4% of RA females. Concurrence of both habits was found in: 75%; 45%; 44%; 36%; 32%; and 2% of the respective. We conclude that tobacco use is still highly prevalent in this population, and generally associated with alcohol consumption, particularly in the upper social class males. This study was financed by the World Cancer Research Fund, London, UK.

CAROTENOIDS II (341.1-341.8)

341.1

Inhibition of Phytoene Desaturase for the Isolation of Phytoene from Cell Suspension Cultures of Tomato (Lycopersicon esculentum cv. VFNT Cherry)

Jessica K. Campbell[1], Randy B. Rogers[2], Mary Ann Lila[2], John W. Erdman, Jr. [1]. 1Food Science and Human Nutrition, University of Illinois, 905 S. Goodwin Ave., Urbana, IL 61801, 2Natural Resources and Environmental Sciences, University of Illinois, Urbana, IL

Epidemiological evidence suggests a reduced risk of prostate cancer with increased tomato consumption. Few studies have been conducted with the tomato carotenoids phytoene and phytofluene, in part due to their lack of commercial availability. Our laboratory has developed a novel approach to produce phytoene and phytofluene in a tomato cell suspension culture system through the incorporation of a phytoene desaturase inhibitor, norflurazon, to cell culture medium. The quantities of these carotenoids were optimized by varying the concentration of norflurazon, type of solvent carrier, and duration of culture exposure to the herbicide. HPLC-PDA analysis revealed that the carotenoid produced through addition of norflurazon was primarily phytoene, with smaller amounts of phytofluene, and negligible amounts of lycopene and β-carotene, whereas lycopene and β-carotene accumulated in the cells in absence of norflurazon. Seven days of treatment with 0.075 mg norflurazon/100 ml culture media was an optimal treatment that gave both excellent cell growth and phytoene and phytofluene production (~6.0 and 1.0 μg/g fresh weight, respectively). Through this culture system and addition of ^{14}C-sucrose in the liquid media, we have produced ^{14}C-radiolabeled phytoene and phytofluene, which will be used to examine the absorption and biodistribution of phytoene and phytofluene in animal trials. (USDA/IFAFS #00-52101-9695)

341.2

The flux of β-carotene (b-C) through Caco-2 cell monolayers is enhanced by retinol (ROL)

Alexandrine During, Earl Harrison. BHNRC, ARS-USDA, Phytonutrients Lab., Beltsville, MD 20705

The purpose of this study was to investigate if b-C and ROL interact during their intestinal absorption. The in vitro model used here consisted of highly differentiated Caco-2 cell monolayers that were cultured on transwells and produced chylomicrons (CM). b-C and ROL were delivered to cells in Tween 40; a fixed b-C level (1uM) and increasing ROL levels (0-10uM) were used to study ROL effects on b-C transport and a fixed ROL level (1uM) and increasing b-C levels (0-10uM) to study b-C effects on ROL transport. ROL at ≥ 2uM resulted in a significant increase of b-C transport; e.g. the extent of b-C absorption increased from 11% without ROL to 19% with 5uM ROL ($P<0.0005$). In contrast, b-C did not have any effect on ROL transport. We hypothesized that ROL facilitated b-C incorporation into CM. This idea is supported by the observation that larger CM were formed in spite of the inverse linear relationship observed between ROL concentration applied to cells and the amount of newly synthetized TG secreted by those cells ($R^2 = 0.93$). By laser light scattering, the average size distribution of CM was: 60nm (1 peak), 90nm (1 peak with shoulder) and 63nm + 300nm (2 distinct peaks) in presence of 0, 2 and 20 uM ROL, respectively. The data indicate clearly that ROL can modify the size of CM, probably via its ester products (RE) formed in intestinal cells which could replace some TG in CM, and thus in turn facilitate b-C incorporation into larger, RE-enriched CM.

341.3

Absorption and lipoprotein kinetics of ^{14}C-β-carotene when consumed in the absence of dietary fat using Accelerator Mass Spectrometry

charlene c ho1, stephen r dueker[1], yumei lin[1], jennifer r follett[1], colleen carkeet[1], bruce b buchholz[2], john s vogel[2], andrew j clifford[1]. [1]nutrition, university of california, 1 shields avenue, davis, ca 95616, [2]center for accelerator mass spectrometry, lawrence livermore national laboratory, livermore, ca

Absorption of lipophilic β-carotene (BC) is poor when consumed without dietary fat. To quantify absorption, we applied Accelerator Mass Spectrometry to measure plasma and lipoprotein responses to a tracer dose (50 nCi, 236 ng) of oral ^{14}C-BC with a meal absent added fat. Frequent blood samples were collected and triacylglyceride-rich (TRL) and LDL fractions isolated. Plasma, TRL and LDL levels of ^{14}C increased by 45 min post dose. The kinetic profile of TRL and plasma were similar with several local concentration maxima to 8 h post dose. In contrast, ^{14}C in LDL fraction showed a gradual, linear rise until 15 h post dose. Label BC, retinol and small amounts of retinyl esters were detected in plasma. From stool excretion data, label was >60% bioavailable. Data suggest BC and some metabolites reach systemic circulation by a mechanism other than induction and secretion of chylomicra. Endogenous fat from biliary circulation and liberated mucosal fat may assist in BC assimilation. A constitutive intestinal VLDL process in recycling endogenous fat may explain ^{14}C in TRL. Data will contrast other ^{14}C-BC kinetic studies from our lab using emulsified oral doses.

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341.4

Immune stimulating action of dietary astaxanthin in humans

Jean Soon Park1, Jong Hee Chyun[2], Yoo Kyung Kim[2], Larry L Line[3], Michael C Maloney[4], Boon P Chew[1]. [1]Food Science and Human Nutrition, Washington State University, FSHN 114, Pullman, WA 99164-6376, [2]Food and Nutrition, Inha University, Incheon, Korea, Republic of, [3]Vice President, US Nutraceuticals, Eustis, FL, [4]Food and Nutrition, Emerald, Eustis

We studied the role of dietary astaxanthin on immunity and oxidative status. Female subjects (21.5 yr) with no history of major diseases received 0, 2, or 8 mg astaxanthin (n = 14) daily for 8 wk in a double-blind, placebo controlled study. Blood was drawn on wk 0, 4 and 8. The tuberculin test was assessed on wk 8. Plasma astaxanthin was undetectable prior to feeding but increased ($P < 0.01$) dose-dependently on wk 4 and 8. Dietary astaxanthin stimulated concanavalin A-, phytohemagglutinin- and pokeweed mitogen-induced lymphoproliferation and increased NK cell cytotoxic activity. In addition, astaxanthin also increased the proportion of total T cells and B cells, but did not influence the populations of Th, Tc or NK cells or the ratio of Th:Tc cells. The frequency of cells expressing LFA-1 marker was higher in subjects given 2 mg (42.1%) but not those given 8 mg (30.6%) astaxanthin compare to control (31.8%) on wk 8. No similar dietary effect was observed with ICAM-1 or LFA-3 expression. Subjects fed 2 mg but not those fed 8 mg astaxanthin had higher DTH response than unsupplemented controls. Dietary astaxanthin dramatically decreased blood DNA damage (8-oxodeoxyguanosine) after 4 wk of feeding but did not influence lipid peroxidation in plasma. Therefore, dietary astaxanthin enhanced immune response and decrease DNA damage in human subjects. Supported by US Nutraceuticals and Washington Technology Center.

341.5

Physiologically attainable concentrations of lycopene do not alter cell number balance but impair mitochondrial function, a characteristic of early apoptosis, in LNCaP human prostate cancer cells

Holly Lynn Hantz, Leeanne Faith Young, Keith R Martin. Nutritional Sciences, The Pennsylvania State University, 126 Henderson Building South, University Park, PA 16802

Prostate cancer is the second leading cause of cancer deaths among men in the U.S. Studies show that people with diets rich in tomato-based foods have reduced risks of cancer, viz., prostate cancer. This is