

Palm-Fruit Juice Polyphenols Protect from DNA Damage Caused by Drug Treatment

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Technology description



Mitochondrial dysfunction and mitochondrial DNA (mtDNA) damage can occur naturally over time during the aging process but can also be induced as side-effects by the drugs used to treat serious diseases, including tuberculosis and cancer. One of the most commonly used anti-retroviral drugs to treat HIV/AIDS (zidovudine or AZT) is known to cause damage to the mitochondrial genome and any mitigation of this permanent side-effect would significantly benefit the long term health of patients. Our invention introduces palm fruit juice (PFJ) as a novel natural product for preventing and treating mitochondrial dysfunction due to mtDNA and genomic DNA damage. PFJ is a water soluble by-product of oil extraction from the fruit of the oil palm (*Elaeis guineensis*) that is rich in antioxidant phenolics and other phytochemicals. PFJ has been found to exhibit a high scavenging activity for hydrogen peroxide, the main reactive oxygen species (ROS) produced in excess by defective mitochondria. The antioxidants in PFJ reduce the level of intracellular ROS and lower the level of oxidative stress in cells

which in turn decreases the number of DNA-associated breaks and mutational events that accumulate upon repair. Such mutations have been correlated with a higher incidence of mitochondrial dysfunction and age-related diseases, such as diabetes, cancer, Parkinson's and Alzheimer's. PFJ can be delivered as a nutraceutical, alone or in conjugation with drug therapies.

Our results in vitro using the human liver carcinoma cell line HepG2 revealed that AZT exposure for 30 days induced up to a 9-fold increase in mutations as compared to normal culture media. When PFJ was added in combination to AZT exposure, the number of mutations significantly decreased by 35% when compared to AZT alone. PFJ was additionally found to mitigate the cytotoxic effects of AZT after exposure to increasing concentrations over the course of a 6-day period. Similar beneficial effects in reducing drug-induced mtDNA mutational loads were also observed by comparing the effects of PFJ on HepG2 cells after exposure to the drug isoniazid (INH) which is commonly used to treat patients having tuberculosis infections.

Our results suggest that antioxidant phenolics from PFJ can be used as a functional food ingredient in beverages or as a supplement in nutraceutical or therapeutic orally delivered products while not causing cytotoxicity. Brandeis Innovation is seeking exclusive partners to commercialize this technology with proposed marketing claims for treating or preventing mitochondrial dysfunction, genomic DNA damage and mtDNA mutations resulting as long-term side effects caused by exposure to nucleoside reverse transcriptase inhibitor and isoniazid drugs, chemotherapy, and radiation. Brandeis University holds the exclusive licensing rights in the United States and Europe for the use of PFJ to prevent DNA damage while Phenolaeis Sdn Bhd holds exclusive background rights from the Malaysian Palm Oil Board for industrial production of PFJ.

Summary

PFJ contains natural polyphenols for treating or preventing mitochondrial dysfunction, mtDNA damage and genomic DNA mutations caused by aging, disease and drugs

The mitigating effects on mtDNA and genome DNA damage was shown in human liver carcinoma cells

The protection is observed with a reduction in reactive oxygen species (ROS) to relieve oxidative stress

"Palm fruit juice mitigates AZT mitochondrial genotoxicity and dose-dependent cytotoxicity." (2104)

Journal of AIDS and Clinical Research 5:400.

Application area

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Advantages

Widely available as a low-cost side product of the palm oil milling process with variable delivery forms

Addresses long-term side-effects of certain drugs such as HIV/AIDS drug AZT and tuberculosis drug INH

Easily incorporated as a potential synergistic agent in nutraceutical or pharmaceutical formulations

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