

## Doxorubicin-induced Hepatotoxicity: Mechanism of Toxicity and Insights to the Protective Role of Bee Propolis

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**SUMMARY.** Doxorubicin (Dox) is one of the very effective anticancer medications; it induces objective tumor responses in solid tumors and in hematologic malignancies. Its use has been limited by its hepatotoxicity, oxidative stress indicated by raised MDA and decreased antioxidant enzymes such as SOD, GSH and catalase in Dox-administrated patients. Bee products, such as propolis contain a broad spectrum of compounds that have many biological activities, like flavonoids. In this review, we primarily concentrated on stating the mechanisms underlying hepatotoxicity brought on by the administration of Dox and making attempts to comprehend it at the molecular level. Additionally, we want to make a case for propolis' ability to protect against multiple toxicity caused by Dox. Propolis is a resinous natural hive product derived from plant exudates. These can show increased the possibility that propolis may be an adjuvant therapy, saving organs from apoptotic actions and oxidative related to Dox, decreased its adverse effect.

**RESUMEN.** La doxorubicina (Dox) es uno de los medicamentos contra el cáncer muy eficaces; induce respuestas tumorales objetivas en tumores sólidos y en neoplasias hematológicas. Su uso se ha visto limitado por su hepatotoxicidad, estrés oxidativo indicado por MDA elevado y disminución de enzimas antioxidantes como SOD, GSH y catalasa en pacientes a los que se administra Dox. Los productos apícolas, como el propóleo, contienen un amplio espectro de compuestos que tienen muchas actividades biológicas, como los flavonoides. En esta revisión, nos concentramos principalmente en exponer los mecanismos subyacentes a la hepatotoxicidad provocada por la administración de Dox y en intentar comprenderlo a nivel molecular. Además, queremos defender la capacidad del propóleo para proteger contra la toxicidad múltiple causada por Dox. El propóleo es un producto resinoso natural de la colmena derivado de exudados vegetales. Estos pueden mostrar una mayor posibilidad de que el propóleo pueda ser una terapia adyuvante, salvando los órganos de las acciones apoptóticas y oxidativas relacionadas con Dox, disminuyendo su efecto adverso.

**KEY WORDS:** bee propolis, doxorubicin, hepatotoxicity, oxidative stress.

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