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RESEARCH ARTICLE

EFFECTS OF DIMETHYL SULFOXIDE (DMSO) ON INNER EAR CELLS

[1]Lee Ji Hyun and *,[2]Moo Kyun Park

[1]Hankuk Academy of Foreign Studies
[2]Department of Otorhinolaryngology, Head and Neck Surgery, Seoul National University College of Medicine 101 Daehak-ro Jongno-gu, Seoul 110-744, Korea

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ABSTRACT

Dimethyl sulfoxide (DMSO) is often used as a solvent *in vitro* and is widely used in *in vitro* ear models. However, data on the cytotoxic effects of DMSO are scarce. We examined the cytotoxic effects of DMSO on rat inner hair cells (HEI-OC1 cells). Cell viability was assessed by MTT assay after exposure of HEI-OC1 cells to DMSO at different concentrations for various times. Exposure to >0.1% DMSO for 24 h decreased the viability of human middle ear epithelial cells. Exposure to >1% DMSO for 4 h decreased the viability of HEI-OC1 cells. We demonstrated the cytotoxic effects of DMSO in *In vitro* models of the ear.

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INTRODUCTION

Dimethyl sulfoxide (DMSO, $(CH_3)_2SO$) is often used in *in vitro* ear experiments, because it is an excellent solvent for a variety of polar and nonpolar organic compounds, and the amount used is easily controlled. It is hygroscopic, colorless, and odorless. It has been used for the cryopreservation of cultured cells. In addition, DMSO is used clinically to treat urinary, rheumatic, and gastrointestinal disorders. Its side effects include diarrhea and vomiting. House Ear Institute-Organ of Corti 1 (HEI-OC1) cells are often used for drug screening and various pathway experiments (Kalinec *et al*., 2003, 2016). They are uniquely derived from hair cells and show different responses to other cells. However, there are few reports on the effects of DMSO on HEI-OC1 cells. This study investigated whether DMSO affects the viability of HEI-OC1 rat inner hair cells.

MATERIALS AND METHODS

HEI-OC1 cells (kindly provided by Dr. Federico Kalinec) are immortalized mouse inner ear cells (Kalinec *et al*., 2003).

Corresponding author: Moo Kyun Park,
Department of Otorhinolaryngology, Head and Neck Surgery, Seoul National University College of Medicine 101 Daehak-ro Jongno-gu, Seoul 110-744, Korea.

HEI-OC1 cells were maintained in Dulbecco's modified Eagle's medium (DMEM; Gibco BRL, Grand Island, NY, USA) containing 10% fetal bovine serum (FBS; JRH Biosciences, Lenexa, KS, USA) and 50 U/mL interferon-γ without antibiotics. Then, the cells were maintained in DMEM supplemented with 10% FBS at 33°C under 10% CO_2. The growth medium was changed every third day. After 6 days, the cells were used for the subsequent studies. We used the MTT [3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium romide; Sigma-Aldrich, St. Louis, MO, USA] assay to measure cell viability. Cells were exposed to 0.1, 0.5, 1, 5, and 10% DMSO (Sigma-Aldrich) for 0, 0.5, 4, and 24 h. Then, fresh MTT (0.5 mg/mL) was added for 3.5–4 h. All data are expressed as means ± SD. One-way analysis of variance (ANOVA) was used to identify significant differences between groups. Scheffé's F-test was used to correct for multiple comparisons if statistical significance was identified by ANOVA. $P<0.05$ for the null hypothesis was considered to indicate statistical significance.

RESULTS

According to the MTT assays, there was no significant cytotoxicity at any dosage at the 30 min or 1 h exposures. When the cells were exposed for 4 h, cell viability decreased in a dose-dependent manner. After exposure for 24 h, cell viability decreased with all dosages (Figure 1).

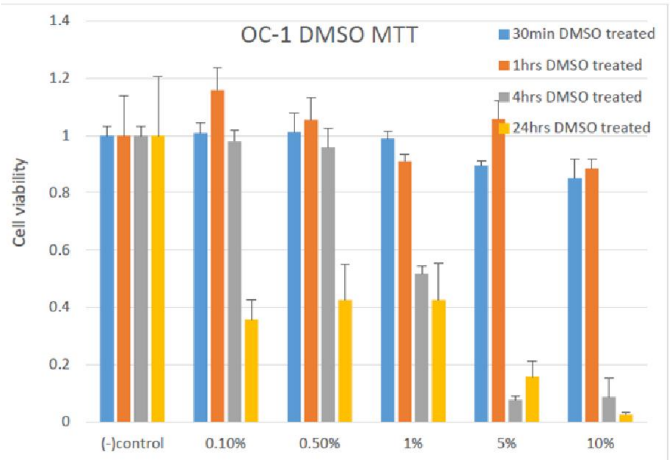

Fig. 1. Viability of rat inner hair cells (HEI-OC1) following exposure to DMSO

Cells were treated with DMSO (0.1, 0.5, 1, 5, and 10%) for the indicated times. Stimulation with DMSO, for longer than 24 h significantly decreased cell viability. Exposure for less than 1 h did not affect cell viability, even with 10% DMSO. The data are means ± S.D of three repeated experiments using triplicate samples.

DISCUSSION

In this study, we showed that DMSO is toxic to HEI-OC1 cells when applied for more than 24 h. Qi *et al*. (2008) observed damage to stereocilia after exposure to 0.5 and 6% DMSO for 24 h in cochlear organotypic cultures. They found that apoptosis was induced by intrinsic mitochondrial and extrinsic membrane cell death. Galvao *et al*. (2014) demonstrated that low-dose (1%) DMSO decreased cell viability using a retinal neuronal cell line. They suggested that the mechanism of cell toxicity by low-dose (2–4%) DMSO was related to caspase-3-independent neuronal death. Wang *et al*. (2012) showed that >5% DMSO decreased the viability of lung adenocarcinoma cells. They suggested that DMSO is an important stimulator of the tumor suppressor protein HLJ1 via AP-1 activation.

REFERENCES

Galvao, J., B. Davis, M. Tilley, E. Normando, M. R. Duchen, and M. F. Cordeiro 2014. "Unexpected low-dose toxicity of the universal solvent DMSO". *FASEB J*, 28(3): 1317–1330.

Kalinec, G., P. Thein, C. Park, and F. Kalinec 2016. "HEI-OC1 cells as a model for investigating drug cytotoxicity". *Hear Res.,* 335: 105–117.

Kalinec, G. M., P. Webster, D. J. Lim, and F. Kalinec 2003. "A cochlear cell line as an in vitro system for drug ototoxicity screening". *Audiol Neurootol*., 8(4): 177–189.

Qi, W., D. Ding and R. J. Salvi 2008. "Cytotoxic effects of dimethyl sulphoxide (DMSO) on cochlear organotypic cultures". *Hear Res*., 236(1–2): 52–60.

Wang, C. C., S. Y. Lin, Y. H. Lai, Y. J. Liu, Y. L. Hsu and J. J. Chen 2012. "Dimethyl sulfoxide promotes the multiple functions of the tumor suppressor HLJ1 through activator protein-1 activation in NSCLC cells". *PLoS One*, 7(4): e33772.

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