類胡蘿蔔素對大白鼠初代肝細胞內抗氧化狀態及脂質過氧化的影響

The effects of carotenoids on the antioxidative status and lipid peroxidation in primary rats hepatocytes

中文摘要

許多研究顯示類胡蘿蔔素具有改善抗氧化及降低脂質過氧化的能力，故推測類胡蘿蔔素具有降低與自由基和活性氧有關的心血管疾病以及癌症，但也有體外實驗發現 beta-胡蘿蔔素不具有增加抗氧化與降低脂質過氧化的效果。目前研究中較少探討類胡蘿蔔素對大白鼠初代肝細胞中抗氧化狀態及脂質過氧化的影響。故本研究採用體外實驗方式，先以類胡蘿蔔素處理大白鼠初代肝細胞，期望類胡蘿蔔素能對肝細胞產生保護的作用，再加入過氧化氫(H2O2)作爲氧化誘導劑，以增加細胞內之氧化壓力，進而探討抗氧化酵素活性以及脂質過氧化的影響。

結果顯示：第一，肝細胞在正常的情況之下，細胞生存力隨著培養時間的增加而減弱，即 LDH leakage 隨著培養時間的增加而增加。由本實驗結果將後續實驗的觀察時間點定爲 24 小時；第二，加入 0~100 uM 過氧化氫，觀察細胞之脂質過氧化及抗氧化狀態的變化以決定後續實驗之氧化誘導劑的添加濃度及添加時間。由本實驗結果決定以 10 uM 過氧化氫處理 10 分鐘；第三，在大白鼠初代肝細胞中添加抗氧化劑（包括：beta-carotene、canthaxanthin、alpha-carotene、lutein、retinol 或 alpha-tocopherol）於培養液中培養 20 小時，再添加或不添加 10 uM 過氧化氫培養 10 分鐘，之後觀察細胞的脂質過氧化以及抗氧化狀態的改變；發現不同類胡蘿蔔素間抗氧化狀態有顯著性差異：canthaxanthin、lycopene 或 lutein 較 beta-胡蘿蔔素可增加抗氧化酵素活性（如：SOD、GRd 和 GST），亦發現類胡蘿蔔素有減少脂質過氧化的趨勢。同時乳化態的類胡蘿蔔素抗氧化效果較脂溶性的類胡蘿蔔素效果顯著。

英文摘要

The studies have shown the important roles of carotenoids in improving antioxidative capacity and decreasing lipid peroxidation, indicating carotenoids may decrease the incidence of cardiovascular disease and cancer related to free radicals and reactive oxygen species. However, it was reported that no effect of beta-carotene on enhancing antioxidative status and lowering lipid peroxidation in vitro was observed. The effects of carotenoids on antioxidative status and lipid peroxidation

in rat hepatic explants were less studied. Therefore, it was hypothesized that carotenoids could protect rat hepatic explants from peroxidation in vitro. Furthermore, this study investigated the effects of carotenoids on antioxidant enzyme activities and lipid peroxidation after the addition of hydrogen peroxide as an oxidative inducer to increase oxidative stress in the cells.

Firstly, the results showed that lactate dehydrogenase (LDH) leakage was increased with increased culture time, suggesting cell viability of the hepatocytes was decreased under the normal condition. The time course study found that LDH leakage was significantly increased after 24-h beta-carotene treatment. Secondly, the dose and timing were determined by the results of lipid peroxidation and antioxidative status after the addition of 0~100 uM hydrogen peroxide. The dose and time course studies indicated that the treatment of 10 uM hydrogen peroxide for 10 min could induce the antioxidative enzyme activities. Thirdly, the effects of beta-carotene, canthaxanthin, alpha-carotene, lutein, retinol or alpha-tocopherol on lipid peroxidation and antioxidative status after 20-h incubation with or without pretreatment of 10 uM hydrogen peroxide for 10 min were investigated. The data indicated that various antioxidative status was observed after the addition of different carotenoids. Canthaxathin, lycopene, or lutein increased the activities of superoxide dismutase, glutathione reductase, and glutathione S-transferase as compared to bata-carotene. In addition, carotenoids had a tendency to inhibit lipid peroxidation. It was also found that beadlet carotenoids, especially anthaxanthin and lutein, had better antioxidative effectiveness compared to oil-soluble carotenoids (crystalline form).