

ABSTRACT

INVOLVEMENT OF MITOCHONDRIAL TRANSCRIPTION FACTOR (TFAM) IN PORCINE GAMETOGENESIS AND PREIMPLANTATION EMBRYO DEVELOPMENT

Mitochondrial Transcription Factor A (TFAM) is responsible for maintenance and transcriptional control of mitochondrial DNA (mtDNA). TFAM knockout is embryolethal. We have studied the expression and distribution of TFAM in the gametes and preimplantation embryos of a domestic pig (*Sus scrofa*), a livestock species of major economic significance. We hypothesized that TFAM will be expressed at high levels in oocytes and embryos and that sperm mitochondria should be devoid of TFAM since they are destined for degradation after fertilization. The content of TFAM mRNA increased considerably during porcine oocyte maturation and preimplantation development of porcine embryos. TFAM protein accumulated in the cytoplasm of porcine oocytes during *in vitro* maturation and was reduced by proteolysis after fertilization. Deviant processing of TFAM protein was observed in parthenogenetically activated oocytes and zygotes reconstructed by somatic cell nuclear transfer (SCNT). Boar sperm TFAM was found to be posttranslationally modified by ubiquitination and relegated to sperm tail principal piece in fully differentiated spermatozoa. These data suggest that mitochondrial transcription factor TFAM is developmentally regulated in porcine gametes and embryos, and may exert a critical role in gametogenesis and preimplantation embryo development. Sperm TFAM protein could be marked for proteolysis by the ubiquitin-proteasome pathway during spermatid elongation to facilitate the degradation of paternal mitochondria after fertilization.

Keywords: TFAM, mtDNA, sperm, mitochondria, preimplantation embryo, oocyte, ubiquitin