Journal of Andrology, Vol. 24, No. 4, July/August 2003

Reactive Oxygen Species and Cryopreservation Promote DNA Fragmentation in Equine Spermatozoa

JULIE BAUMBER*, BARRY A. BALL*, JENNIFER J. LINFOR† AND STUART A. MEYERS†

*From the Departments of * Population Health and Reproduction and † Anatomy, Physiology, and Cell Biology, University of California, Davis.*

Correspondence to: B. A. Ball, Department of Population Health and Reproduction, 1114 Tupper Hall, University of California, Davis, CA 95616 (e-mail: baball{at}ucdavis.edu).

The objective of this study was to examine the effect of reactive oxygen species (ROS) and cryopreservation on DNA fragmentation of equine spermatozoa. In experiment 1, equine spermatozoa were incubated (1 hour, 38°C) according to the following treatments: 1) sperm alone; 2) sperm + xanthine (X, 0.3 mM)-xanthine oxidase (XO, 0.025 U/mL); 3) sperm + X (0.6 mM)-XO (0.05 U/mL); and 4) sperm + X (1 mM)-XO (0.1 U/mL). In experiment 2, spermatozoa were incubated (1 hour, 38°C) with X (1 mM)-XO (0.1 U/mL) and either catalase (200 U/mL), superoxide dismutase (SOD, 200 U/mL), or reduced glutathione (GSH, 10 mM). Following incubation, DNA fragmentation was determined by the single cell gel electrophoresis (comet) assay. In experiment 3, equine spermatozoa were cryopreserved, and DNA fragmentation was determined in fresh, processed, and postthaw sperm samples. In experiment 1, incubation of equine spermatozoa in the presence of ROS, generated by the X-XO system, increased DNA fragmentation ($P < .005$). In Experiment 2, the increase in DNA fragmentation associated with X-XO treatment was counteracted by the addition of catalase and GSH but not by SOD, suggesting that hydrogen peroxide and not superoxide appears to be the ROS responsible for such damage. In experiment 3, cryopreservation of equine spermatozoa was associated with an increase ($P < .01$) in DNA fragmentation when compared with fresh or processed samples. This study indicates that ROS and cryopreservation promote DNA fragmentation in equine spermatozoa; the involvement of ROS in cryopreservation-induced DNA damage remains to be determined.

Key words: DNA damage, oxidative stress, antioxidants, horse, sperm

Journal of ANDROLOGY HOME

M.-W. Li, S. Meyers, T. L. Tollner, and J. W. Overstreet
Damage to Chromosomes and DNA of Rhesus Monkey Sperm Following Cryopreservation
J Androl, July 1, 2007; 28(4): 493 - 501.
[Abstract] [Full Text] [PDF]

Journal of ANDROLOGY HOME

E. Garcia-Rosello, C. Matas, S. Canovas, P. N. Moreira, J. Gadea, and P. Coy
Influence of Sperm Pretreatment on the Efficiency of Intracytoplasmic Sperm Injection in Pigs
J Androl, March 1, 2006; 27(2): 268 - 275.
[Abstract] [Full Text] [PDF]

Journal of ANDROLOGY HOME

J. Roca, M. J. Rodriguez, M. A. Gil, G. Carvajal, E. M. Garcia, C. Cuello, J. M. Vazquez, and E. A. Martinez
Survival and In Vitro Fertility of Boar Spermatozoa Frozen in the Presence of Superoxide Dismutase and/or Catalase
J Androl, January 1, 2005; 26(1): 15 - 24.
[Abstract] [Full Text] [PDF]

Mutagenesis HOME

M. M. Dobrzynska, A. Baumgartner, and D. Anderson
Antioxidants modulate thyroid hormone- and noradrenaline-induced DNA damage in human sperm
Mutagenesis, July 1, 2004; 19(4): 325 - 330.
[Abstract] [Full Text] [PDF]
