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Effect of oxygen tension during first 2 days of in vitro culture on bovine embryo histone acetylation and developmental ability

H. Goto[1)], S. Takeo[2)], S. Hashimoto[1)], Y. Morimoto[1)], H. Iwata[2)], T. Kuwayama[2)]
1)IVF Namba Clinic,Osaka, Japan. 2) Tokyo University of Agriculture Atsugi, Japan.

Oxygen concentration in the atmospheric culture condition affects embryo quality and gene expression. The 8-cell stage of bovine embryo development is a critical time at which major zygotic genome activation occurs and the acetylation level of histone H4 is reported to be highest. Modification of the acetylation level of histone H4 by treatment with trichostatin A has been shown to affect gene expression of 8-cell stage embryos and the ratio of inner cell mass (ICM) to total cell number (TC) of the resultant blastocysts. In the present study, we collected bovine oocytes from slaughterhouse derived ovaries and produced in vitro fertilized embryos. After fertilization, putative zygotes were cultured under a high oxygen concentration (20%) or a low oxygen concentration (5%) for 2 days. The developed 8-cell stage embryos were then immunostained against histone H4K5, K8, K12, HDAC1, and GCN5 or were cultured for 5 days. At day 7 after insemination, the ratios of blastulation and blastocyst ICM/TC were examined. The acetylation level of histone H4K12 was similar between the 2 oxygen culture conditions. The acetylation level of histone H4K5 was lower but that of H4K8 was higher in embryos derived from culture with a high oxygen concentration than in those derived from culture with a low oxygen concentration. The expression levels of HDAC1 and GCN5 in the embryos was similar between oxygen conditions. When the 8-cell stage embryos derived from the two culture conditions were cultured for 5-day under low oxygen concentration (5%), developmental ratio to the blastocyst stage and ICM/TC ratio was similar between the two oxygen groups. In conclusion, oxygen culture conditions from fertilization to 8-cell stage affects the acetylation level of histone H4, but the difference may be ameliorated during in vitro development to the blastocyst stage.