

(171) Blueberry Leaf Inhibits Hepatitis C Virus RNA Replication

Ena Akamatsu^{*1}, Takanori Kai², Hideaki Hirabaru², Chizuko Yukizaki³, Miho Sakai⁴, Hirofumi Uto⁵, Hirohito Tsubouchi⁶, Hisato Kunitake⁷

¹Miyazaki Prefectural Industrial Support Foundation, Research Promotion Bureau for Collaboration of Regional Entities, 16500-2, Higashi-kaminaka, Sadowara-cho, Miyazaki City, Miyazaki, 880-0303, Japan; ²Unkai Shuzo Co., Ltd., Research & Development, 1800-5, Azamameshinkai, Oaza Minamimata, Aya-cho, Higashimorokata-gun, Miyazaki, 880-1303, Japan; ³Miyazaki Prefectural Food Research & Development Center, Food Development Department, 16500-2, Higashi-kaminaka, Sadowara-cho, Miyazaki City, Miyazaki, 880-0303, Japan; ⁴Miyazaki Prefectural Food Research & Development Center, Food Development Dept.; ⁵Faculty of Medicine, University of Miyazaki, Dept. of Internal Medicine 2, 5200 Oaza Kihara, Kiyotake-cho, Miyazaki-gun, Miyazaki, 889-1692, Japan; ⁶Kagoshima University Graduate School of Medical & Dental Sciences, Dept. of Digestive and Life-style Related Disease, 8-35-1, Sakuragaoka, Kagoshima City, Kagoshima, 890-8520, Japan; ⁷Faculty of Agriculture, University of Miyazaki, Dept. of Biochemistry & Applied Biosciences, 1-1, Nishi, Gakuenkibanadai, Miyazaki City, Miyazaki, 889-2192, Japan

Blueberry (*Vaccinium* sp.) fruits contain high concentrations of polyphenols such as anthocyanin. It is well known that polyphenols have antioxidant activity, so it is likely that the fruit has a possible preventative effect against several diseases like cancer. However, only a few reports so far have studied the human health benefits of the leaves. In this study, the antioxidant activity and antiviral effects of blueberry leaves were investigated. The leaves of three groups of blueberry, northern highbush blueberry (NHB), southern highbush blueberry (SHB), and rabbiteye blueberry (REB), were examined. These leaves were harvested in July and extracted with 80% ethanol. Samples were analyzed for antioxidant activity (DPPH radical scavenging activity) and antiviral activity against hepatitis C virus using the replicon cell assay (Lomann et al., 1999). The antioxidant activity showed significant variability between cultivars and species, with REB having about two times the activity of NHB and SHB. Antiviral activity was observed in the extracts of the leaves and the fruit, and the activity of the leaves was higher than that of the fruit. Among the cultivars and species evaluated, the antiviral activity of REB was higher than that of NHB and SHB. In addition, we discovered a positive correlation ($r=0.68$) between the antioxidant activity and the antiviral activity, using the leaves of hybrid seedlings of REB. Therefore, it is possible to speculate that the antiviral activity bears some relation to the antioxidant activity.

(172) Strawberries Inhibit Cancer Cell Proliferation

Shiow Wang^{*1}, Kimberly Lewers¹, Linda Bowman², Min Ding²

¹U.S. Department of Agriculture, Fruit Laboratory, Beltsville, MD, 20705-2350; ²Center for Disease Control and Prevention, Health Effects Laboratory Division, Morgantown, WV, 26505-2888

Representatives of three species of strawberries (*Fragaria virginiana*, *F. chiloensis* and *F. ×ananassa*) were evaluated for antioxidant capacity, scavenging capacity for reactive oxygen species (ROO[·], OH[·], O₂^{·-}, and O₂^{·-}), and inhibitory effect on proliferation of A549 human lung epithelial cancer cells. Differences among the strawberry genotypes were observed for all three qualities. High antioxidant and scavenging capacities were found in 'CFRA 0982', 'JP 95-1-1', NC 95-19-1 and RI 30. Lowest antioxidant and scavenging capacities were found in 'Allstar'. There was also a relationship between scavenging capacity and the inhibition of cancer cell proliferation. The correlations (R^2) between the scavenging capacities for the reactive oxygen species and the inhibition of cancer cell proliferation were 0.8074, 0.8279, 0.7862 and 0.7761 for ROO[·], OH[·], O₂^{·-} and O₂^{·-}, respectively. These results suggest that antioxidants, specifically their scavenging capacities, may play an important role in the antiproliferative activity of strawberries. This study also identified strawberry germplasm of value in developing cultivars useful for cancer prevention.

(173) Phytonutrient Accumulation and Antioxidant Capacity at Eight Developmental Stages of Black Raspberry Fruit

Mustafa Ozgen¹, Artemio Z. Tulio, Jr.², Ann M. Chanon²,

Nithya Janakiraman¹, R. Neil Reese⁴, A. Raymond Miller², Joseph C. Scheerens^{*2}

¹Gaziosmanpasa University, Horticulture, Tasliciftlik, Tokat, 60240, Turkey; ²The Ohio State University, Horticulture and Crop Science, Ohio Agricultural Research and Development Center, Wooster, OH, 44691; ³The Ohio State University, School of Environment and Natural Resources, Ohio Agricultural Research and Development Center, Wooster, OH, 44691; ⁴South Dakota State University, Biology and Microbiology, Brookings, SD, 57007

To investigate phytonutrient accumulation in black raspberries, fruits of 'Jewel' and 'MacBlack' were harvested at stages from the onset of color development (S1) to ripe fruit (S7). S1-S7 samples were characterized for color reflectance and then frozen at -28 °C within an hour of harvest. Additional ripe fruit were maintained at 20 °C for 3 days to overripen (S8) before freezing. After storage, samples were analyzed for dry weight (DW), total soluble solids (TSS), fructose (FRU), glucose (GLU), and organic acid (ORG) contents; total phenolic (PHE) and anthocyanin (ACY) contents; individual cyanidin glycoside levels (ICG); and antioxidant capacity (FRAP and ABTS) by standard methodology. 'Jewel' and 'MacBlack' ripened similarly. Chroma values and DW percentage decreased while TSS levels, sugar contents (FRU+GLU), PHE, ACY, the ACY : PHE ratio, and ICG increased with progressive ripening stages (S1-S7). Values of PHE, ACY, and ICG were highly correlated ($r < +0.95$) with FRAP and ABTS values. ACY levels in S6 fruit were 18% to 23% less than those of S7; lower S6 ACY levels were associated with reduced antioxidant capacity in 'MacBlack', but not 'Jewel'. Overripened fruit (S8) exhibited increased DW (11% to 25%) and decreased sugar contents (16% to 17%), consistent with moisture and respiratory losses after harvest. After correction for these losses, S7 and S8 levels of PHE, ACY, FRAP, and ABTS were similar in 'MacBlack'. However, as 'Jewel' overripened, ACY levels and antioxidant activity increased 44% and 22% to 26%, respectively. Our data suggests that significant changes in the antioxidant behavior of black raspberries can occur during the periods surrounding peak ripeness.

(174) Determination of Fatty Acid Composition in 120 Korean Native Rice Cultivars

Kyoung-Shim Cho^{*1}, Hyun-Ju Kim¹, Jae-Ho Lee¹, Jung-Hoon Kang², Young-Sang Lee¹

¹Soonchunhyang University, Biological Resources and Technology, Shinchang-myeon Eupnae-ri 646, Asan, Chung-Nam, 336-745, South Korea; ²National Institute of Agricultural Biotechnology, RDA, Information Network, Genebank, 225 Seodundong, Kwonseonku, Suwon, Kyonggi-do, 441-707, South Korea

Fatty acid is known as a physiologically active compound, and its composition in rice may affect human health in countries where rice is the major diet. The fatty acid composition in brown rice of 120 Korean native cultivars was determined by one-step extraction/methylation method and GC. The average composition of 9 detectable fatty acids in tested rice cultivars were as followings: myristic acid; 0.6%, palmitic acid; 21.2%, stearic acid; 1.8%, oleic acid; 36.5%, linoleic acid; 36.3%, linolenic acid; 1.7%, arachidic acid; 0.5%, behenic acid; 0.4%, and lignoceric acid; 0.9%. Major fatty acids were palmitic, oleic and linoleic acid, which composed around 94%. The rice cultivar with the highest linolenic acid was cv. Jonajo (2.1%), and cvs. Pocheonjangmebye and Sandudo showed the highest composition of palmitic (23.4%) and oleic acid (44.8%), respectively. Cultivar Pocheonjangmebye exhibited the highest composition of saturated fatty acid (28.1%), while cvs. Sandudo and Modo showed the highest mono-unsaturated (44.8%) and poly-unsaturated (42.4%) fatty acid composition, respectively. The oleic acid showed negative correlation with palmitic and linoleic acid, while positive correlation between behenic and lignoceric acids was observed.

(175) Variety- and Cultivation Place-dependent Variations in Capsaicinoid Content of Red Peppers Produced in Cheongyang Area

Jae-Ho Lee^{*1}, Hyun-II Cha, Sang-Mi Moon, Kyoung-Shim Cho, Young-Sang Lee

Soonchunhyang Univ., Biological Resources and Technology, Shinchang-myeon Eupnae-ri 646, Asan, Chung-Nam, 336-745, South Korea;