

EFFECTS OF SOFT DRINKS AND MAGGI NOODLE MASALA ON MITOSIS IN *ALLIUM CEPA* L. ROOT TIPS

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ABSTRACT

In the present research work, the effects of various soft drinks on the mitotic division in the root tips of onion (*Allium cepa* L.) were studied. The onion bulbs were allowed to germinate in soil and after germination, the roots were treated with various soft drinks (RICHYAA, COCA COLA, PEPSI, SPRITE and 7 UP) and maggi masala solution for 1 hour. After one hour, the root tips were used for the mitotic studies. Untreated root tips served as control. From the results, it was clear that the different soft drinks significantly reduced the rate of cell division and caused many chromosomal aberrations. COCA COLA treated root tips showed numerous interphase lesions and cells failed to proceed to actual mitotic divisions. In other treatments, the cells proceed to prophase, but single and double nuclear lesions observed clearly in the cells. Similarly, the maggi masala treated root tips also showed prophase lesions. Thus from the results it can be concluded that, the widely used soft drinks and maggi masala imparted severe chromosomal aberrations in root cells, which can lead to mutagenic effects.

Keywords: *Allium cepa*, Chromosomal aberrations, Mitosis, Soft drinks

INTRODUCTION

Soft drinks are non-alcoholic water based flavoured beverages that may be sweetened, acidified, or carbonated, and can include fruit juice or added salts. Their flavor can come from plant extracts or various aromatic ingredients. They offer virtually none of the essential nutrients and are sweetened with sugar, high fructose corn syrup, fruit juice a sugar substitute or some combination of these. Soft drinks flavours came from artificial or natural flavours. Acids like citric and phosphoric acid contribute a sour flavour and also function as preservatives. Colouring agents might also be added. The British Soft Drinks Association Annual Report (2016) indicates that soft-drink consumption in the UK rose slightly—by 0.2%—between 2010 and 2015. In 2015, consumers drank 13.3 billion litres, compared with 13.2 billion litres in 2010, with no- or low-calorie beverages (0–20 kcal per 100 ml) accounting for 58% of total intake.

Some soft drinks have been linked to negative impacts on both dental and overall health, particularly among children and adolescents. In response, manufacturers and government bodies have undertaken various measures to lessen the health risks associated with sugar-sweetened beverages. These initiatives include prohibiting soft-drink sales in schools, limiting advertising, reformulating products, and imposing taxes on sugary drinks.

Similarly, the noodles are very popular nowadays among children and youngsters. This is mainly due to the easy preparation method of noodles. But these noodles used along with the masala supplied along with the noodles. This masala contains many food preservatives and there are several reports on the side effects of consuming noodles excessively. Eating noodles every day, especially instant noodles, can lead to several negative health effects including: high blood

pressure due to high sodium content, weight gain from excessive calories, nutrient deficiencies due to low fiber and protein, digestive issues like bloating and constipation, increased risk of heart disease, and potential metabolic disruptions derived from processed carbs and harmful fats.

There are many reports on the effects of soft drinks on human health. But research work related to the influence of these soft drinks and noodle masala on cell division is less. This project work discusses the effects of five common soft drinks and noodle masala (maggi) on mitosis of onion root tips.

MATERIALS AND METHODS

MATERIALS

Plant material

Onion (*Allium cepa* L.)

Soft drinks

Commonly used soft drinks-RICHIYAA, COCA COLA, PEPSI, SPRITE and 7 UP

Noodle Masala

Maggi noodle masala

Chemicals

1. Modified Carnoy's fluid
(1 acetic acid: 2 alcohol)
2. 70% Alcohol
3. 1N HCl
4. 2% Acetocarmine

METHODS

Incubation of *Allium cepa* bulbils in the Petri dishes for cytological studies

Allium cepa Assay

Onion bulbs (*Allium cepa* L., $2n=16$) of average size were allowed to germinate in soil. After 48 hours, the bulbs were taken out and washed in distilled water to remove the soil. Then the roots of onion bulbs were treated with different soft drinks and maggi masala solution for 1 hour in small glass bottles. Onion bulbs in distilled water was used as control. After 1 hour, the root tips were cut and fixed in modified Carnoy's fluid for 1 hour. After the fixations, the roots were taken out and washed in distilled water and then stored in 70% alcohol. For the cytological studies, the stored root tips were washed with distilled water to remove the alcohol and it was then treated with 0.1 N HCl for the cell separation. After this, the root

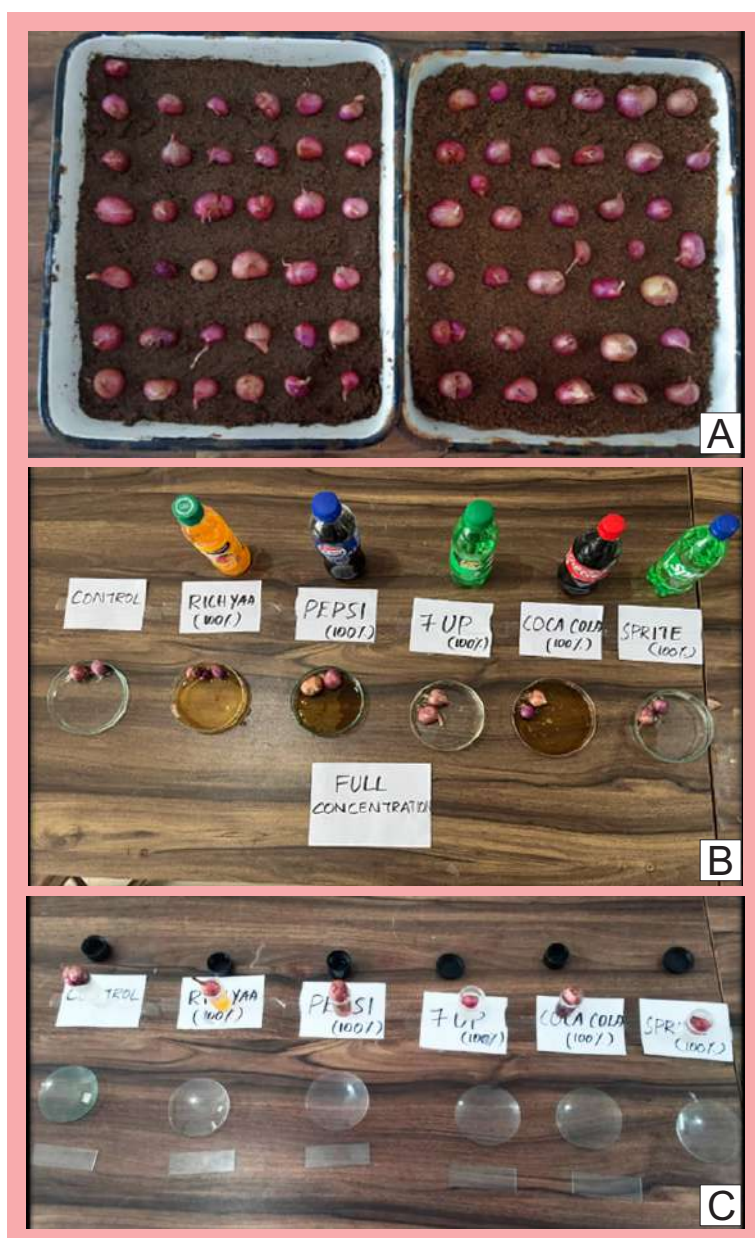


Fig. 1: Experimental set - Germination of onion bulbs in soil (A), Treatment of onion bulbs in Petri dishes and glass bottles (B, C).

tips again washed in distilled water and the extreme tip of roots with high mitotic activity was placed on glass slide, treated with 2% acetocarmine stain and coverslip was placed over the root tips and gently warmed and smear preparation was done by gently squashing the root tips. The smear was observed under compound microscope (LABOMED) (Fig. 1).

RESULTS

Cytological studies

In the control root tips normal cell division was observed. The mitotic stages like, prophase, metaphase and anaphase were observed in the cells of control. The number of cells undergoing cell division was also found to be high (Fig. 2 A&B). But in the treated root tips, the number of dividing cells was very less and most of the cells failed to proceed to metaphase itself. Among the different treatments, Coca cola showed highest mitotic aberrations, where, the cell division was arrested and

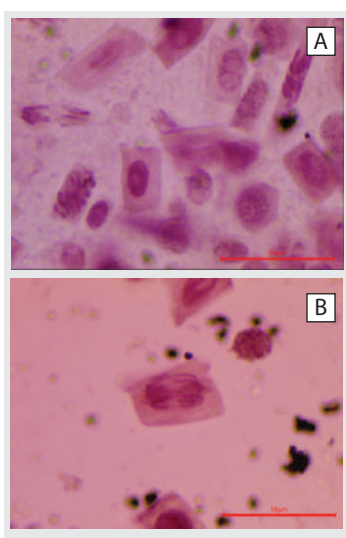


Fig. 2: Control – Mitotic stages- Prophase, Metaphase and Anaphase (A), Anaphase (B)

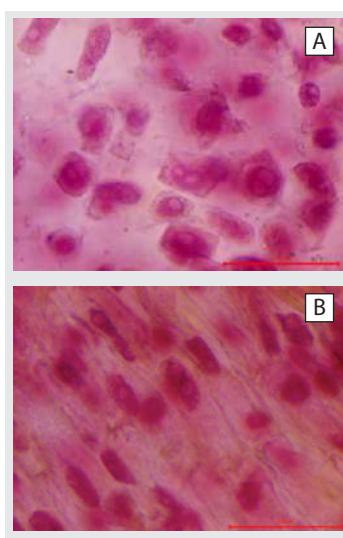


Fig. 3: Coca cola – Interphase lesions (A, B)

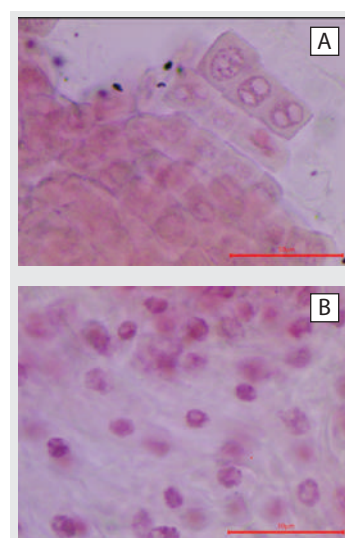


Fig. 4: 7UP – Prophase lesions (A, B)

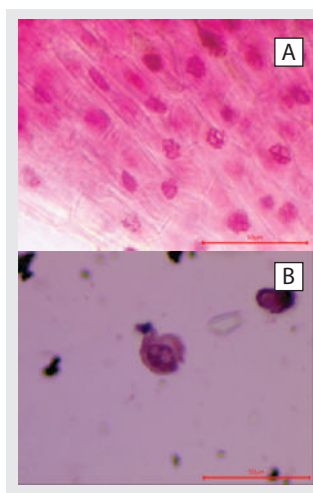


Fig. 5: Pepsi – Prophase lesions (A, B)

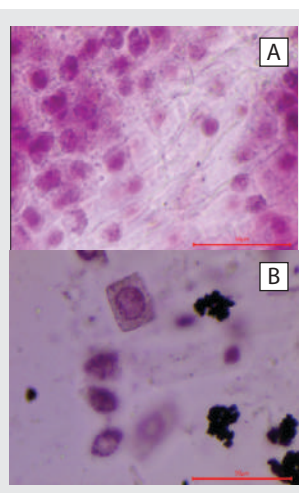


Fig. 6: Sprite – Sticky Anaphase (A), Prophase lesions (B)



Fig. 7: Richyaa – Interphase (A), Prophase lesions (B)

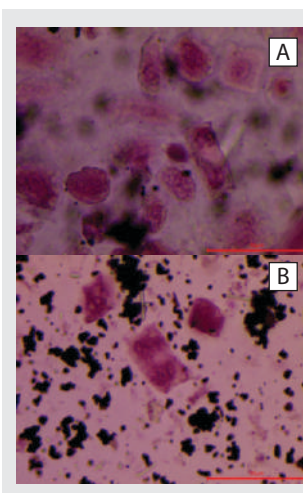


Fig. 8: Maggi Masala- Prophase lesions (A), Anaphase bridge (B)

in the interphase itself, nuclear lesions and chromosomal disintegration was observed (Fig. 3 A&B). In all other treatments prophase lesions were observed (Fig. 4 to 7). The least effect was observed in the sprite treated roots, where the cell entered the anaphase, but the anaphase was sticky due to the destruction of spindle fibers (Fig. 6A). The maggi masala treated root tips also showed several prophase lesions and anaphase bridges (Fig. 8 A&B).

DISCUSSION

Soft drink consumption has risen sharply over the past few decades, with the most significant growth seen in children and teenagers. Frequent intake of sugar-rich and acidic soft drinks—both regular and diet—can negatively affect dental and overall health, contributing to issues such as tooth decay, dental erosion, weight gain, obesity, and a higher likelihood of developing type 2 diabetes. Due to these detrimental effects of soft drinks on human health, the current project work is an attempt to investigate whether these so called soft drinks has harmful or beneficial effects on cytology of plants.

From the results of the project work, it was clear that all the soft drinks as well as maggi masala imparted negative effects on the cell division in onion root tips. Chandraker et al (2014) and Kayraldiz et al. (2001) studied the cytogenetic effects of different chemicals on root tip cells of *Allium cepa* L. Their studies showed that as the concentration of chemicals increased, cytotoxic effects and abnormalities in mitosis increased, which again indicate that these chemicals had negative impact on *Allium cepa* L. The inhibition of cell division, especially in the coca cola treated onion root tips may be due to the prevention of DNA synthesis during interphase and holding the cell from interphase. In other treatments, prophase lesions were observed, which may be due to the disintegration of chromosomes by the soft drinks. The metaphase and anaphase stages were not observed in the treated root tips, except in sprite treatment which again implies that the soft drinks caused destruction of spindle apparatus during mitosis. In sprite treated roots, anaphase was observed, but it was interrupted and observed as sticky anaphase.

SUMMARY AND CONCLUSION

In the present project work the effects of various soft drinks and maggi masala on onion root tip was studied and it was found that all the soft drinks used significantly reduced the rate of cell division and caused many chromosomal aberrations. The study provides strong evidence that common dietary substances such as soft drinks and Maggi Masala can negatively impact cell division and cause genetic alterations in plant cells. Although onion root tip cells serve as a model system, the findings raise concerns about potential health risks associated with prolonged consumption of these substances. Further research is needed to explore their effects on human cells and long-term implications on health.

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