W4 – SEASONALITY OF REPRODUCTION AND ITS CONTROL

W41 - Effect of Dietary Fatty Acids on Embryo Development, Endocrine Status and Milk Yield of Lactating Holstein Cows during Two Seasons

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The key determinant for the profitability of dairy herd is fertility. Albeit rapid progress in genetics and management of high producing dairy herds, reproductive efficiency has decreased in last years and thermal environment is accepted as a major factor affecting fertility and milk yield in lactating dairy cows in this regard (Kadzere et al. 2002). In this experiment, it was aimed to detect effects of rumen protected fats on milk yield, fertility, embryo development and quality and some blood hormone concentrations of lactating Holstein cows. Twenty Holstein cows at their first lactation separated into two groups according to live weights, body conditions, milk yields and day of lactation for each season. Cows in both Control (C) and Protected Fat (PF) groups were fed individually according to NRC (1996) and protected fat consumption for PF cows were adjusted everyday according to changes in average feed consumption of last 3 days. Blood samples were collected from jugular vein into 10 mL heparinized vacuette. Blood samples were centrifuged at +5º C for 10 min at 2060 g to separate plasm for enzyme immunoassay (EIA) and stored at -20º C until the day of assay. Blood sampling for cortisol were obtained at 2:00 pm every day during experiment. Samplings for LH were obtained for 48 hours after PRID (Progesterone releasing intravaginal device) removal. Time gap between samplings for LH was 4 hours for the first 12 hours; 2 hours for following 24 hours and 4 hours for the last 12 hours following PRID removal of each cow. Samplings were obtained at 0, 12, 24, 36 and 48 hours for estradiol and 1, 3, 5 and 7 days for progesterone following PRID removal. Dry matter, solid non-fat and casein contents of milk did not differ by fat supplementation. Total plasma progesterone concentrations were decreased in summer ($P<0.05$) but not affected by fat supplementation. Both season and fat supplementation did not have any significant effects on plasma cortisol concentrations ($P>0.05$). Plasma estrogen concentrations increased by fat supplementation ($P<0.05$). Peak and average LH concentrations were not affected both by season and fat supplementation. Two-twelve cell embryo rates increased in both season by fat supplementation ($P<0.01$). Blastocyst rates were decreased in summer ($P>0.05$). Effect of protected fats on first and second grade embryos were found statistically significant ($P<0.05$). The present findings suggest that fat supplementation to the diet of lactating cows is not adequate to prevent negative effects of summer heat stress, but also some management practices e.g. sprinkler + fan can be more beneficial to minimize these effects.

References:

Kadzere CT, Murphy MR, Silanikove N, Maltz E. Heat stress in lactating dairy cows: a review. Livest. Prod. Sci., 2002; 77:59–91.

NRC. Nutrient Requirements of Beef Cattle (7th Ed.). National Academy Press, 1996, Washington, DC.

W42 - Summer induces DNA damage in boar sperm: Implications for the management of seasonal infertility.

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At 40% share, pork is the most widely eaten meat globally. As such, research efforts must improve production

and efficiency in the pig industry to meet growing demand. However, summer heat stress has a significant negative impact on pig fertility; causing embryonic death and decreased litter size that cost the industry millions in productivity losses. This problem is particularly prevalent in the tropics where ambient temperatures rise beyond the animal's zone of thermal comfort. Boars are particularly vulnerable to the effects of heat stress due to their inefficient capacity to sweat; non-pendulous scrotum; and the high susceptibility of boar sperm to temperature shock. Moreover, due to limited endogenous antioxidant systems inherent in mammalian spermatozoa and the loss of cytosolic repair mechanisms during spermatogenesis, the DNA in these cells are particularly susceptible to oxidative damage. While a seemingly healthy looking sperm may swim and fertilize an oocyte normally, studies in mice demonstrate that heat stress-induced DNA damage can disrupt expression of key developmental genes in early embryos after fertilization and distort the formation of the blastocyst; resulting in implantation failure and pregnancy loss. The aim or our study is to determine whether heat stress induces DNA damage to boar sperm that could significantly contribute to the high rates of embryo loss and pregnancy failure observed in sows during summer infertility.

The quality of sperm obtained from n=6 Large White boars housed in the dry tropics of Townsville, North Queensland, Australia was evaluated across different seasons (summer, winter and spring) during 2014 - 2015. Sperm motility was characterised by Computer-Assisted Sperm Analysis (CASA; IVOS version 10: Hamilton Thorne, USA), and sperm DNA integrity evaluated by Terminal deoxynucleotidyl transferase dUTP Nick-End Labelling (TUNEL; In situ cell death detection kit, fluorescein: Roche, Germany). Twenty-thousand spermatozoa per boar per treatment were analysed using flow cytometry (CyAn ADP analyser. Beckman Coulter, USA).

Sperm had equal motility across all seasons (total motility: 70.8 ± 5.5% vs. 71.3 ± 8.1% vs. 90.2 ± 4.2%, $P > 0.05$; progressive motility: 41.7 ± 2.8% vs. 35.4 ± 7.0% vs. 46.6 ± 4.0%, $P > 0.05$ for spring, summer and winter respectively). However, sperm in summer exhibited ~9-fold higher DNA damage than that in winter and spring (16.1 ± 4.8% vs. 1.1 ± 0.2% and 1.8 ± 0.4% respectively; $P < 0.05$).

These results demonstrate that summer negatively affects sperm DNA integrity in boars without depressing sperm motility. This means traditional methods of evaluating semen quality may not detect inherently compromised spermatozoa. We are currently evaluating the effect of this DNA-damaged sperm on rates of fertilization, development and survival in pig embryos. Our study emphasizes the need for improved management practices and development of strategies to mitigate heat stress in boars during summer.

W43 - Seasonal effects on sperm quality of Holstein dairy bulls in Spain

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The epigenome could be an important link between the environment and gene expression. Parental stress produced by high temperatures during summer could potentially cause adverse epigenetic changes in male gametes. The aim of this study was to evaluate possible seasonal epigenetic effects on the sperm quality of Holstein bulls in Spain. Sperm samples from 11 Holstein bulls in northern Spain were collected in three seasons (winter, spring and summer). Analyses of sperm quality were performed. Sperm motility was assessed by computer-assisted semen analysis. Sperm morphology was evaluated using William's staining. Plasma membrane integrity, acrosome status and chromatin integrity were analysed by flow cytometry using SYBR14-PI vital staining, FITC-PNA combined with calcium ionophore and PI, and acridine orange respectively. Mean values were analysed by analysis of variance, using the SAS software. The statistical model (PROC MIXED) included the fixed effect of season, and the random effect of bull. Pairwise tests of significance were performed using t-test. $P<0.05$ were considered statistically significant. All results are expressed as mean±SD.