

Cytotoxicity and genotoxicity study of *Aloe vera* gel using *Allium cepa* as a plant bioassay

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Structured Abstract

Background: *Aloe vera*, a tropical plant from the Liliaceae family, was extensively used for a broad range of medical and cosmetic applications due to its antiviral, antimicrobial, antitumour, and antifungal properties. Despite these known benefits, limited studies have investigated its cytotoxic and genotoxic effects, particularly in commercial skincare products such as *Nature Republic Aloe Vera Soothing Gel*. This study aimed to evaluate the cytotoxic and genotoxic effects of *Aloe vera* gel by comparing the physical changes in *Allium cepa*, examining alterations in the mitotic index, and identifying chromosomal aberrations.

Methods: The research was done by exposing *Allium cepa* root tips to different concentrations of 2%, 4%, 6%, and 8% of *Nature Republic Aloe Vera Soothing Gel*, with distilled water as the control, over 24 and 48 hours. The *Allium cepa* test, is a well-known method used to study cytotoxicity and genotoxicity by looking at root length, growth rate, mitotic index, and chromosome changes. These were analysed using one-way ANOVA and Tukey post hoc test, supporting the conclusion that *Aloe vera* gel has cytotoxic and genotoxic effects.

Results: Most results showed no significant difference ($p > 0.05$), except for root length at 48 hours and chromosomal abnormalities at both 24 and 48 hours. The results found that root length, growth rate, and mitotic index increased from 0% to 4% concentration, with 4% having the strongest positive effect, as low to moderate concentrations of *Aloe vera* gel promote cell division and root growth due to helpful compounds like polysaccharides, amino acids, and plant hormones. However, at higher concentrations 6% and 8%, these effects dropped significantly. Meanwhile, chromosomal abnormalities steadily increased, with noticeable changes starting at 4% and peaking at 6% and 8% which indicates low doses help growth, but higher doses cause damage to cells, leading to issues like nuclear lesions, disintegration, lobulated cells, micronuclei, c-mitosis, lagging chromosomes, and sticky chromosomes.

Conclusion: In conclusion, this study's findings indicated considerable potential in the cytotoxicity and genotoxicity of *Aloe vera* gel, which revealed a significant inhibitory effect on cellular processes at higher concentrations. The implications of these results extend beyond plant systems, suggesting potential risks to other biological organisms.

Keywords: *Aloe vera*, *Allium cepa*, Chromosomal aberrations, Mitotic index

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