



## A Specific Combination of Ascorbic Acid, Lysine, Proline and Epigallocatechin Gallate Inhibits Proliferation and Extracellular Matrix Invasion of Various Human Cancer Cell Lines (2003)

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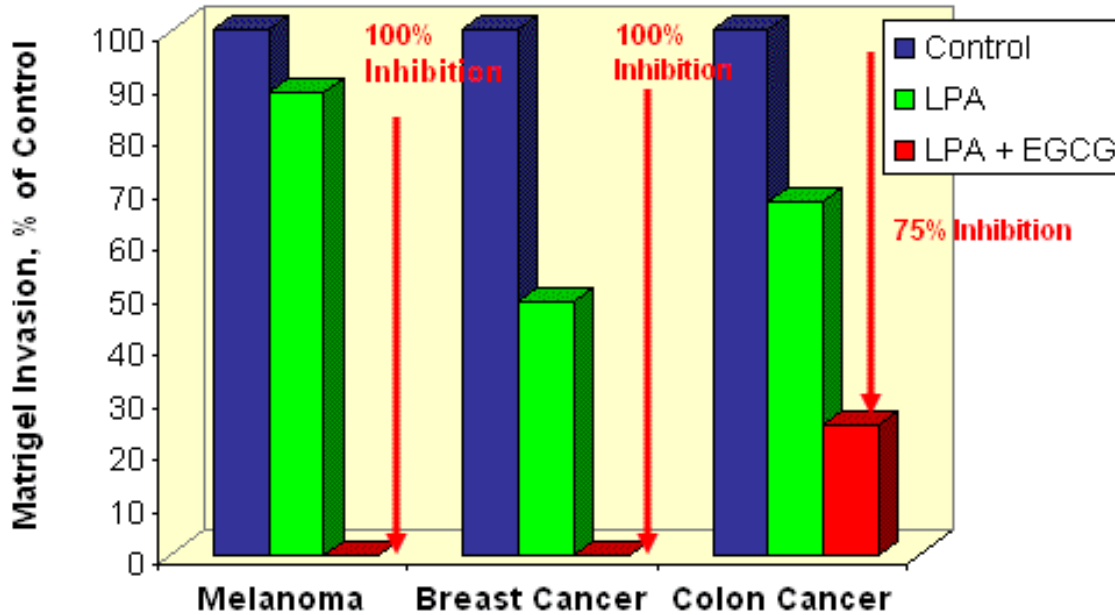
### Abstract

We found that a specific combination of ascorbic acid (AA, 100  $\mu$ M), proline (P, 140  $\mu$ M), and lysine (L, 400  $\mu$ M) had a significant anti-proliferative and anti-metastatic effect against some human cancer cell lines in the breast (MDA-MB-231), colon (HCT 116), and skin (melanoma, A2058). In the presence of this nutrient combination, the invasion of extracellular matrix by human breast cancer cells, melanoma cells, and colon cancer cells was inhibited by 50%, 10%, and 30%, respectively. The addition of Epigallocatechin Gallate (EGCG) further enhanced this nutritional synergy and produced a more pronounced inhibitory effect on both cellular proliferation and matrix invasion. The proliferation of breast cancer cells (MDA-MB-231) in the presence of AA, P, L and 20  $\mu$ g/ml of EGCG was reduced to 74%. The proliferation of colon cancer cells (HCT 116) was reduced to 69%, compared to the non-supplemented medium. The increase in concentration of EGCG to 50  $\mu$ g/ml did not cause much further reduction in the cell number of breast cancer cells, but it did reduce the proliferation of colon cancer cells to 4.6% and melanoma cells to 30% of the control. Matrigel invasion by breast cancer cells (MDA-MB-231) and human melanoma cells (A2058) in the presence of AA, P, L and 20  $\mu$ g/ml of EGCG was stopped completely. At a similar concentration, the invasion of colon cancer cells was reduced to 24.9%. However, the expression of matrix metalloproteinases (MMPs) -2 and -9 was not altered by this nutrient combination in melanoma cells as visualized by gelatinase zymography. MMP-2 and MMP-9 were significantly inhibited by EGCG in a dose-dependent fashion; L, P, and AA had no additional effect. Thus, the combination of AA, P, L and EGCG shows great potential for the control of cancer using a safe and multi-targeted approach.

**Comment:**

This study demonstrated significant anti-proliferative and anti-metastatic effects in vitro against some human cancer cell lines (breast, colon, and melanoma) using a specific combination of ascorbic acid, proline, and lysine. The addition of epigallocatechin gallate (EGCG) to the nutrient mixture enhanced the inhibitory effect on both cellular proliferation and invasion. These results are significant in showing the great potential of the control of cancer growth and metastasis using a safe nutrient approach.

**Nutrient Synergy Inhibits Cancer Cell Matrigel Invasion**



**Legend:**

LPA = Lysine (L, 400  $\mu$ M) + Proline (P, 140  $\mu$ M) + Ascorbic Acid (A, 100  $\mu$ M)

EGCG = Epigallocatechin Gallate 20  $\mu$ g/ml