



Research Article

Effects of soft drink “Sprite” on root tips of *Allium cepa*.

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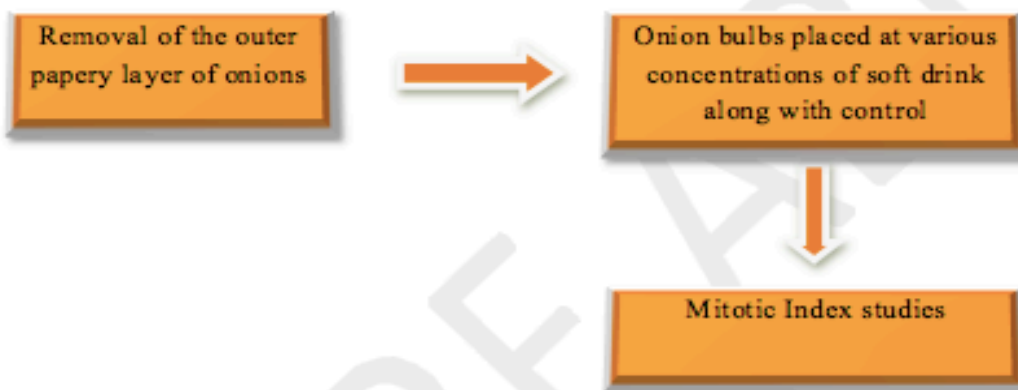
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Objective: To study the effects of soft drink on the mitotic index in root tips of *Allium cepa* at various concentrations.

Methodology:



The duration taken for the research: 02 months

Conclusion: The results revealed that the soft drink Sprite induces chromosomal aberrations as well as inhibition in cell division in the root tips of *Allium cepa*. Most of the aberrations were observed in chromosomes at Metaphase and Anaphase stage. It was found that the rate of cell division decreased on increasing the concentration and time exposure of tested soft drink. Thus it gives a warning about these drinks as they may cause harmful effects to the health.

Applicable Industries/Sectors: Food industries (Fast Moving Consumer Goods -FMCG) and Pubic.

Expected outcome: Public awareness about the impact of the soft drink consumption and disposal to the environment.

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Abstract

The present investigation has been conducted to study the effects of five different concentrations of soft drink “Sprite”(2%, 4%, 6%, 8%, 10%) with time exposure of 48hours on root tips of *Allium cepa* while distilled water is served as control and exposed to 48 hours. It was found that both the concentration of soft drink and time affect the mitotic index. The chromosome aberrations were higher affected in 10% concentration of the soft drink.

Keywords: Mitotic index, Chromosomal aberrations, Soft drinks “Sprite”.

Introduction

Most of the living organisms, including human beings in this biosphere, are regularly exposed to a variety of xenobiotics. Consumption of soft drink plays a significant role in a variety of diseases like obesity, diabetes, dental and bone disorders and others, more so among children and adolescents. The toxic effects of the soft drink have gained much attention due to the frequent scientific reports and media attention. Most of them are prepared by mixing carbonated water with the syrup of sugar, phosphoric acid, caffeine, and other natural flavours.

In human beings, a large number of popular soft drinks cause dental enamel erosion (Jandt, 2006). Frequent consumption of soft drink is associated with an increased incidence of wrist and forearm fractures (Ma and Jones, 2004) due to decrease in the bone mineral density among children in the age group of 9-16 years. Recent studies have shown that the consumption of soft drink and sweetened fruit soups are positively associated with a higher risk of pancreatic cancer (Larsson *et al.*, 2006). In the case of plants, soft drink when applied, retard the absorption of nutrients and water resulting in a decrease in plants development and ultimately leads to death. The present study was to prove the effect of soft drink “Sprite” on root tips of *Allium cepa*.

Allium cepa bulbs were selected for research materials because it is easy to obtain root meristem and have a less number of chromosomes ($2n=16$). The cells at the root tips are actively dividing, resulting in many cells that will be in the mitosis stage. The onion is a subspecies and primary member of the genus *Allium*. Because many *Allium* species share the common name Onion, the “Garden Onion” also known as the “Bulb Onion” and “Shallot” is referred to as *Allium cepa* (Jones *et al.*, 1963)

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Materials and Methods

Dry, healthy white *A. cepa* were collected from local markets. The outer papery brown layers were peeled off, and the dried basal root plates were cleaned. They were placed in a beaker filled with distilled water, and the root growth was observed for 48 hrs. Rests of the bulbs were placed in 2%,4%,6%, 8% and 10% of Sprite soft drink for 48 hours. The root tips were excised and kept in fixative (ethanol: acetic acid, 3:1 v/v) for 90 min and hydrolyzed in 1 N HCl. It was stained in 1% aceto-carmine and squashed using a glass rode to observe the cells clearly on a microscope slide. A light microscope was used for mitotic study and to check the chromosomal aberrations. Mitotic index is calculated using the below formula and tabulated.

$$\text{Mitotic index} = \frac{\text{Number of dividing cells (n)}}{\text{Total number of cells contained}} \times 100$$

Results and Discussion

Effect of soft drink on Mitotic index

Exposure to soft drink" Sprite" inhibited mitotic index in a concentration-dependent manner when compared to the mitotic index of the control. The lowest mitotic index value was recorded for 10% of Sprite. The mitotic index decreased as the concentrations of the soft drink increased from 2% to 10%. The aberrations observed during the treatment increased over higher concentration exposure to soft drinks. The most common aberration was spindle abnormalities in metaphase, and it might be due to failure of chromosomes to form the metaphase plate correctly, or some of the chromosomes were not aligned in the equatorial line when other chromosomes were arranged at the equator. Instead, they were scattered over the cell and formed chromosome fragments and bridges.

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Figure 1: *Allium cepa* grown in water (control), 2%, 4%, 6%, 8% and 10% concentration of sprite

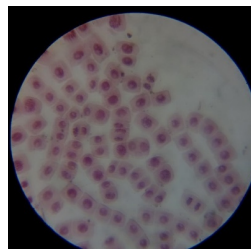


Figure 2: Microscopic view of mitotic cell division in the root of *Allium cepa* grown in water.

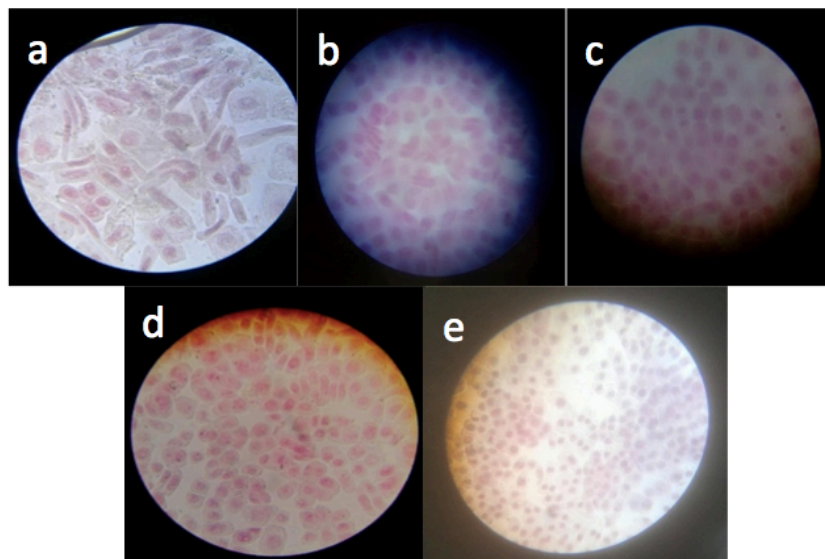


Figure3: Effect of various concentrations of sprite on mitosis in the cells of *Allium cepa*. a: Mitosis in 2% sprite, b: Mitosis in 4% sprite, c: Mitosis in 6% sprite, d: Mitosis in 8% sprite, e: Mitosis in 10 % sprite

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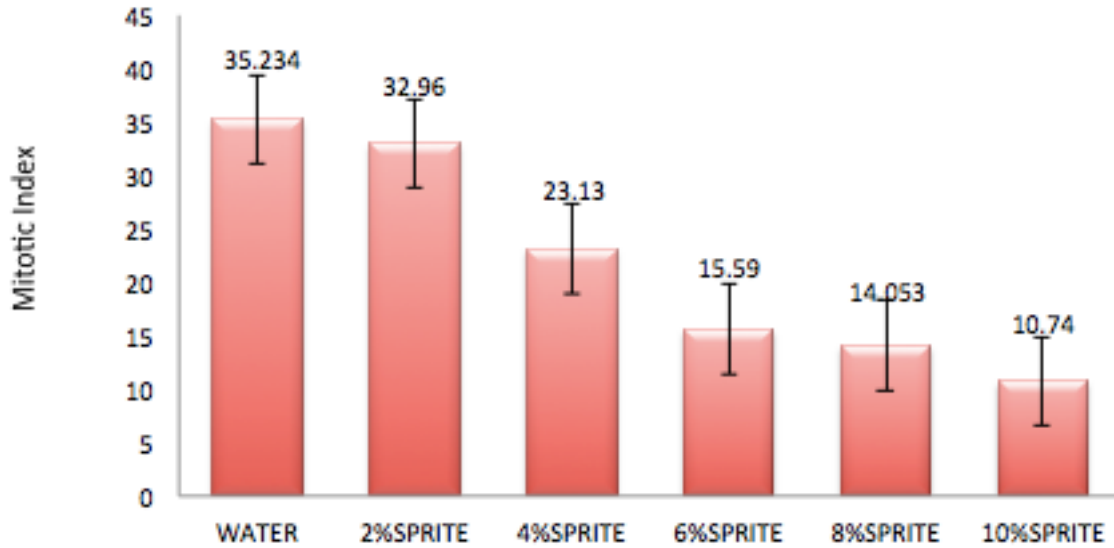


Figure 3: Graph representing the decrease in the mitotic index in root tips of *Allium cepa* treated with the various concentrations of the sprite.

In this study, a toxic effect of the soft drink “Sprite” was evaluated by analysing the root growth. The high concentration of Sprite, i.e. 10%, caused inhibition of root growth and showed a significant difference between the control group (water). Besides, Cytotoxicity was estimated by observing the mitotic index. The mitotic index of *Allium cepa* treated with different concentration of sprite was significantly decreased when compared with control (water). According to Karaismailoglu [3] decline in mitotic index in *Allium cepa* root cells with increasing treatment periods with soft drinks may reflect cytotoxicity of soft drinks through the inhibition of cell cycle from the S (synthetic) phase to the M (mitosis) phase, or might be due to prevention of DNA synthesis and holding the cell from entering mitosis

Conclusion

It revealed that the soft drink Sprite produces chromosomal aberrations as well as inhibition in cell division in the root tips of *Allium cepa* and also that most of the aberrations observed in chromosomes at Metaphase and Anaphase stages. From this, it was cleared that the rate of cell division decreases on increasing the concentration and time exposure of tested soft drink. Thus it gives a warning to the consumption of these drinks as they are harmful to the health, and their regular intake must be avoided.

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Reference

1. Rencüzoğullari, E., Kayraldiz, A., İla, H. B., Çakmak, T., & Topaktaş, M. (2001). The cytogenetic effects of sodium metabisulfite, a food preservative in root tips cells of *Allium cepa* L. *Turkish Journal of Biology*, 25(4), 361-370.
2. Auerbach, C. (1951). Soft Spring Harbour symposia on quantitative biology, 16,199.
3. Berkey, C. S., Rockett, H. R., Field, A. E., Gillman, M. W., & Colditz, G. A. (2004). Sugar added beverages and adolescent weight change. *Obesity research*, 12(5), 778-788.
4. Choi, H. K., & Curhan, G. (2008). Soft drinks, fructose consumption, and the risk of gout in men: prospective cohort study. *Bmj*, 336(7639), 309-312.
5. Choi, S., PARK, K. H., Cheong, Y., Moon, S. W., PARK, Y. G. & PARK, H. K. (2012). Potential effects of tooth brushing on human dentin wear following exposure to acidic soft drinks. *Journal of Microscopy*, 247(2), 176-185
6. Farhan, E. M., & Tawfiq, R. F. (2016). Detection of Cytotoxicity and Carcinogenicity of Soft Drink " Cola" on *Allium Cepa* Root Cells.
7. Hannah, C., Priya, E. J. S., & Mammen, A. (2016). Duration-dependent mutagenic study of cola drinks on *Allium cepa* L. *Biosciences Biotechnology Research Asia*, 7(2), 807-812.
8. Herceg, Z. (2007). Epigenetics and cancer: towards an evaluation of the impact of environmental and dietary factors. *Mutagenesis*, 22(2), 91-103.
9. Johnson, S., Saikia, N., & Kumar, A. (2006). Analysis of pesticide residues in soft drinks. *Centre for Science and Environment Report 41, 2006, Tughlakabad institutional area, New Delhi, 110062*
10. James, J., & Kerr, D. (2005). Prevention of childhood obesity by reducing soft drinks. *International journal of obesity*, 29(S2), S54.
11. Jensdottir, T., Bardow, A., & Holbrook, P. (2005). Properties and modification of soft drinks in relation to their erosive potential in vitro. *Journal of dentistry*, 33(7), 569-575.
12. Jones, H. A., & Mann, L. K. (1963). Onions and their allies. *Onions and their allies*.
13. Karaismailoglu, M. C. (2014). Investigation of the Cytotoxic and Genotoxic Effects of *Artemisia annua* Methanol Extract with the *Allium* Test. *Ekoloji Dergisi*, 23(91).
14. Sax, K., & Sax, H. J. (1966). Radiomimetic beverages, drugs, and mutagens. *Proceedings of the National Academy of Sciences of the United States of America*, 55(6), 1431.

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15. Kumar, L. P., & Panneerselvam, N. (2007). Cytogenetic studies of food preservative in *Allium cepa* root meristem cells. *Med. Biol*, 14(2), 60-63.
16. Levan, A. (1951, January). Chemically induced chromosome reactions in *Allium cepa* and *Vicia faba*. In *Cold Spring Harbor symposia on quantitative biology* (Vol. 16, pp. 233-243). Cold Spring Harbor Laboratory Press.
17. George, Maya, & George, Arya. (2017). Genotoxicity of Caffeinated Soft Drinks on Meristematic Root Cells of *Allium*. *IJRSET*, 6,11.
18. Okagbue, R. A. (1990). Comparative cytological effects of three antimalaria crude plant extract *Azadirachta indica*, *A. jusc*, *Alstoniaboonei*, *Carica papaya* and three synthetic Antimalaria drugs Chloroquine, Daraprim, and Fansidar on the root tip mitosis of *Hippeastrum equestre*. *NigJor Bot*, 7, 51-62.
19. Okoli, B.E. & Russom, Z. (1987). Effects of an aqueous extract of *Cassia alata* leaves on mitosis of *Allium cepa*. *Biologia Africana*, 46, 54-62.
20. Palha, P. G. (2005). Tecnologia de refrigerantes. *Rio de janeiro: Ambev*.
21. KB, S., & Rangaswamy, V. (1979). Cytological effects of paper mills effluents on somatic cells of *Allium cepa*. *Cytologia*, 44(4), 921-926.
22. Chandraker, S. K., Priyanka, S., & Bhawana, P. (2014). Clastogenic effect of soft drink on root tip of *Allium cepa*. *International Journal of Current Microbiology and Applied Sciences*, 3(5), 200-206.
23. Umar, I.D. (2004), Cytological effects of crude water extracts on three commonly used masticatories on *Allium cepa* root tip. Proceedings of the 29th Annual Conference of the Genetic Society of Nigeria held at University of Agricultural Abeokuta, 15-19.
24. Wongkhantee, S., Patanapiradej, V., Maneenut, C., & Tantbirojn, D. (2006). Effect of acidic food and drinks on surface hardness of enamel, dentine, and tooth-coloured filling materials. *Journal of dentistry*, 34(3), 214-220.



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