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FILE: ▪ Noni (*Morinda citrifolia*) Juice
▪ Toxicology
▪ Hydroxyanthraquinones

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RE: Genotoxicity of Noni Juice Associated with the Occurrence of Hydroxyanthraquinones

Westendorf J, Effenberger K, Iznaguen H, Basar S. Toxicological and analytical investigations of noni (*Morinda citrifolia*) fruit juice. *J Agric Food Chem.* Epub 12/23/2006.

The tropical noni (*Morinda citrifolia*) plant has traditionally been used by native Polynesians as a food and for cosmetic and medicinal purposes. In the 1990s, American scientists became aware of the potential health benefits of noni juice, and the juice was introduced into the marketplace of more than 50 countries worldwide. It is estimated that millions of people consume noni juice daily, and, after almost 10 years of consumption, no adverse effects had been reported until recently. Two recent publications reported three cases of liver toxicity linked to the consumption of noni juice. It was speculated that the hydroxyanthraquinones present in the juice may have been responsible for the reported liver toxicity. The aim of the present study was to evaluate the genotoxic potential of noni juice in relation to its constituent hydroxyanthraquinones.

Three different batches of Tahitian noni juice (TNJ) prepared in 2004 were provided by Tahitian Noni International Inc. (Provo, UT) for use in this study. The genotoxic effects of different concentrations of TNJ were evaluated in primary rat hepatocytes and H4IIE rat hepatoma cells. An analysis for DNA strand breaks and DNA repair synthesis was conducted in liver cells. A 100-fold concentrated ethyl acetate extract of TNJ was used in a mutagenicity assay conducted in three strains (TA100, TA98, and TA1537) of *Salmonella typhimurium*. An additional mutagenicity test was conducted with V79 Chinese hamster fibroblasts. A root sample of the plant was chemically analyzed by high-performance liquid chromatography (HPLC) to determine the hydroxyanthraquinone profile.

Treatment of H4IIE rat hepatoma cells and primary rat hepatocytes showed "no extraordinary toxic effects." Toxicity was observed only at concentrations greater than 10% TNJ. No DNA strand breaks were found in liver cells after treatment with TNJ up to a dose of 1 g/kg, or approximately 700 mL of juice for an adult human, and no DNA repair

synthesis was observed. "Slight mutagenic effects" were observed in frame shift mutation TA 98 and TA1537 strains, but not in the point mutation strain TA100, in the *S. typhimurium* microsome assay. Since these effects were increased by addition of red grape juice to TNJ it was speculated that flavonoids such as quercetin might be responsible for the effect; however, quercetin, identified as a bacterial mutagen, is not mutagenic in mammalian systems and widely accepted as innocuous for human consumption. [1] No mutagenic effects were observed in V79 Chinese hamster fibroblasts. HPLC analysis confirmed the absence of hydroxyanthraquinones in the root sample tested at concentrations of 1 ppm or greater.

The authors conclude that no hepatotoxic or genotoxic effects of TNJ were observed after a battery of in vitro tests were conducted. The concentration of hydroxyanthraquinones in the TNJ was below 1 ppm; therefore, even if 1 L of juice was consumed daily, the total amount of hydroxyanthraquinones ingested would be less than 1 mg. Such low concentrations of hydroxyanthraquinones have never been shown to be toxic. On the basis of the current findings and those of previous animal studies, noni juice is considered safe for human consumption as long as the juice is prepared under controlled conditions and contains no unidentified additives.

—Brenda Milot, ELS

Reference

[1]Aeschbacher HU, Meier H, Ruch E. Nonmutagenicity in vivo of the food flavonol quercetin. *Nutr Cancer* 1982; 4(2):90-98.

The American Botanical Council has chosen not to reprint the original article.