臺北醫學大學保健營養學系

第二十二次營養師在職教育課程

彩虹蔬果
– 癌症遠離

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2008/8/23

95年國人十大死因

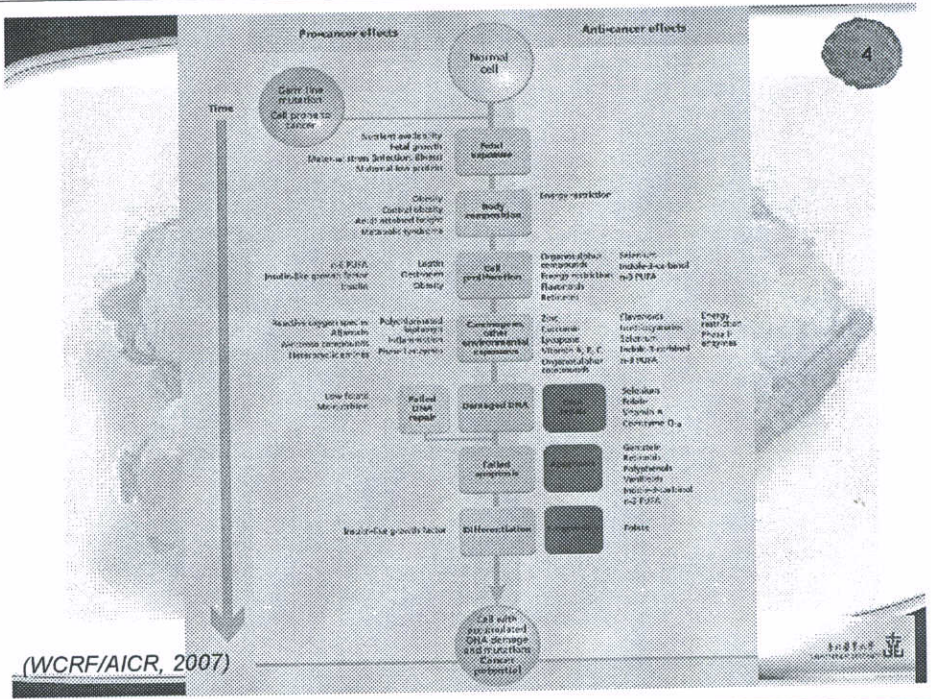
順位	死因	死亡人數	死亡百分比%	平均每生肖數	時間
1	惡性腫瘤	37,998	28.1 (+1.3)	104人/日	13分50秒
2	腦血管疾病	12,596	9.3 (-0.1)	35人/日	41分44秒
3	心臟疾病	12,283	9.1 (-0.2)	34人/日	42分47秒
4	糖尿病	9,690	7.2 (-0.4)	27人/日	54分14秒
5	事故傷害	8,011	5.9 (-0.1)	22人/日	1小時6分
6	肺炎	5,396	4.0 (-0.1)	15人/日	1小時37分
7	慢性肝病及肝硬化	5,049	3.7 (-0.3)	14人/日	1小時44分
8	腎炎、腎徵候群及腎性病變	4,712	3.5 (-0.0)	13人/日	1小時52分
9	自殺	4,406	3.3 (+0.2)	12人/日	1小時59分
10	高血壓性疾病	1,816	1.3 (-0.0)	5人/日	4小時49分

(行政院衛生署)

95年國人十大癌症死因

順位	合計	男性	女性
1	肺癌	肝癌	肺癌
2	肝癌	肺癌	肝癌
3	結腸直腸癌	結腸直腸癌	結腸直腸癌
4	女性乳癌	口腔癌	女性乳癌
5	胃癌	胃癌	胃癌
6	口腔癌	食道癌	子宮頸癌
7	攝護腺癌	攝護腺癌	胰臟癌
8	子宮頸癌	胰臟癌	非何杰金淋巴癌
9	食道癌	非何杰金淋巴癌	膽囊癌
10	胰臟癌	鼻咽癌	卵巢癌

(行政院衛生署)



(WCRF/AICR, 2007)

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Anti-cancer dietary components

- Fruit and vegetable
  - Dietary fiber
  - Vitamins
  - Minerals
  - Phytochemicals
    - Non-nutritive substances
    - Health promotion effects

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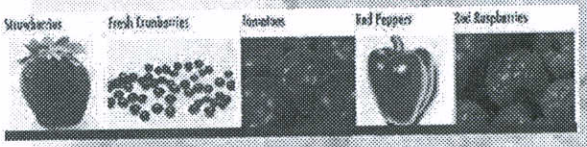
5 A Day - The Color Way



- Lycopene, Anthocyanins, Quercetin

RED

It's important to eat all your colors every day to get the variety of vitamins, minerals, and phytochemicals you need to stay healthy and fit. Including **RED** in your low-fat diet helps maintain:

- Heart health*
- Memory function
- A lower risk of some cancers*
- Urinary tract health

*Diets rich in fruits and vegetables may reduce the risk of some types of cancer and other chronic diseases.

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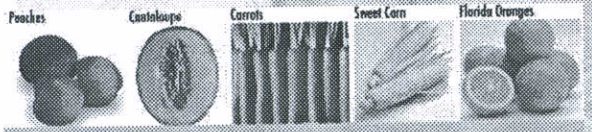
5 A Day - The Color Way



YELLOW/ORANGE

- Carotenes, Zeaxanthine, Bioflavonoids
- Vitamin C

To stay healthy and fit, think color and variety when you make your fruit and vegetable choices. Including YELLOW/ORANGE in your low-fat diet helps maintain:

- A lower risk of some cancers*
- Heart health*
- Vision health
- A healthy immune system

*Diets rich in fruits and vegetables may reduce the risk of some types of cancer and other chronic diseases.

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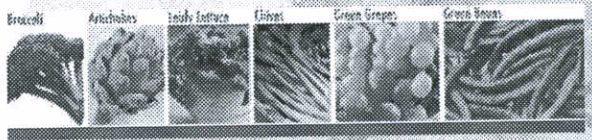
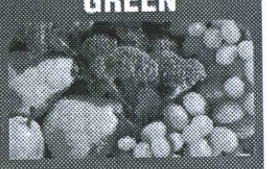
5 A Day - The Color Way



GREEN



- Carotenoids, Indoles

To get the range of vitamins, minerals, and phytochemicals you need to stay healthy and fit, eat a colorful variety of fruits and vegetables. Including **GREEN** in your low-fat diet helps maintain:

- Vision health
- A lower risk of some cancers*
- Strong bones and teeth

*Diets rich in fruits and vegetables may reduce the risk of some types of cancer and other chronic diseases.

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5 A Day - The Color Way

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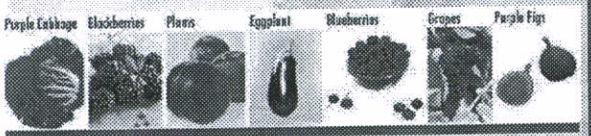

- Flavonoids, Anthocyanins

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BLUE/PURPLE

Eat all your colors every day to get the variety of vitamins, minerals, and phytochemicals you need to stay healthy and fit. Including **BLUE/PURPLE** in your low-fat diet helps maintain:

- A lower risk of some cancers*
- Urinary tract health
- Memory function
- Healthy aging

*Diets rich in fruits and vegetables may reduce the risk of some types of cancer and other chronic diseases.

5 A Day - The Color Way

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- Allicin, Polyphenols, Anthocyanins
- Selenium

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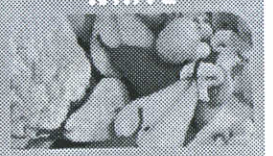
WHITE



Eating a colorful mix of fruits and vegetables daily provides the variety of vitamins, minerals, and phytochemicals you need to stay healthy and fit. Including WHITE in your low-fat diet helps maintain:

- Heart health*
- Cholesterol levels that are already healthy
- A lower risk of some cancers*

*Diets rich in fruits and vegetables may reduce the risk of some types of cancer and other chronic diseases.

Selected phytochemicals in foods

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TABLE 2 Selected Examples of Bioactive Food Components That May Modify Cancer Risk

Food source	Class of compound	Bioactive food component (s)
Cruciferous vegetables (arugula, bok choy, broccoli, Brussels sprouts, cauliflower, collard greens, kale, mustard greens, radishes, rutabaga, turnips)	Isothiocyanate	Benzyl isothiocyanate, 2-phenethyl isothiocyanate, sulforaphane, allyl isothiocyanate, 3-methylsulfinylpropyl isothiocyanate
	Glycosinolate	Indole-3-carbinol, 3,3'-diindolylmethane, indole-3-acetonitrile
Vegetables	Minerals	Calcium, zinc, selenium
	Flavonoids	Quercetin, rutin
	Vitamins	Folic acid, vitamin A, vitamin E, vitamin C
Dark green vegetables (spinach, kale)	Carotenoids	Lutein
	Vitamins	Vitamin A, vitamin C
Vegetables, fruits, black tea	Flavonoid	Anthocyanins
Onions, garlic, scallions, chives	Allium compounds (Organosulfur compounds)	Diallyl sulfide, allylmethyl trisulfide, allyl mercaptan, S-allylcysteine
	Flavonoid	Tangeritin, nobiletin, rutin
Citrus fruit	Terpenoid	p-Limonene, perillyl alcohol, geraniol, menthol, carvone
Citrus fruit (peel), caraway seed oil	Monoterpenes	
Berries, tomatoes, potatoes, broad beans, broccoli, squash, onions	Flavonoid	Quercetin
Radish, horse radish, kale, endive	Flavonoid	Kaempferol
Tea, chocolate	Polyphenol	Epigallocatechin gallate, epigallocatechin, epicatechin, catechin
Grapes, red wine	Polyphenol	Resveratrol, catechin
Tumeric, curry, mustard fruits, coffee beans, soybeans	Polyphenol	Curcumin, caffeic acid
Strawberries, raspberries, blackberries, walnuts, pecans	Polyphenol	Caffeic acid, ferulic acid, ellagic acid
Cereals, pulses (millet, sorghum, soya beans)	Isoflavone	Genistein
Orange vegetables and fruit	Carotenoid	α- and β-carotene
Tomatoes	Carotenoid	Lycopene
Tea, coffee, cola, cacao (cocoa and chocolate)	Methylxanthines	Caffeine, theophylline, theobromine
Dairy products (milk, cheese, yogurt)	Vitamins	Vitamin D, calcium
Red meat	Vitamins	Iron

Source: Adapted from Manson (2003).

Mechanisms associated with carcinogenesis

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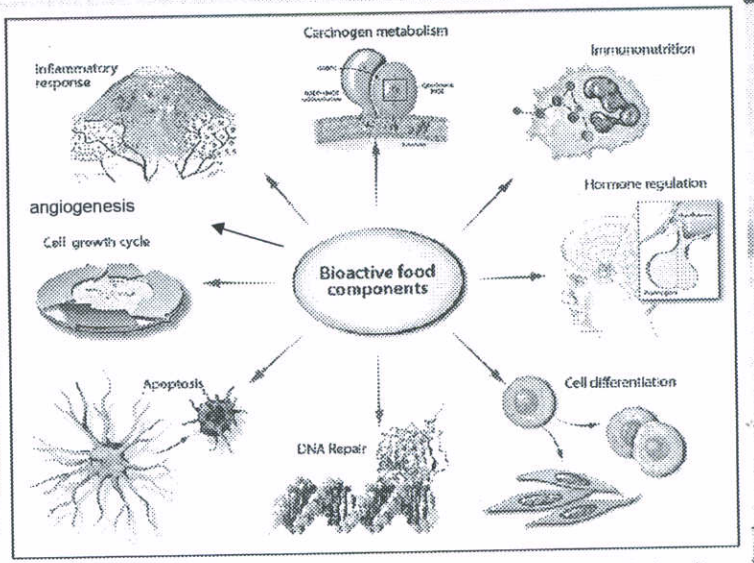
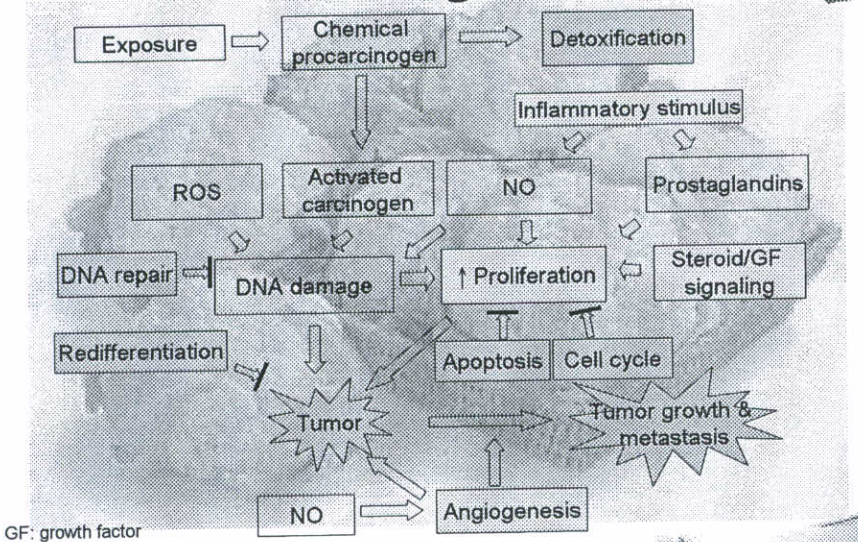


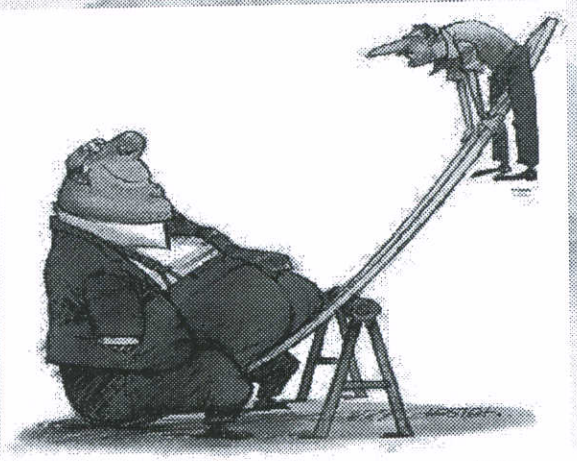
FIGURE 1 Bioactive food components can influence genetic and epigenetic events associated with a host of disease processes. (Modified from Trujillo et al., 2005.)

Carcinogenesis

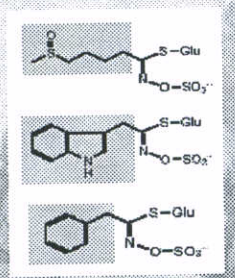


GF: growth factor
NO: nitric oxide
ROS: reactive oxygen species

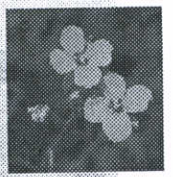
Imbalance of metabolism



Phytochemicals in cruciferous vegetable



Glucosinolates

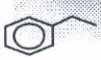


myrosinase

Isothiocyanates

Phenylethyl isothiocyanate (PEITC)

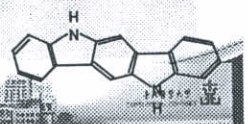
Benzyl isothiocyanate (BITC)



Indoles

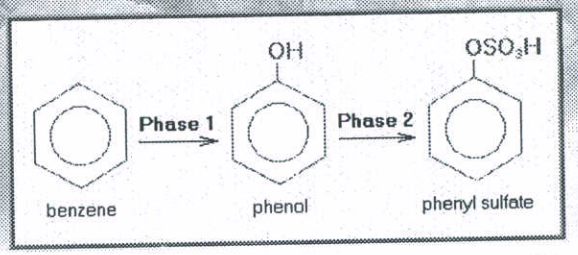
Indole-3-carbinol (I3C)

Indolo[3,2-b]carbazole (ICZ)



Carcinogen metabolism

- **Xenobiotic metabolizing enzymes**
  - **Phase I enzymes**
    - Cytochrome P450s (CYPs)
  - **Phase II enzymes**
    - Glutathione S-transferase (GST)
    - Quinone reductase (QR)



Carcinogen metabolism

Phase I: CYP1A1 activity

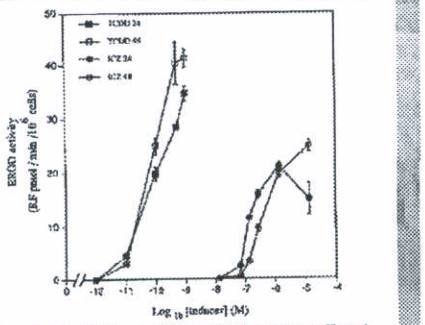
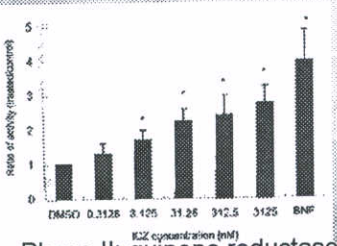
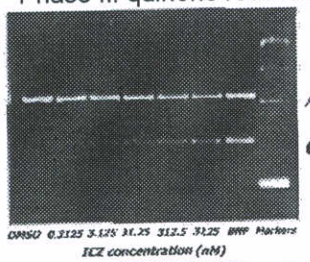


Fig. 1. Effect of ICZ and TCDD on EROD activity in Hepa-1 cells. Cells were treated with different concentrations of inducer for 24 or 48 h. The cells were then harvested for analysis of enzyme activity. Symbols and bars represent mean values and the ranges of two individual determinations



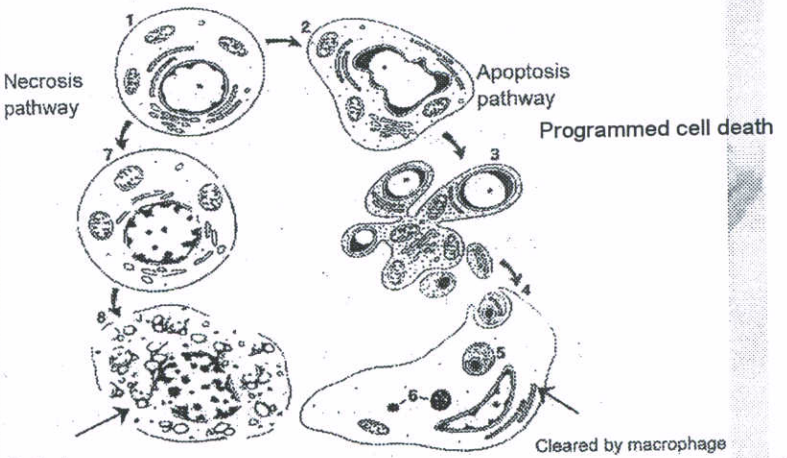
Phase II: quinone reductase



Chen et al., 1995; Chen & Yang, 2002

Chen

Cell death -- apoptosis



Kerr et al., 1994

Apoptosis

Annexin V staining

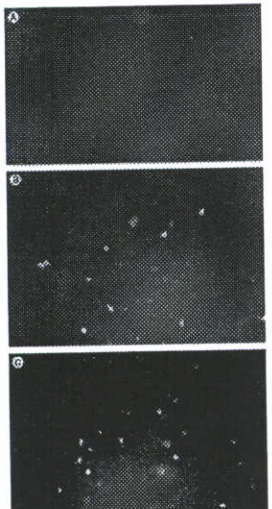


Fig. 4. Fluorescent microscopy of PEITC-induced morphological changes in A549 cells. Cells were treated with ethanol (A), 10 μM PEITC (B), or 25 μM PEITC (C) for 24 h. Cells were then stained with annexin V-FITC and PI and photographed under a fluorescence microscope. Green color indicates apoptotic cells at an early stage, green and red (orange) indicate cells at the middle or late stage of apoptosis, and red indicates necrotic cells. (For interpretation of the references in color in this figure legend, the reader is referred to the web version of this article.)

Flow cytometric analysis

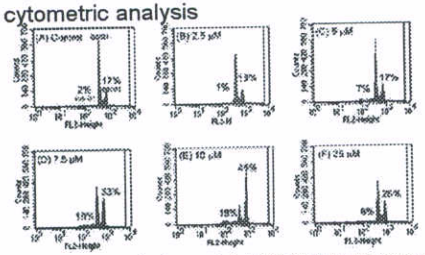


Fig. 3. Representative histograms of cytometric analysis after treatment of cells with PEITC. A549 cells were treated with various concentrations of PEITC for 24 h. Cells were then collected, fixed in 70% ethanol and stained with PI for flow cytometric analysis for DNA content. Values represent the mean from four measurements.

Protein expression

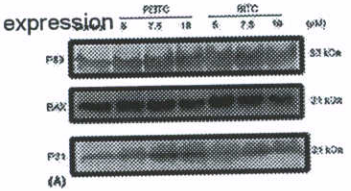
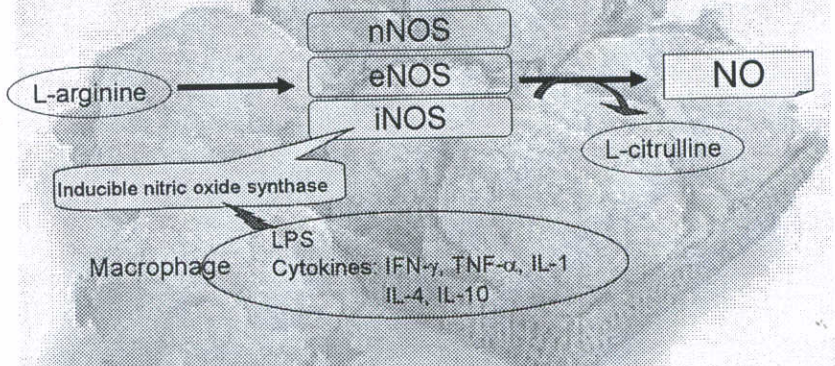


Fig. 5. Effects of various concentrations of PEITC or BITC on the expressions of P53, P21, and Bax proteins in A549 cells. (A) Cells were treated with various concentrations of PEITC or BITC, and the cytosolic protein was extracted after 24 h. 30 μg of cytosolic protein was separated by SDS-PAGE, and P53, P21, and Bax proteins were respectively detected. This experiment was repeated three times, and similar results were obtained. (B) Densitometric quantification of the proteins.

Kuang & Chen, 2004

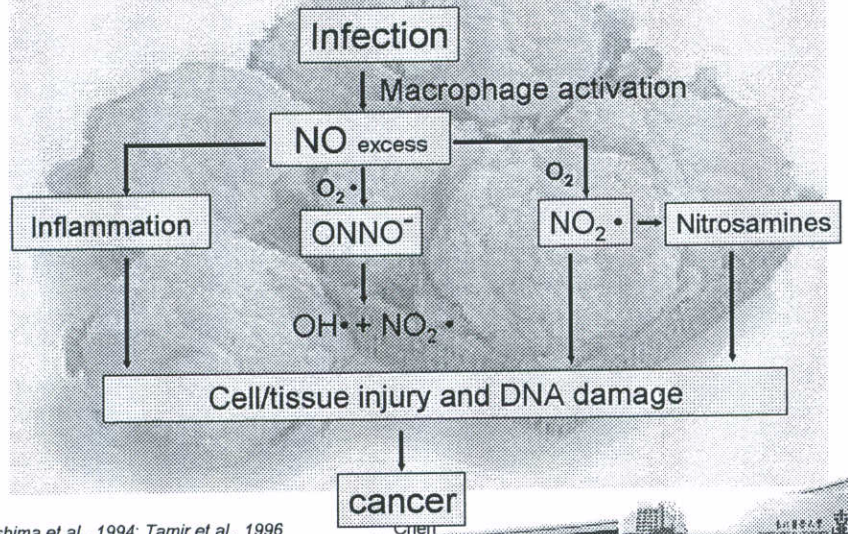
Inflammation -- NO



LPS (lipopolysaccharide)
TNF -α (tumor necrosis factor -α)
IFN -γ (Interferon-γ)
IL (Interleukin)

Chen

Inflammation -- NO and cancer



Ohishima et al., 1994; Tamir et al., 1996

Inflammation -- NO production

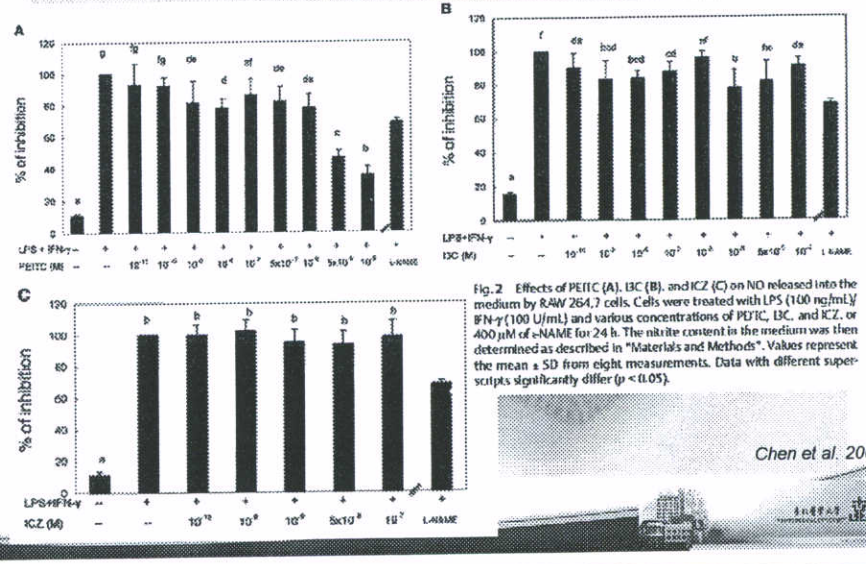
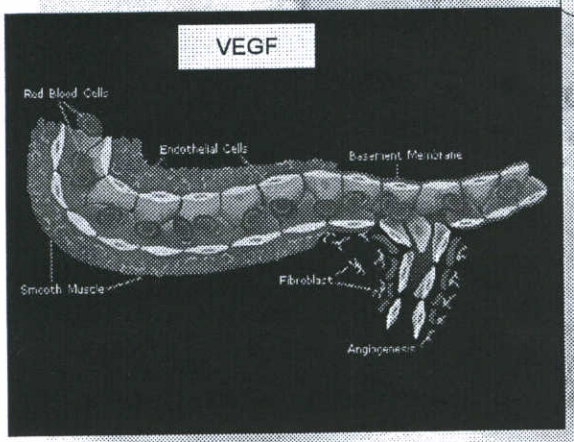


Fig. 2 Effects of PEITC (A), I3C (B), and ICZ (C) on NO released into the medium by RAW 264.7 cells. Cells were treated with LPS (100 ng/mL)/IFN-γ (100 U/mL) and various concentrations of PEITC, I3C, and ICZ, or 400 μM of L-NAME for 24 h. The nitrite content in the medium was then determined as described in "Materials and Methods". Values represent the mean ± SD from eight measurements. Data with different superscripts significantly differ ($p < 0.05$).

Chen et al. 2003

Angiogenesis



MMP-2
MMP-9

Proliferation

Basal lamina breakdown

Migration

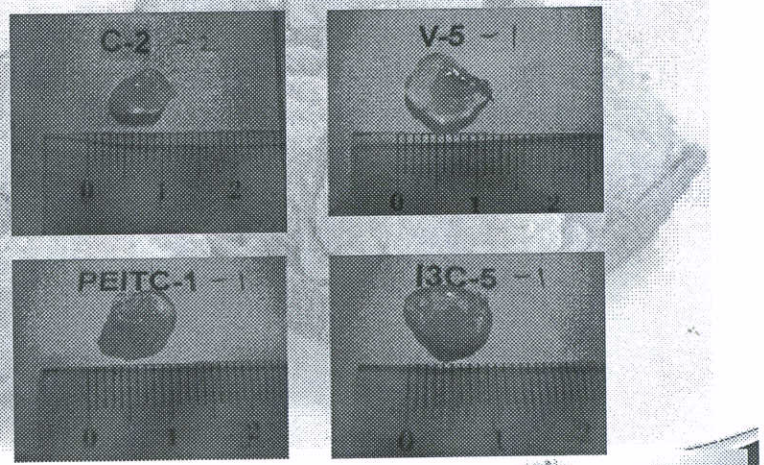
Tube formation

Vessel maturation

VEGF: vascular endothelial growth factor
MMP: matrix metalloproteinase

Angiogenesis

In vivo



Angiogenesis

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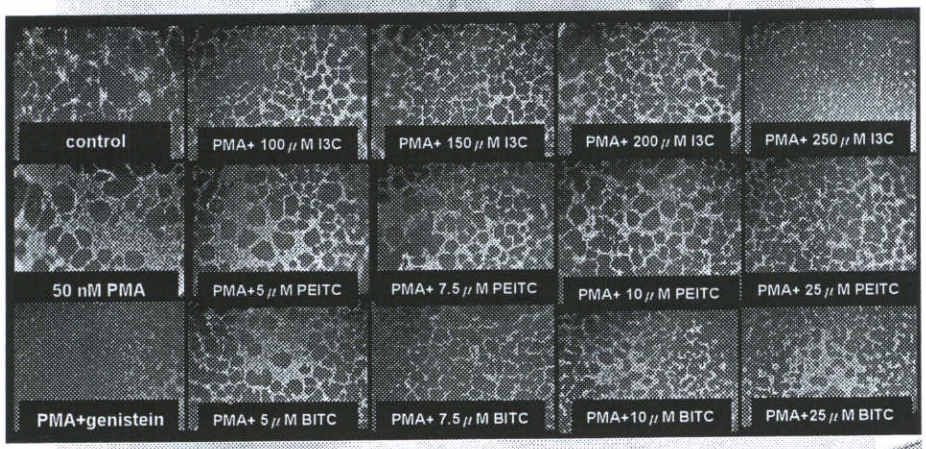
---- Tube formation



Wu et al., 2005; 吴, 2004

Chen

Angiogenesis

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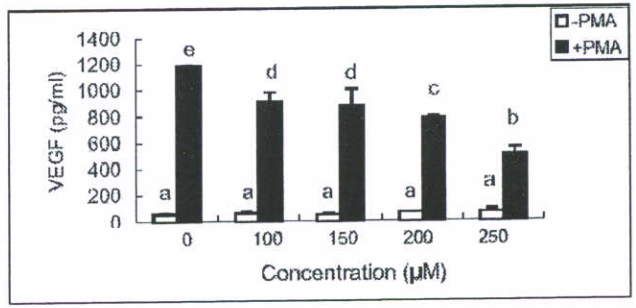
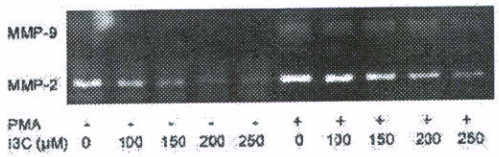
-- VEGF, MMPs

I3C





Wu et al., 2005

Carcinogenesis

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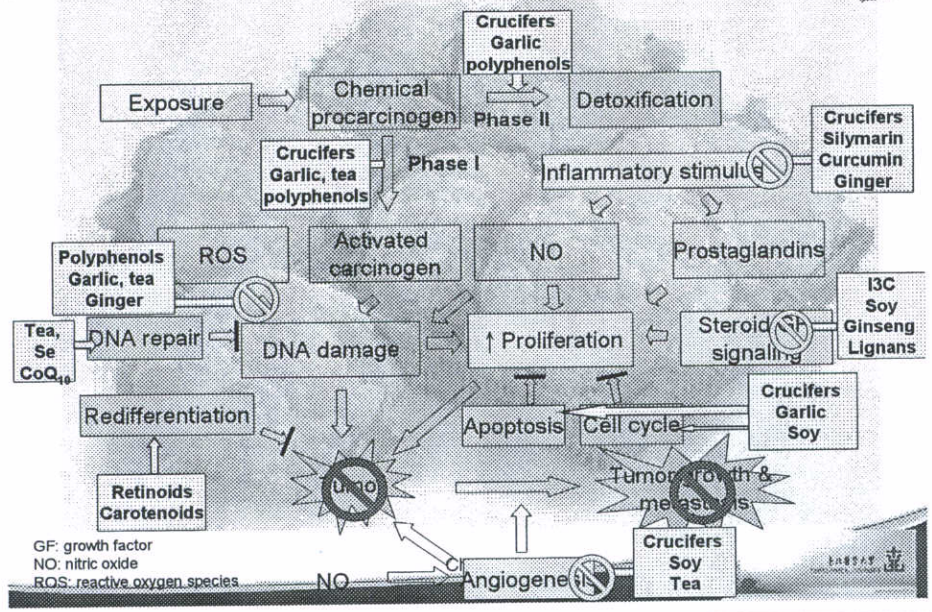

Goals and recommendations for cancer prevention

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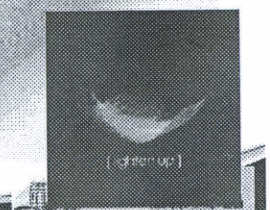
- **Body fatness**
  - Be as lean as possible within the normal range of body weight
- **Physical activity**
  - Be physically active as part of everyday life
- **Foods and drinks that promote weight gain**
  - Limit consumption of energy-dense foods; avoid sugary drinks



(WCRF/AICR, 2007)

Goals and recommendations for cancer prevention

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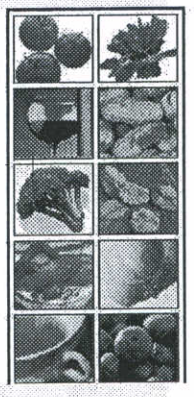
- Plant foods
  - Eat mostly foods of plant origin
- Animal foods
  - Limit intake of red meats and avoid processed meat
- Preservation, processing, preparation
  - Limit consumption of salt; avoid moldy cereals (grains) or pulses (legumes)



(WCRF/AICR, 2007)

Goals and recommendations for cancer prevention

30

- Alcoholic drinks
  - Limit alcoholic drinks
- Dietary supplements
  - Aim to meet nutritional needs through diet alone
- Breastfeeding
  - Mothers to breastfeed; children to be breastfed
- Cancer survivors
  - Follow the recommendations for cancer prevention

(WCRF/AICR, 2007)

Prevention is better than cure!

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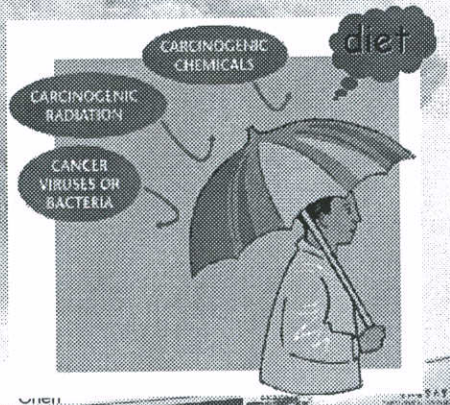

Thank you for your attention!

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