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Effects of vitamin C, vitamin E, and molecular hydrogen on the placental function in trophoblast cells

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Abstract

Aim: This study aimed to investigate the effects of three different antioxidants, namely vitamin C, vitamin E, and molecular hydrogen, on cytotrophoblasts in vitro.

Methods: Two trophoblast cell lines, JAR and JEG-3, were exposed to different concentrations of vitamin C (0, 25, 50, 100, 500, 1,000, 5,000 $\mu\text{mol/L}$), vitamin E (0, 25, 50, 100, 500, 1,000, 5,000 $\mu\text{mol/L}$), and molecular hydrogen (0, 25, 50, 100, 500 $\mu\text{mol/L}$) for 48 h. The cell viability was detected using the MTS assay. The secretion of human chorionic gonadotropin (hCG) and the tumor necrosis factor- α (TNF- α) were assessed and the expression of TNF- α mRNA was observed by real-time RT-PCR.

Results: Cell viability was significantly suppressed by 500 $\mu\text{mol/L}$ vitamins C and E ($P < 0.05$), but not by 500 $\mu\text{mol/L}$ molecular hydrogen ($P > 0.05$). The expression of TNF- α was increased by 100 $\mu\text{mol/L}$ vitamin C and 50 $\mu\text{mol/L}$ vitamins E, separately or combined ($P < 0.05$), but not by molecular hydrogen (0-500 $\mu\text{mol/L}$), as validated by real-time RT-PCR. But the secretion of hCG was both inhibited by 50-500 $\mu\text{mol/L}$ molecular hydrogen and high levels of vitamin C and E, separately or combined.

Conclusion: High levels of antioxidant vitamins C and E may have significant detrimental effects on placental function, as reflected by decreased cell viability and secretion of hCG; and placental immunity, as reflected by increased production of TNF- α . Meanwhile hydrogen showed no such effects on cell proliferation and TNF- α expression, but it could affect the level of hCG, indicating hydrogen as a potential candidate of antioxidant in the management of preeclampsia (PE) should be further studied.

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