FACULTY OF VETERINARY MEDICINE
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THE EFFECT OF NATURAL HEAT STRESS ON BULL SEMEN QUALITY AND SUBSEQUENT EMBRYO DEVELOPMENT

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At present, breeding companies are having concerns about the possible impact of natural heat stress on animal fertility. The goal of our project is to address those concerns and to determine the effects of increased temperature on bull fertility.

Experimental design

Frozen bovine semen samples were obtained from 6 Holstein bulls exposed on 3 consecutive days to natural heat stress (HS) (August 2016, in a range of 13 to 32ºC), and to lower temperature (control) (March 2016, in a range of -4 to 11ºC).

AUGUST 2016 HS

MARCH 2016 Control

Methodology

After Percoll purification, the effect of heat stress on bull semen quality was assessed by:

- Motility: Computer Assisted Sperm Analysis (CASA)
- DNA breaks: TUNEL

*Fluorescence microscopy

- Membrane integrity: Propidium Iodide (PI)
- Reactive oxygen species (ROS): DCFH-DA + CellROX
- Lipid peroxidation: BODIPY 581/591 C11

*Flow cytometry analyzer

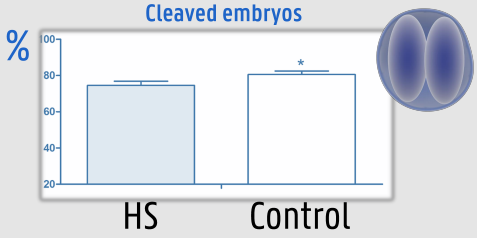
- Embryo development rates: *In Vitro* Fertilization (IVF)

Results

No significant differences between HS semen and the control group were found for:

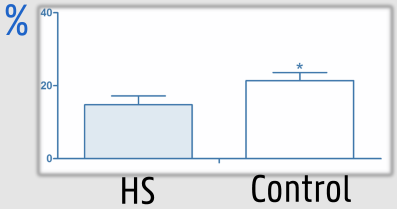
- Total and progressive sperm motility
- DNA breaks
- Membrane integrity
- Production of reactive oxygen species (ROS)
- Lipid peroxidation

Cleaved embryos

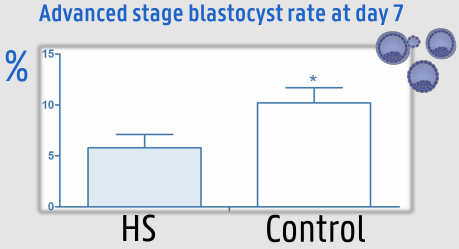


*Indicates $p<0.05$

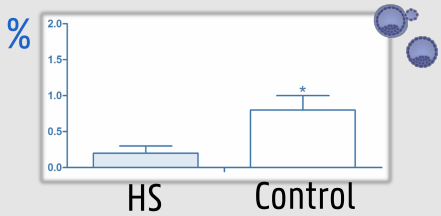
Total blastocyst rate at day 7



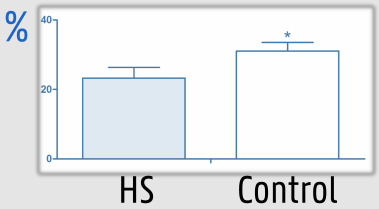
Advanced stage blastocyst rate at day 7



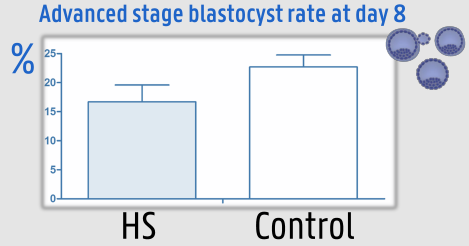
Hatching and hatched blastocyst rate at day 7



Total blastocyst rate at day 8

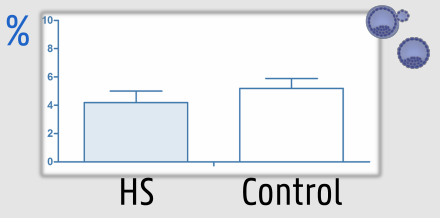


Advanced stage blastocyst rate at day 8



Advanced stage blastocysts: Expanded, Hatching and Hatched

Hatching and hatched blastocyst rate at day 8



Conclusions

- Quality parameters of Percoll-purified sperm did not differ significantly between heat-stressed semen and the control group.
- The decrease in blastocyst rates and the delayed hatching observed in embryos produced with heat-stressed semen indicates that molecular mechanisms for advanced blastocyst development were affected.

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