

## THERAPEUTICS

### NPARR 2(4), 2011-0447, **Determination of Antimicrobial Activity of Sorrel (*Hibiscus sabdariffa*) on *Escherichia coli* O157:H7 Isolated from Food, Veterinary, and Clinical Samples**

The use of medicinal plants as natural antimicrobial agents is gaining popularity. Sorrel (*Hibiscus sabdariffa*) is widely used for the treatment of diseases. The objective of this study was to investigate the antimicrobial activity of sorrel on *Escherichia coli* O157:H7 isolates from food, veterinary, and clinical samples. Phenolics of the calyces were extracted from 10 g of ground, freeze-dried samples using 100 mL of 80% aqueous methanol. Concentrations of 10%, 5%, and 2.5% methanol extract of sorrel were investigated for its antimicrobial activity. Inhibition zones were indicated by a lack of microbial growth due to inhibitory concentrations of sorrel diffused into semisolid culture medium beneath the sorrel-impregnated disk. The results of this experiment showed that the most potent sorrel concentration was 10%, then 5%, and finally 2.5%. The overall mean zone of inhibition for the sorrel extract was 12.66 mm for 10%, 10.75 mm for 5%, and 8.9 mm for 2.5%. The highest inhibition zones (11.16 mm) were observed in veterinary samples, and the lowest (10.57 mm) in the food samples. There were significant ( $P < 0.05$ ) differences among mean zones of inhibition found in the food, veterinary, and clinical sources. Based on the source of samples and concentration of sorrel extract, the lowest mean inhibition was  $7.00 \pm 0.04$  mm from clinical samples, and the highest was  $15.37 \pm 0.61$  mm from a food source. These findings indicated that sorrel was effective at all levels in inhibiting *E. coli* O157:H7; thus it possesses antimicrobial activity and hold great promise as an antimicrobial agent [Marjorie Fullerton, Janak Khatiwada, Jacqueline U. Johnson, Shurrita Davis and Leonard L. Williams\* (Center for Excellence in Post-Harvest Technologies, North Carolina A&T State University, 500 Laureate Way, Suite 422,2 Kannapolis, NC 28081-4332, USA), *Journal of Medicinal Food*, 2011, 14(9), 950-956].

### NPARR 2(4), 2011-0448, **Antioxidant and anticarcinogenic effects of methanolic extract and**

### **volatile oil of fennel seeds (*Foeniculum vulgare*)**

The present study evaluated the efficacy of fennel seed methanolic extract (FSME) for its antioxidant, cytotoxic, and antitumor activities and for its capacity to serve as a nontoxic radioprotector in Swiss albino mice. The natural antioxidant compounds of FSME for use in industrial application was also assessed. Cytotoxic activity of FSME was evaluated in a mouse model of Ehrlich ascites carcinoma (EAC) and on different types of human cell lines in vitro. The safety and optimum dose of FSME were determined. FSME, 100 mg/kg, was injected intraperitoneally into mice bearing EAC before the mice were exposed to three 2-Gy doses of gamma irradiation. After 30 days, mice were fasted for 18 h and then sacrificed to observe the lifespan of EAC-bearing hosts. Malondialdehyde (MDA), catalase activity, glutathione content, and total protein in serum, liver tissue, and ascitic fluid were determined. Iron, total iron-binding capacity, transferrin, and ferritin were also evaluated in serum. The data showed the presence of different types of compounds in FSME, such as flavonoids, terpenoids, alkaloids, phenols, and sterols; estragole (71.099%) was the predominant alcohol, gallic acid was the phenolic compound (18.895%), and L-limonene was the most prevalent monoterpene hydrocarbon (11.967%). The mean  $\pm$  standard deviation 50% inhibitory concentrations were  $50 \pm 0.03$   $\mu$ g/mL for the MCF7 breast cancer cell line and  $48 \pm 0.22$   $\mu$ g/mL for the Hepg-2 liver cancer cell line. The significant increase in MDA levels and the significant decrease in catalase activity and glutathione content in liver and tumor tissue in mice bearing EAC were ameliorated after FSME administration. In contrast, total protein content was increased in ascitic fluid. Serum iron was inversely proportional to the levels of ferritin and transferrin and total iron-binding capacity. Administration of FSME before irradiation exerted a cytoprotective effect against gamma irradiation, as manifested by a restoration of the MDA level, catalase activity, and GSH content to near-normal levels. In conclusion, FSME may have remarkable anticancer potential against a breast cancer cell line (MCF7) and liver cancer cell line (Hepg-2). It also showed strong free radical-scavenging activity (100%). Thus, FSME may reduce oxidative stress and protect mouse cells from damage caused by reactive oxygen species. In addition, it could be used as a safe,

effective, and easily accessible source of natural antioxidants to improve the oxidative stability of fatty foods during storage. FSME also exhibited an antitumor effect by modulating lipid peroxidation and augmenting the antioxidant defense system in EAC-bearing mice with or without exposure to radiation [Ragaa Hosny Mohamad\*, Amal Mohamad El-Bastawesy, Mohamad Gamil Abdel-Monem, Assmaa Mahmoud Noor, Hussain Abdel Rahman Al-Mehdar, Sabry Mohamad Sharawy and Mahmuod Mohamad El-Merzabani), (National Cancer Institute, Cancer Biology, Fom Al-Khalig-Al-Kaser Al-Aini Street, Cairo 11234, Egypt), *Journal of Medicinal Food*, 2011, **14**(9), 986-1001].

**NPARR 2(4), 2011-0449, Garlic allicin as a potential agent for controlling oral pathogens**

Garlic has been used medicinally throughout human history. Allicin is considered the most therapeutic constituent of garlic. This study tested the antimicrobial activity of garlic allicin on oral pathogens associated with dental caries and periodontitis. Allicin was found effective against all the tested bacteria. The broth dilution method revealed that planktonic growth of the cariogenic, gram-positive species *Streptococcus mutans*, *S. sobrinus*, and *Actinomyces oris* was inhibited by an allicin concentration of 600  $\mu\text{g/mL}$  or higher. Planktonic growth of the tested gram-negative periopathogenic species *Aggregatibacter actinomycetemcomitans* and *Fusobacterium nucleatum* was inhibited by a minimum allicin concentration of 300  $\mu\text{g/mL}$ . *Porphyromonas gingivalis*, an anaerobic, gram-negative pathogen and the bacterium most associated with chronic periodontitis, demonstrated the lowest sensitivity to allicin (2,400  $\mu\text{g/mL}$ ). Gel zymography and the synthetic chromogenic substrate *N* $\alpha$ -benzoyl-L-arginine 4-nitroanilide hydrochloride demonstrated that allicin inhibits the proteases of *P. gingivalis*, including the arginine and lysine gingipains known as major virulence factors of this organism. A gingipain-inactivated mutant demonstrated high sensitivity to allicin (<300  $\mu\text{g/mL}$ ), revealing that gingipains confer resistance to allicin. Live/dead staining followed by analysis with confocal laser scanning microscopy revealed that allicin was bactericidal to *S. mutans* grown in mature biofilms. However, this bactericidal effect was reduced as biofilm depth increased. In

conclusion, these results support the traditional medicinal use of garlic and suggest the use of allicin for alleviating dental diseases Gilad Bachrach\*, Areen Jamil, Ronit Naor, Golan Tal, Zvi Ludmer and Doron Steinberg (Institute of Dental Sciences, The Hebrew University-Hadassah School of Dental Medicine, The Hebrew University of Jerusalem, P.O.B. 12272, Jerusalem 91120, Israel), *Journal of Medicinal Food*, 2011, **14**(11), 1338-1343.]

**NPARR 2(4), 2011-0450, Anti-Hyperglycemia properties of tea (*Camellia sinensis*) bioactives using in vitro assay models and influence of extraction time**

Tea (*Camellia sinensis*) has well-known health benefits, which are attributed to its polyphenolic metabolites. This research explored the potential of regular tea consumption and influence of extraction time typically used in daily consumption of tea, as a therapeutic dietary support for potential management of early stage type 2 diabetes using in vitro assay models. Extraction times of 2 and 5 minutes were compared. The 5-minute extraction time had significantly higher total phenolic content compared with the 2-minute extraction time. Choice Darjeeling 5-minute extraction yielded the highest amount of total phenolics (299.6 $\pm$ 5.9  $\mu\text{g/g}$ ), followed by Tazo Black 5-minute extraction (240 $\pm$ 9.7  $\mu\text{g/g}$ ), whereas Bigelow Green 2-minute extraction had the lowest total phenolic content (53 $\pm$ 8.2  $\mu\text{g/g}$ ). 1, 1-Diphenyl-2-picrylhydrazyl scavenging-linked antioxidant activity was high (81–91%) for all types evaluated, and for most samples it was influenced by the extraction time. Similarly, high in vitro  $\alpha$ -glucosidase inhibition was observed in almost all the samples assayed, and for most samples the 5-minute extraction had significantly higher inhibition compared with the 2-minute extraction time. The most fermented teas showed highest  $\alpha$ -amylase inhibition: Choice Darjeeling 5-minute extraction had the highest inhibition (84.1%), followed by Tazo Black 5-minute extraction (71.6%). Angiotensin converting enzyme inhibition was not observed in any sample. Overall, the 5-minute extraction time was found to have more relevance for potential benefits for managing hyperglycemia than the 2-minute procedure. This research suggests that tea offers an attractive potential strategy to regulate postprandial hyperglycemia toward an overall dietary support for type 2 diabetes

management [Chandrakant Ankolekar, Trisha Terry, Kevin Johnson, David Johnson, Ana Christina Lopez Barbosa, and Kalidas Shetty\* (Laboratory of Food Biotechnology, (Department of Food Science, Chenoweth Laboratory, University of Massachusetts, Amherst, MA 01003, USA), *Journal of Medicinal Food*, 2011, **14**(10): 1190-1197].

**NPARR 2(4), 2011-0451, *Morinda citrifolia* Linn. leaf extract possesses antioxidant activities and reduces nociceptive behavior and leukocyte migration**

Herbal drugs have been used since ancient times to treat a wide range of diseases. *Morinda citrifolia* Linn (popularly known as “Noni”) has been used in folk medicine by Polynesians for over 2,000 years. It is reported to have a broad range of therapeutic effects, including effects against headache, fever, arthritis, gingivitis, respiratory disorders, infections, tuberculosis, and diabetes. The aim of this study was to investigate the antioxidant, anti-inflammatory, antinociceptive, and antibacterial properties of the aqueous extract from *M. citrifolia* leaves (AEMC). Antioxidant activity was observed against lipid peroxidation, nitric oxide, and hydroxyl radicals. The antinociceptive effect of AEMC was observed in the acetic acid–induced writhing test at the higher dose. Moreover, AEMC significantly reduced the leukocyte migration in doses of 200 and 400 mg/kg and showed mild antibacterial activity. Together, the results suggest that properties of *M. citrifolia* leaf extract should be explored further in order to achieve newer tools for managing painful and inflammation conditions, including those related to oxidant states, Mairim Russo Serafini, Rodrigo Correia Santos, Adriana Gibara Guimarães, João Paulo Almeida dos Santos, Alan Diego da Conceição Santos, Izabel Almeida Alves, Daniel Pens Gelain, Paulo Cesar de Lima Nogueira, Lucindo José Quintans-Júnior, Leonardo Rigoldi Bonjardim, and Adriano Antunes de Souza Araújo\* (Departamento de Fisiologia, Curso de Farmácia - UFS Address, Av. Marechal Rondon SN, CEP 49100-000, São Cristóvão - SE, Brazil), *Journal of Medicinal Food*, 2011, **14**(10), 1159-1166].

**NPARR 2(4), 2011-0452, High potential of agro-industrial by-products of pomegranate (*Punica granatum* L.) as the powerful antifungal and antioxidant substances**

Microorganisms such as fungi are one of the most important factors that cause oxidative processes during postharvest stage and consequently deterioration of agriculture products would not be unexpected. On the other hand, high antioxidant properties of industrial by-products of pomegranate propose them as powerful antioxidant and antifungal substances. So to investigate the antioxidant and antifungal properties of pomegranate, two independent factorial experiments based on randomized design with 5 replications were conducted. In the first experiment the effect of 3 different parts of pomegranate (peel, seed and leaf) and 2 different kinds of extracts (aqueous and methanolic) with 4 concentrations (0, 500, 1000 and 1500 ppm) were investigated on 3 postharvest fungi (*Penicillium italicum*, *Rhizopus stolonifer* and *Botrytis cinerea*). In the second experiment antioxidant capacity and phenolic content were measured for two different extracts from different parts. Based on the results the methanolic extract showed the highest inhibitory effects on the mycelia growth (IMG) and spore germination (ISG) with 49.82 and 41.25% respectively. On the other hand, peel and seed extracts had more inhibitory effect (IMG and ISG) than leaf extract. The phenolic content of peel extract were also measured 2.8 fold higher than pomegranate leaf extract and antioxidant capacity of peel, seed and leaf extracts of pomegranate were 55.3%, 35.7% and 16.4% respectively. Therefore, it seems that the high percentage of phenolic content in the peel and seed of pomegranate could cause the high antifungal and antioxidant activity of their extracts [Ali Tehranifara\* Yahya Selahvarzia, Mahdiyeh Kharrazia and Vahid Jahan Bakhshb (Center of Pomegranate Research, Department of Horticultural Science, Faculty of Agriculture, Ferdowsi University of Mashhad, Mashhad, Iran), *Industrial Crops and Products*, 2011, **34** (2011) 1523-1527].