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Male Genital Tract Antioxidant Enzymes: Their Source, Function in the Female, and Ability to Preserve Sperm DNA Integrity in the Golden Hamster

HONG CHEN[*], PAK HAM CHOW[‡], SO KWAN CHENG[†], ANNIE L. M. CHEUNG[*], LYDIA Y. L. CHENG[†] AND WAI-SUM O[*]

From the Department of [*] Anatomy and [†] Biochemistry, Faculty of Medicine, The University of Hong Kong, and [‡] Department of Anatomy, Faculty of Medicine, The Chinese University of Hong Kong, Hong Kong SAR, P. R. China.

Correspondence to: Dr Wai-sum O, Department of Anatomy, Faculty of Medicine, The University of Hong Kong, 21 Sassoon Road, Hong Kong SAR, P. R. China (e-mail: owaisum{at}hkucc.hku.hk).

Recently, we reported that male accessory sex gland (ASG) secretions protect sperm genomic integrity by demonstrating that DNA damage was more extensive in sperm not exposed to the secretions. The present study was conducted to find out if ASGs secrete the main antioxidant enzymes superoxide dismutase (SOD), glutathione peroxidase (GPx or GSH-Px), and catalase (CAT) and if the most abundant one, SOD, can protect those sperm that were not exposed to ASG secretions against NADPH-induced oxidative stress. Four experimental groups of male golden hamsters were used: intact animals with proven fertility, animals with all major ASGs removed (TX), animals that were bilaterally vasectomized, and sham-operated controls. SOD, CAT, and GPx activities were measured in secretions from all 5 ASGs and sperm-free uterine flushing from virgin females and those mated with the experimental males. The alkaline comet assay was used to analyze DNA integrity of the TX group sperm after incubation in a medium containing 50 U/mL of SOD along with 0 to 20 mmol/L NADPH. The main antioxidant enzyme in ASGs was SOD from coagulating glands ($P < .05$) and GPx together with CAT from ampullary glands ($P < .05$). Uterine flushing of ejaculates that contained ASG secretions had more SOD and CAT activities than those with epididymal secretions alone ($P < .05$ and $P < .001$, respectively), whereas activity of GPx was the same ($P > .05$). Addition of SOD in vitro dose dependently decreased the incidence of single-strand DNA damage in sperm not exposed to ASG secretions incubated in the presence of 0 to 20 mmol/L NADPH ($P < .001$). These results indicated that, in terms of abundance, SOD was the main antioxidant enzyme secreted by male ASGs, whereas CAT was the second one. The GPx activity came from both epididymis and ASGs. We conclude that ASG secretions play a significant role in protecting sperm against oxidative stress.

Key words: Superoxide dismutase, glutathione peroxidase, catalase, sperm DNA damage, oxidative stress, Syrian hamster

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