

Aquaporin 9 facilitated the movement of DMSO and acetamide through the plasma membrane in mouse morulae

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Abstract: The permeability to water and cryoprotectants of the plasma membrane affects suitable conditions for cryopreservation of the cell. Previously, we showed that water, glycerol, ethylene glycol, DMSO, and acetamide move through mouse oocytes predominantly by simple diffusion across the plasma membrane, whereas water and these cryoprotectants move through morulae predominantly by facilitated diffusion via channel processes. We also showed that aquaporin 3, an aquaglyceroporin, plays an important role in the facilitated diffusion of water, glycerol, and ethylene glycol, but that other channels are involved in the movement of DMSO and acetamide. In this study, we try to clarify the relevance of aquaporin 9, another aquaglyceroporin, in the movement of DMSO and acetamide in mouse morulae. In oocytes, the expression of mRNA of aquaporin 9 and that of aquaporin 9 protein were quite low. In morulae, those were higher than in oocytes. To suppress the expression of aquaporin 9 in morulae, double-stranded (ds) RNA of mouse aquaporin 9 was injected in 1-cell zygotes and the embryos were cultured to the morula stage. The expression of aquaporin 9 in morulae was markedly suppressed by injecting the ds-RNA. The permeability of ds-RNA-injected morulae to DMSO and acetamide was markedly lower than that of intact morulae, but the permeability to water, glycerol, and ethylene glycol was not significantly affected by the injection of ds-RNA. These results strongly suggest that aquaporin 9 plays an important role in the facilitated diffusion of DMSO and acetamide in mouse morulae. The results will provide valuable information for understanding the movement of water and cryoprotectants in mouse embryos.

Key words: water; cryoprotectant; permeability; cryopreservation; mouse; oocyte; embryo; aquaporin

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