. Pp. 13-31. Oklahoma Agric. Exp. Sta. MP-133. Stillwater, Okla.

[6] Mattos, R., C.R. Staples, A. Arteche, M.C. Wiltbank, F.J. Diaz, T.C. Jenkins,T.C. and Thatcher, W.W. (2004). The effects of feeding fish oil on uterine secretion of $PGF_{2\alpha}$, milk composition, and metabolic status of periparturient Holstein cows. J. Dairy Sci., 87: 921-932.

[7] McNamara, S., T. Butler, D.P. Ryan, J.F. Mee, P. Dillon, F.P. O'Mara, S.T. Butler, D. Anglesey, M. Rath and J.J. Murphy, 2003. Effect of offering rumen protected fat supplements on fertility performance in spring- calving Holstein- Friesian cows. Animal Reproduction Science, 79: 45-56.

[8] Moseley, W.M., T.G. Dunn, C.C. Kaltenbach, R.E. Short and R.B. Staigmiller, 1982. Relationship of growth and puberty in beef heifers fed monensin. J. Anim. Sci., 55: 357-362.

[9] Petit, H.V. and H. Twagiramungu, 2006. Conception rate and reproductive function of dairy cows fed different fat sources. Theriogenology, 66: 1316-1324.

[10] Randell, R.D., 1990. Nutrition and postpartum rebreeding in cattle. J. Anim. Sci., 68: 853.

[11] Richards, M.W., R.P. Wettemann and H.M. Schenemann, 1987. Plasma glucose and insulin, and anestrus in relationship between nutritionally restricted beef cows. Proc. Soc. Sec. Am. Soc. Anim. Sci., p.64. (Abstr).

[12] Rizos, D., W. Griffin, P. Duffy, C. Quinn, F.J. Mulligan, J.F. Roche, M.P. Boland and P. Lonergan, 2004. The effect of feeding propylene glycol to dairy cows during the early post-partum on insulin concentration and the relationship with oocyte developmental competence. Reproduction Fertility and Development, 16: 262.

[13] Rutter, L.M., R.D. Randel, G.T. Schelling and D.W. Forrest, 1983. Effect of abomasal infusion of propionate on the GnRH-induced luteinizing hormone release in prepuberal heifers. J. Anim. Sci., 56: 1167-1173.

[14] Short, R.E. and D.C. Adams, 1988. Nutritional and hormonal interrelationships in beef cattle reproduction. Can. J. Anim. Sci., 68: 29-39.

[15] Staples, C.R., J.M. Burke and W.W. Thatcher, 1998. Influence of supplemental fats on reproductive tissues and performance of lactating cows. J. Dairy Sci., 81: 856-871.