Decline in peroxidase and catalases by lindane may cause an increase in reactive oxygen species in *Saccharomyces cerevisiae*

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Abstract

Lindane is an organochlorine insecticide, persistent in soils and aquifers, lipophilic, chemically and biochemically inert that accumulates along the human food chain. It is commonly used on a wide variety of crops, in warehouses, in public health to control insect-borne diseases, and as a seed treatment. Lindane is also presently used in lotions, creams, and shampoos for the control of lice and mites in humans. Several chemicals as lindane, toxic for aquatic organisms, birds and mammals have been in the news recently, since the European Union intends to ban it. Therefore it is urgent to clarify the toxicological mechanisms of this compound in eukaryotic cells. Thus the main purpose of this work was to evaluate the effects of lindane in the wine wild-type *Saccharomyces cerevisiae* UE-ME$_3$. The results show that lindane inhibited cell growth of *S. cerevisiae* UE-ME$_3$, causing a decrease in the biomass produced along 72 h, as well as cell viability from 24 h of assay. On the other hand, was detected an increase in the reactive oxygen species content of post-12,000×*g* sediment of cells exposed to 5 μM lindane and post-12,000×*g* supernatant of cells subjected to any exposure conditions, eventually conditioned by a decline in glutathione peroxidesase and catalase T activities, which has become the detoxification of hydrogen peroxide less effective. The increase in the CAT A activity without significant changes in the alkaline phosphatase and Se-GPx activities justified, in part, the increase in ROS levels of *S. cerevisiae* exposed to lindane, as well as the loss of cell viability due to inadequate response of glutathione cycle or cells signaling pathways that assure lipid biosynthesis.

Keywords: organochlorine; gluthatione peroxidase; yeast

1. Introduction

Lindane or gamma 1α,2α,3β,4α,5α,6β-hexachlorocyclohexane (Fig. 1) is an organochlorine phytochemical widely used as an insecticide for over 50 years, regarded as environmentally persistent, bioaccumulative and chemically stable, is distributed in a ubiquitously way up to large distances. Their use puts high concern in the global community since been awarded geno-, neuro-, hepato- and immunotoxic properties in studies conducted on rodents and even the ability to affect reproduction and development in laboratory animals. Although it is used in veterinary and human medicine, its environmental concentration can cause metabolic changes that can lead to oxidative stress or other unforeseeable consequences [1-7].

Saccharomyces cerevisiae UE-ME$_3$, vinous native strain of Alentejo, Portugal, was selected as biological model to test the toxicity of lindane in a eukaryotic organism, being described as resistant to the presence of phytochemicals or metal and mimic the response of higher eukaryotes such as humans, by having homologies with sequential enzymatic systems of the response to stress [8,9].

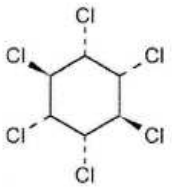

Fig. 1. Structure of lindane.