# 十字花科蔬菜衍生物對於血管內皮 **E.A. hy 926** 細胞株中一氧化氮合成酶與黏著分子表現之影響

# Effects of cruciferous vegetable derivatives on endothelial nitric oxide synthase and adhesion molecules expression in endothelial E.A. hy 926 cells


## 中文摘要

本研究主要以血管內皮 E.A. hy 926 細胞株為實驗模式，探討十字花科蔬菜衍生物 indole-3-carbinol (I3C)、indolo 3,2-b carbazole (ICZ)、$\beta$-phenylethyl isothiocyanate (PEITC)及 benzyl isothiocyanate (BITC)對於血管內皮細胞一氧化氮合成?(eNOS)以及 TNF-$\alpha$誘導之黏著分子表現的影響，並進一步瞭解其可能之機制。由 MTS 細胞毒性分析結果顯示，不論有無 TNF-$\alpha$(10 ng/ml)誘導下，除了 BITC 於 10 $\mu$M 會造成細胞毒性外，其餘衍生物(1 nM ~ 10 $\mu$M)皆不會對細胞造成毒性傷害。以 adhesion assay 分析單核球 U937 細胞株黏著於血管內皮 E.A. hy 926 細胞株之結果指出，除 I3C 外，10 $\mu$M 之 ICZ、PEITC 及 BITC 皆可抑制由 TNF-$\alpha$誘導之 U937 黏著於 E.A. hy 926 細胞。Western blot 分析結果顯示，唯有 10 $\mu$M 之 PEITC 與 BITC 可增加 eNOS 蛋白質之表現。RT-PCR 與 ELISA 結果指出，1nM ~ 10 $\mu$M 之 ICZ、PEITC 及 BITC 可分別抑制由 TNF-$\alpha$誘導之 ICAM-1 mRNA 表現，然而這些衍生物並不影響細胞膜表面 ICAM-1 蛋白質之表現。此外，1nM ~ 10 $\mu$M 之 PEITC、10 $\mu$M 之 ICZ 及 BITC 亦可分別抑制由 TNF-$\alpha$誘導之 VCAM-1 mRNA，而 10 $\mu$M 之 ICZ、PEITC 與 BITC 皆可分別抑制細胞膜表面 VCAM-1 之蛋白質表現。而 I3C 對 ICAM-1 與 VCAM-1 mRNA 與蛋白質之表現皆無顯著影響。總而言之，10 $\mu$M 之十字花科蔬菜衍生物 PEITC 與 BITC 可增加 eNOS 蛋白質表現，且 10 $\mu$M 之 ICZ、PEITC 與 BITC 也可藉由抑制 VCAM-1 mRNA 表現而減少細胞膜表面 VCAM-1 蛋白質表現，進而減少單核球細胞黏著於內皮細胞；然而，ICZ、PEITC 及 BITC 雖可抑制 ICAM-1 mRNA 之表現，但不影響細胞膜表面 ICAM-1 蛋白質之含量，而 I3C 對這些分子皆無顯著影響。

## 英文摘要

The purpose of this study was to investigate the effects of cruciferous vegetable derivatives, indole-3-carbinol (I3C), indolo 3,2-b carbazole (ICZ), $\beta$-phenylethyl isothiocyanate (PEITC) and benzyl isothiocyanate (BITC) on the expression of endothelial nitric oxide synthase (eNOS) and adhesion molecules in TNF-α stimulated endothelial E.A. hy 926 cells. The results obtained from MTS assay showed that all derivatives (1nM ~ 10μM), except 10μM BITC, did not affect cells viability regardless of the presence of TNF-α. Adhesion analyses showed that 10μM ICZ, PEITC and BITC, but not I3C, inhibited the adhesion of TNF-α-induced monocytic U937 cells to E.A. hy926 cells. Western blot analyses indicated that 10μM PEITC and BITC, except I3C and ICZ, enhanced the expression of eNOS protein. RT-PCR and Cell-ELISA analyses showed that 1nM ~ 10μM ICZ, PEITC and BITC inhibited the expression of TNF-α-induced ICAM-1 mRNA, but all derivatives had no effect on the expression of cell-surface ICAM-1 protein. On the other hand, 1nM ~ 10μM PEITC, 10μM ICZ and BITC inhibited the expression of TNF-α-induced VCAM-1 mRNA and 10μM ICZ, PEITC and BITC inhibited the expression of cell-surface VCAM-1 protein. However, I3C did not show any suppressive effects on these factors. In conclusion, cruciferous vegetable derivatives, PEITC and BITC increased eNOS protein and ICZ, PEITC and BITC inhibited cell-surface VCAM-1 protein through decreased the expression of VCAM-1 mRNA, and thus reduced monocytes adhesion to endothelial cells. However, all derivatives, except I3C, inhibited the expression of ICAM-1 mRNA, although they did no affect the expression of cell-surface ICAM-1 protein.