MOLECULAR AND GENOTOXIC STUDIES OF SOME NATURAL AND SYNTHETIC COMPOUNDS

By

ASMAA MAHER METWALY MOHAMED
B.Sc. Agric. Sci. (Biotechnology), Fac. Agric., Cairo Univ., 2013

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ABSTRACT

Many health risks occur as a result of the use of synthetic food additives in industry, on a large scale, that was illustrated by many health and cancer organizations. So that, the present study investigated the genotoxicity effects of nine food additives that includes different classes of synthetic and natural additives (Colors, Preservatives, Antioxidants, Flavors and Sweeteners) on lymphocytes from rats or human volunteer.

The genotoxicity was estimated using the alkaline comet assay, while the cytotoxicity was determined by Trypan blue exclusion method and the IC_{50} was calculated for each compound. Significant genotoxic effect obtained in the comet assay presented as tail percentages and tail moment for DNA strand breaks. Hence, the migration of its fragmentations from the head (chromosomes in nucleus) by electrophoretic mobility was determined on low melting agarose gel.

Furthermore, the investigation of the genotoxic effects of tested food colorants and sweeteners including; Erythrosine, Carminic acid, Aspartame and Sorbitol on another cell type (human lymphocyte cells) were proceeded using the alkaline comet assay. Their ability to induce apoptosis, which is required to be sure that the tested compounds are safe on human health, was also studied.

The results showed that most of the investigated natural food additives have no detected genotoxicity effects at the tested concentrations, while most of the corresponding synthetic food additives gave significant genotoxic results at the same concentrations. However, Carminic acid as a natural coloring agent showed genotoxic result similar to its corresponding synthetic food coloring agent (Erythrosine). Furthermore, Isoamyl acetate and Butylated hydroxyl anisole (BHA) as synthetic additives, showed no genotoxic effect. Aspartame at 6 µg/ml and 10 µg/ml revealed a significant DNA damage at *p*. value <0.05 .

Unexpectedly, Sorbitol as a natural sweetener showed a high genotoxic effect and it induced apoptosis in human lymphocytes. Meanwhile, Erythrosine, Carminic acid and Aspartame gave no detectable genotoxic effects, but they induced apoptosis in the tested cells.

From the obtained results, it can be concluded that the synthetic food additives (Erythrosine, Potassium sorbate and Aspartame) and Carminic acid, as natural food coloring agents, caused DNA strand breaks in rat lymphocyte cells; which in turn leads to dangerous health effects. However, Sorbitol did not depict harmful effects on DNA, when tested on rat lymphocyte cells, but it caused a life cycle disturbances, induces the apoptotic pathway and DNA damage, which revealed its harmful effects at cellular and genetic levels in human lymphocyte cells, at the tested concentration. In contrary, Erythrosine, Carminic acid and Aspartame did not affect DNA, however these additives have bad effects on cell cycle when they were tested on human lymphocyte cells. Likewise, these additives conferred apoptosis insult.

Keywords: Synthetic and natural food additives, cytotoxicity, genotoxicity, alkaline comet assay, Sorbitol, apoptosis

DEDICATION

I wish to thank my family for providing a loving environment for me. My parents, Maher, M. and Rda, A. and my brothers Eslam Maher and Youssef Maher .They raised me, supported me and loved me. To them I dedicate this thesis. I wish to thank my doctors and my colleagues in Biochemistry department for their kind feelings and their love.

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