DNA Repair induced by Molecules Present in Raw Fruits and Vegetables.

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Unrepaired DNA damage is the primary molecular causative factor of most Human Degenerative Conditions. It has been mostly studied on cancer cells, however. neurological disorders usually are initiated because of unrepaired Nuclear DNA damage.

Research in Molecular Biology in the last decade, have identified a large number of molecular components present in fruit and vegetables with the ability to enhance the Cellular DNA Repair Systems. Please finds enclosed below a selection of abstracts from the almost one thousand medical papers published in the last decade on the subject: DNA repair induced by molecules present in fruit and vegetables.

We have enclosed also a Power Point Attachment with slides on the subject DNA repair induced by fruit and vegetables.

http://ebookbrowse.com/slide-show-dna-repair-induced-by-molecules-present-in-fruit-and-vegetables-pps-d134659007

John Grinstein PhD / Food Biochemistry Research

Mutat Res. 2001 Sep 20;496(1-2):39-45. Links

Antimutagenic effect of one variety of green pepper (Capsicum spp.) and its possible interference with the nitrosation process.

Dr. Ramirez-Victoria P, Guzman-Rincon J, Espinosa-Aguirre JJ, Murillo-Romero S.
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It is known that the poblano green pepper, a significant component in the Mexican diet, contains certain natural compounds such as chlorophyll, beta-carotene, and vitamins,

which have antimutagenic and/or anticarcinogenic properties. Using the somatic mutation and recombination test in wing cells of Drosophila melanogaster, an extract of thepoblano pepper (Capsicum spp.) was evaluated to determine its antimutagenic effect against the nitrosation process, simulating the process occurring in the human stomach caused by known food additives.

The experiments suggest that some compounds present in the green pepper may cause this antimutagenic effect by interfering with the nitrosation process. The role of the extract and one of its components, such as vitamin C, in the nitrosation process will be discussed.

Nutr Cancer. 2001;39(1):148-53.Related Articles, Links

Kiwifruit protects against oxidative DNA damage in human cells and in vitro.

Collins BH, Horská A, Hotten PM, Riddoch C, Collins AR.
Rowett Research Institute, Bucksburn, Aberdeen AB21 9SB, UK.

Antioxidant micronutrients may account for the beneficial effects of fruits on human health. A direct demonstration that consumption of fruit decreases oxidative DNA damage in human cells would support this hypothesis. Kiwifruit was taken as an example of a food with putative antioxidant properties, and its effectiveness at decreasing oxidative DNA damage was assessed in ex vivo as well as in vitro tests.

We have demonstrated significant antioxidant activity of kiwifruit ex vivo and in vitro, not attributable entirely to the vitamin C content of the fruit. Our dual approach is appropriate for testing other fruit and vegetable products for potential antioxidant effects. *Mutat Res. 2005 Apr 4;582(1-2):155-62. Links*

Protection by quercetin and quercetin-rich fruit juice against induction of oxidative DNA damage and formation of BPDE-DNA adducts in human lymphocytes.

Wilms LC, Hollman PC, Boots AW, Kleinjans JC.
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Flavonoids are claimed to protect against cardiovascular disease, certain forms of cancer and ageing, possibly by preventing initial DNA damage. Therefore, we investigated the protective effects of the flavonoid quercetin against the formation of oxidative DNA

damage and bulky DNA adducts in human lymphocytes, both in vitro and ex vivo.

The combination of our findings in vitro and ex vivo provides evidence that quercetin is able to protect against chemically induced DNA damage in human lymphocytes, which may underlie its suggested anticarcinogenic properties.

Cell Biol Toxicol. 2004 Mar;20(2):71-82. Links

Ex-vivo and in vitro protective effects of kolaviron against oxygen-derived radical-induced DNA damage and oxidative stress in human lymphocytes and rat liver cells.

Farombi EO, Møller P, Dragsted LO.
Institute of Food Safety and Nutrition, Division of Biochemical and Molecular Toxicology, 2860 Søborg, Denmark. olatunde.farombi@yahoo.com

The present study reports the protective effects of kolaviron, a Garcinia biflavonoid from the seeds of Garcinia kola widely consumed in some West African countries against oxidative damage to molecular targets ex-vivo and in vitro.

We suggest that kolaviron exhibits protective effects against oxidative damage to molecular targets via scavenging of free radicals and iron binding. Kolaviron may therefore be relevant in the chemoprevention of oxidant-induced genotoxicity and possibly human carcinogenesis.

Biofactors. 2004;21(1-4):109-12. Links

Chaga mushroom extract inhibits oxidative DNA damage in human lymphocytes as assessed by comet assay.

Park YK, Lee HB, Jeon EJ, Jung HS, Kang MH.
Department of Medical Nutrition, Kyunghee University, 1 Hoekidong, Dongdaemoonku, Seoul 130-701, South Korea.

The Chaga mushroom (Inonotus obliquus) is claimed to have beneficial properties for human health, such as anti-bacterial, anti-allergic, anti-inflammatory and antioxidant activities. The antioxidant effects of the mushroom may be partl y explained by protection of cell components against free radicals. Evaluation of oxidative damage was

performed using single-cell gel electrophoresis for DNA fragmentation (Comet assay). Using image anal ysis, the degree of DNA damage was evaluated as the DNA tail moment.

Cells pretreated with Chaga extract showed over 40% reduction in DNA fragmentation compared with the positive control (100 micromol H2O2 treatment). Thus, Chaga mushroom treatment affords cellular protection against endogenous DNA damage produced by H2O2.

Phytother Res. 2008 Mar;22(3):376-83. Links

In vitro antioxidant, antimutagenic and genoprotective activity of Rosa roxburghii fruit extract.

Van der Westhuizen FH, van Rensburg CS, Rautenbach GS, Marnewick JL, Loots du T, Huysamen C, Louw R, Pretorius PJ, Erasmus E.
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The antioxidant properties of the fruit of the Rosa roxburghii (RR) plant have been associated with several putative health promoting effects. The possible cytotoxic, mutagenic/antimutagenic and genotoxic effects of RR fruit extract were investigated. The effect on antioxidant status and protection against induced oxidative stress were also investigated using primary rat hepatocytes.

A significant antimutagenic effect of the extract was observed against the metabolic activated mutagens 2-acetylaminofluorene and aflatoxin B1 and to a lesser extent against methyl methanesulfonate. It is concluded that these results support the associated health promoting potential of Rosa Roxburghii fruit and in particular against oxidative stress. *Food Chem Toxicol. 2007 Aug;45(8):1428-36. Epub 2007 Feb 12.*

Consumption of Brussels sprouts protects peripheral human lymphocytes against 2-amino-1-methyl-6-phenylimidazo[4,5-b]pyridine (PhIP) and oxidative DNA-damage: results of a controlled human intervention.

Trial.Hoelzl C, Glatt H, Meinl W, Sontag G, Haidinger G, Kundi M, Simic T, Chakraborty A, Bichler J, Ferk F, Angelis K, Nersesyan A, Knasmüller S.
Institute of Cancer Research, Department of Medicine I, Medical University of Vienna, Vienna, Austria.

To find out if the cancer protective effects of Brussels sprouts seen in epidemiological studies are due to protection against DNA-damage, an intervention trial was conducted in which the impact of vegetable consumption on DNA-stability was monitored in lymphocytes with the comet assay.

After consumption of the sprouts (300 g/p/d, n = 8), a reduction of DNA-migration (97%) induced by the heterocyclic aromatic amine 2-amino- 1-methyl-6-phenyl-imidazo-[4,5-b]pyridine (PhIP) was observed whereas no effect was seen with 3-amino-1-methyl-5H-pyrido[4,3-b]-indole (Trp-P-2). This effect protection may be due toinhibition of sulfotransferase 1A1, which plays a key role in the activation of PhIP. In addition, a decrease of the endogenous formation of oxidized bases was observed and DNA-damage caused by hydrogen peroxide was significantly (39%) lower after the intervention.

These effects could not be explained by induction of antioxidant enzymes glutathione peroxidase and superoxide dismutase, but in vitro experiments indicate that sprouts contain compounds, which act as direct scavengers of reactive oxygen species. Serum vitamin C levels were increased by 37% after sprout consumption but no correlations were seen between prevention of DNA-damage and individual alterations of the vitamin levels.

Our study shows for the first time that sprout consumption leads to inhibition of sulfotransferases in humans and to protection against PhIP and oxidative DNA-damage.

Cancer Epidemiol Biomarkers Prev. 2004 Jul;13(7):1199-205. Links

The effect of cruciferous and leguminous sprouts on genotoxicity, in vitro and in vivo.

Gill CI, Haldar S, Porter S, Matthews S, Sullivan S, Coulter J, McGlynn H, Rowland I. Northern Ireland Centre for Food and Health, University of Ulster, Coleraine, United Kingdom. C.Gill@ULST.AC.UK

Vegetable consumption is associated with a reduced risk of colorectal cancer, which is the second most common cancer after lung/breast cancer within Europe. Some putative protective phytochemicals are found in higher amounts in young sprouts than in mature plants. The effect of an extract of mixed cruciferous and legume sprouts on DNA damage induced by H(2)O(2) was measured in HT29 cells using single cell microgelelectrophoresis (comet). Significant antigenotoxic effect (P < or = 0.05) was observed when HT29 cells were pre-incubated with the extract (100 and 200microL/mL) for 24 hours and then challenged with H(2)O(2). A parallel design intervention study was carried out on 10 male and 10 female healthy adult volunteers (mean age = 25.5 years) fed 113 g of cruciferous and legume sprouts daily for 14 days.

The effect of the supplementation was measured on a range of parameters, including DNA damage in lymphocytes (comet), the activity of various detoxifying enzymes (glutathione S- transferase, glutathione peroxidase, and superoxide dismutase), antioxidant status using the ferric reducing ability of plasma assay, plasma antioxidants (uric acid, ascorbic acid, and alpha-tocopherol), blood lipids, plasma levels of lutein, and lycopene.

A significant antigenotoxic effect against H(2)O(2)-induced DNA damage was shown in peripheral blood lymphocytes of volunteers who consumed the supplemented diet when compared with the control diet (P = 0.04). No significant induction of detoxifying enzymes was observed during the study, neither were plasma antioxidant levels or activity altered.

The results support the theory that consumption of cruciferous vegetables is linked to a reduced risk of cancer via decreased damage to DNA.

Am J Clin Nutr. 2007 Feb;85(2):504-10. Links

Watercress supplementation in diet reduces lymphocyte DNA damage and alters blood antioxidant status in healthy adults.

Gill CI, Haldar S, Boyd LA, Bennett R, Whiteford J, Butler M, Pearson JR, Bradbury I, Rowland IR.
Northern Ireland Centre for Food and Health, Centre for Molecular Biosciences, University of Ulster, Coleraine, N Ireland, United Kingdom. c.gill@ulster.ac.uk

BACKGROUND: Cruciferous vegetable (CV) consumption is associated with a reduced risk of several cancers in epidemiologic studies.

OBJECTIVE: The aim of this study was to determine the effects of watercress (a CV) supplementation on biomarkers related to cancer risk in healthy adults. DESIGN: A single-blind, randomized, crossover study was
conducted in 30 men and 30 women (30 smokers and 30 nonsmokers) with a mean age of 33 y (range: 19-55 y).

CONCLUSION: The results support the theory that consumption of watercress can be linked to a reduced risk of cancer via decreased damage to DNA and possible modulation of antioxidant status by increasing carotenoid concentrations

Free Radic Res. 2002 Jan;36(1):113-8. Links

Effects of dietary antioxidants on human DNA ex vivo.

Szeto YT, Benzie IF.
Department of Nursing and Health Sciences, The Hong Kong Polytechnic University, Kowloon, Hong Kong SAR, People's Republic of China.

The protective effect of fruits and vegetables against cancer is well established. It is believed that this effect is mediated by antioxidants and decreased oxidative damage to DNA. However, the identity of the antioxidant(s) responsible is not clear.

Damage may have been caused by production of H2O2 from these polyphenolics. Neither ascorbic acid nor alpha-tocopherol protected or damaged DNA. Further study of the role of quercetin and caffeic acid in DNA protection is needed.

Mutat Res. 2000 Apr 28;459(3):211-8. Links

Effects of epigallocatechin gallate and quercetin on oxidative damage to cellular DNA.

Johnson MK, Loo G.

Graduate Program in Nutrition, The University of North Carolina at Greensboro, Greensboro, NC 27402-6170, USA.

Phenolic phytochemicals are thought to promote optimal health, partly via their antioxidant effects in protecting cellular components against free radicals. The aims of this study were to assess the free radical-scavenging activities of several common phenolic phytochemicals, and then, the effects of the most potent phenolic phytochemicals on oxidative damage to DNA in cultured cells.

In contrast, noticeable DNA damage was induced in Jurkat T-lymphocytes by incubating with 10-fold higher concentrations (i.e., 100 microM) of either EGCG (comet score: 56+/-17) or quercetin (comet score: 64+/-13) by themselves. Collectively, these data suggest that low concentrations of EGCG and quercetin scavenged free radicals, thereby inhibiting oxidative damage to cellular DNA. But, high concentrations of either EGCG or quercetin alone induced cellular DNA damage

Mol Cell Biochem. 2004 Dec;267(1-2):67-74. Links

Effects of polyphenols from grape seeds on oxidative damage to cellular DNA.

Fan P, Lou H.
School of Pharmaceutical Sciences, Shandong University, Jinan, Shandong, PR China.

Grape seed polyphenols have been reported to exhibit a broad spectrum of biological properties. In this study, eleven phenolic phytochemicals from grape seeds were purified by gel chromatography and high performance liquid chromatography (HPLC). The antioxidant activities of five representative compounds with different structure type were assessed by the free radical-scavenging tests and the effects of the more potent phytochemicals on oxidative damage to DNA in mice spleen cells were investigated.

Collectively, these data suggest that procyanidin B4, catechin, gallic acid were good antioxidants, at low concentration they could prevent oxidative damage to cellular DNA. But at higher concentration, these compounds may induce cellular DNA damage, taking catechin for example, which explained the irregularity of dose-effect relationship. / Carcinogenesis. 1999 Sep;20(9):1737-45. Links

Anti-tumor-promoting activity of a polyphenolic fraction isolated from grape seeds in the mouse skin two-stage initiation-promotion protocol and identification of procyanidin B5-3'-gallate as the most effective antioxidant constituent.

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Center for Cancer Causation and Prevention, AMC Cancer Research Center, Denver, CO 80214, USA.

Procyanidins present in grape seeds are known to exert anti-inflammatory, anti-arthritic and anti-allergic activities, prevent skin aging, scavenge oxygen free radicals and inhibit UV radiation-induced peroxidation activity. Since most of these events are associated with the tumor promotion stage of carcinogenesis, these studies suggest that grape seed polyphenols and the procyanidins present therein could be anticarcinogenic and/or anti-tumor-promoting agents.

Taken together, for the first time these results show that grape seed polyphenols possess high anti-tumor-promoting activity due to the strong antioxidant effect of procyanidins present therein. In summary, grape seed polyphenols in general, and procyanidin B5-3'-gallate in particular, should be studied in more detail to be developed as cancer chemopreventive and/or anticarcinogenic agents.

Cancer Lett. 1999 Jan 29;135(2):151-7. Links

Inhibition of TPA-induced tumor promotion in CD-1 mouse epidermis by a polyphenolic fraction from grape seeds.

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Department of Food Science and Human Nutrition, University of Illinois, Urbana 61801, USA.

The anti-tumor promoting activity of a polyphenolic fraction from grape seeds (GSP) was examined in CD-1 mouse skin epidermis. Specifically, the ability of this fraction to inhibit 12-O-tetradecanoylphorbol-13-acetate (TPA)-induced tumor promotion and two markers of promotion in mouse skin, ornithine decarboxylase (ODC) and myeloperoxidase (MPO) activities, was evaluated.

These studies indicate that GSP possesses anti-tumor promoting activity when applied to CD-1 mouse skin prior to treatment with TPA. The mechanism of this tumor inhibition is due, in part, to a GSP-associated inhibition of TPA-induced epidermal ODC and MPO activities. Thus, GSP warrants further evaluation as a skin cancer chemopreventative agent.

Int J Cancer. 2005 Jan 20;113(3):423-33. Links

Anthocyanin- and hydrolyzable tannin-rich pomegranate fruit extract modulates MAPK and NF-kappaB pathways and inhibits skin tumorigenesis in CD-1 mice.

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Chemoprevention has come of age as an effective cancer control modality; however, the search for novel agent(s) for the armamentarium of cancer chemoprevention continues. We argue that agents capable of intervening at more than one critical pathway in the carcinogenesis process will have greater advantage over other single-target agents. Pomegranate fruit extract (PFE) derived from the tree Punica granatum possesses strong antioxidant and antiinflammatory properties.

The results of our study provide clear evidence that PFE possesses antiskin-tumor-promoting effects in CD-1 mouse. Because PFE is capable of inhibiting conventional as well as novel biomarkers of TPA-induced tumor promotion, it may possess chemopreventive activity in a wide range of tumor models. Thus, an in-depth study to define active agent(s) in PFE capable of affording antitumor-promoting effect is warranted.

Oncogene. 2004 Jul 1;23(30):5203-14. Links

Lupeol modulates NF-kappaB and PI3K/Akt pathways and inhibits skin cancer in CD-1 mice.

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Chemoprevention has become an effective cancer control modality; however, the search for novel agent(s) for the armamentarium of cancer chemoprevention continues. We argue that agents capable for inhibition of promotion stage of tumorigenesis with the ability to intervene at several critical pathways in the tumorigenesis process will have greater advantage over other single-target agents.

Lupeol, a triterpene, is the principal constituent of common fruit plants such as olive, mango, fig and medicinal herbs that have been used to treat skin aliments. Lupeol has been reported to possess a wide range of medicinal properties that include strong antioxidant, antimutagenic, anti-inflammatory and antiarthritic effects. In the present study, we show that Lupeol possesses antitumor- promoting effects in a mouse skin tumorigenesis model.

These results for the first time provide evidence that Lupeol possesses antiskin tumor-promoting effects in CD-1 mouse and inhibits conventional as well as novel biomarkers of tumor promotion. We suggest that Lupeol is an attractive antitumor-promoting agent that must be evaluated in tumor models other than skin carcinogenesis.