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EVALUATION OF ANTIGENOTOXIC POTENTIAL OF TURMERIC EXTRACT AGAINST SODIUM POTASSIUM TARTRATE, A FOOD ADDITIVE

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ABSTRACT

Turmeric, the 'Golden spice' is the rhizome of Curcuma longa, which is a member of the family Zingiberaceae. Curcumin, the principal curcuminoid found in turmeric is the most active ingredient of the turmeric that gives its characteristic properties. The present study analyses the chromosomal aberrations that can be induced by Sodium potassium tartrate, a meat preservative in Onion root meristem cells and the efficiency of natural turmeric powder in reducing the cytotoxic effect of Sodium potassium tartrate. The concentrations of Na K tartrate used were 0.01%, 0.1%, 1% and 10% and observations were made on germination percentage, mitotic index, mitotic aberrations and frequency of mitotic aberrations. The efficacy of turmeric was assessed by the pre-exposure, co-exposure and post exposure treatments. The Co - exposure was found to be better than pre- exposure and post exposure as the former showed more mitotic index and reduced frequency of aberrations than the other two. Pre exposure showed better results than post exposure because in former more mitotic index and reduced frequency of aberrations were observed than latter.

Key words: Turmeric, antigenotoxic potential, Na-K tartrate, mitotic aberrations, Onion root cells

INTRODUCTION

Food additives are substances intentionally added to foodstuffs to perform specific functions, such as to improve shelf life, to enhance colour, flavour or consistency. The use of this additives is a well-accepted practice but not without controversy. Many additives used in modern food industry, have been in use for centuries in the preparation of food ingredients such as salt, sugar and vinegar which have served as preserving agents for thousands of years. The safety of all food additives that are currently authorized has been assessed by the Scientific Committee on Food (SCF) and the European Food Safety Authority (EFSA).

A preservative is a substance or a chemical that is added to products such as food, beverages, pharmaceutical drugs, paints, biological samples, cosmetics, wood and many other products to prevent decomposition by microbial growth or by undesirable chemical changes. In general, preservation is implemented in two modes, chemical and physical. Chemical preservation entails adding chemical compounds to the product. Physical preservation entails processes such as refrigeration or drying.

Since pre historic times, chemicals have been added to foods to perform special functions. Although basic food contains no additives, in processed food many alternatives are used. Technological advances in food processing have increased the variety and use of these additives. Today more than 2500 different additives are intentionally added to foods to produce desired effect. The use of this

additives is a well-accepted practice but not without controversy.

METHODOLOGY

a. Range Finding Test

To find out the suitable concentrations of the chemical (Sdium potassium tartrate) to be used in the experiment, range finding test was conducted using the concentrations 0.01%,0.1%,1% and 10%. From the results obtained, concentrations of sodium potassium tartrate that can be used in the assay were fixed as 0.01%, 0.1%, 1% and 10%.

b. Preparation of turmeric powder

For the preparation of turmeric powder, fresh rhizomes of *Curcuma longa* were collected. These were washed thoroughly, chopped into pieces and were dried in open sunlight. Dried rhizome was ground to make fine powder of turmeric.

c. Preparation of turmeric extract

20g of turmeric powder was weighed out accurately using an electronic weighing balance and was dissolved in 200ml distilled water. The mixture was kept in shaker for 24 hours. It was then filtered using filter paper to obtain10% stock solution. From the 10% stock solution, 5 mg/ ml extract was made by pipetting out 5 ml extract into a measuring cylinder and making the final volume to 100ml.

d. Test for antigenotoxicity

To study the antigenotoxic effect of turmeric, three sets of experiments were conducted as follows:

Pre - exposure

20ml of 5mg/ml *Curcuma longa* rhizome turmeric extract was added to first set of onion containing petriplates and kept for 24 hours. Then the bulbs were washed with distilled water and exposed to equal amount of different concentrations of test solution for another 24 hours. The control was supplied with only distilled water.

Co - exposure

20 ml of both chemical and *Curcuma longa* rhizome extract were simultaneously added to the second set of petriplates. Then after 48 hours, the root tips were fixed after washing with distilled water.

Post - exposure

The onions were first treated with 20 ml of respective concentrations of test solution for 24 hours. After the pre-treatment, the bulbs were washed and exposed to the same amount of extract. The petriplates were kept at room temperature for 48 hrs. for the germination of onion bulbs. After 48 hrs., the germinated bulbs were washed in distilled water for the removal of test solutions. The root tips were cut with razor blade and fixed in Carnoy's fluid. The microscopic preparations were developed by chromosome squash technique.

Photomicrographs of cells under mitosis and different mitotic abnormalities were taken using computer connected with Labomed Photo micrographic unit.

e. Analysis of the parameters.

Germination percentage (GP) =

$$\frac{Number\ of\ bulbs\ germinated}{Total\ number\ of\ bulbs}\ x\ 100$$

Mitotic index (MI) =

$$\frac{Number\ of\ dividing\ cells}{Total\ number\ of\ cells}\ x\ 100$$

Frequency of Mitotic aberrations =

$$\frac{Number\ of\ cells\ s\square owing\ aberrations}{Total\ number\ of\ dividing\ cells}\ x\ 100$$

g. Statistical Analysis

Results obtained were analyzed statistically to find out mean and standard deviation. One way ANOVA was performed for assessing the significance of the results.

RESULTS AND DISCUSSION

According to Grant (1982), Allium test has been used for the determination of genotoxic effect of various compounds and it is considered as the standard procedure for quick testing and detection of toxicity of food additives. In the current study, when onion bulbs are treated with sodium potassium tartrate for 48 hrs., higher germination percentage (100%), maximum number of roots /bulbs, maximum mitotic index (95%) and absence of mitotic aberrations were observed in control. Gradual decrease of germination percentage, no. of roots/bulb, mitotic index and increase in the appearance of mitotic aberrations were noted with increase of concentration of the chemical. Lower germination percentage, reduced no. of roots / bulb, minimum mitotic index, maximum mitotic aberrations and maximum frequency of aberrations were noted in higher concentrations of Na – K tartrate (table 1). Similar findings were observed in *Vinca faba* root cells (Pandey and Santhosh, 2007) and also in *Allium cepa* root cells treated with food additives other than sodium potassium tartrate (Faizah and Wahab, 2014; Palani et al., 2007; Sifa, 2005).

Different types of abnormalities revealed after treatment with Na - K tartrate in the present study were pulverized chromosome at metaphase, chained metaphase, chromosome clumping, sticky chromosome, dislocation of chromosome, diagonal metaphase, nuclear lesions, chromosome breakage, diagonal telophase, chromosome clumping at metaphase and strap shaped nucleus.

In recovery test, three types of exposures were given to onion bulbs *Curcuma longa* rhizome extract: Pre- exposure, Co-exposure and Post exposure. On treatment with *Curcuma longa* rhizome extract, an increase in mitotic index was noted compared to the chemical alone treated onion bulbs. Also, the frequency of mitotic aberrations was decreased. The type of aberrations was also reduced and it shows the antigenotoxic effect of *Curcuma longa* against chemicals. The Co -exposure was found to be better than pre-exposure and post exposure because the former showed more mitotic index and reduced frequency of aberrations than the other two. Then pre- exposure is found to be better than post exposure because in pre - exposure more MI and reduced frequency of aberrations were observed compared to post - exposure (table1).

The results indicate that the consumption of food containing these additives along with the turmeric in any form is better than the consumption of food before or after the intake of this herbal product. The positive results with regard to the toxicity of Na - K tartrate in the *Allium* test should be considered as a warning and also an indication that the tested chemical may be a risk to human health and to our environment.

Table 1. Antigenotoxic potential of turmeric extract against Sodium potassium tartrate

Concentration	GP			Roots/bulb			MI			Frequency of aberrations		
	PrE	CE	PoE	PrE	CE	PoE	PrE	CE	PoE	PrE	CE	PoE
DIST.WATER	80	80	80	9	5	8	0.85	0.85	0.79	0	0	0
0.01	60	60	60	8	6	7	0.74	0.80	0.61	9.8	8.6	11.08
0.1	30	40	40	4	3	4	0.62	0.79	0.60	29.1	11.58	22.9
1	20	40	20	2	3	3	0.51	0.65	0.53	30.05	23.1	30.5
10	10	-	-	2	-	-	0.59	-	-	33.1	-	-

PrE-pre exposure, CE-Coexposure, PoE-Post Exposure

CONCLUSION

The present study revealed that sodium potassium tartrate, which is used frequently in food industry as preservative and flavouring agent have genotoxic effects. Further studies in animal models are needed to confirm harmful effect of sodium potassium tartrate if used as

food additive.

The study also confirmed the antimutagenic and

antigenotoxic property of turmeric rhizome extract which was responsible for the decrease in sodium potassium tartrate induced chromosomal aberrations. Co - exposure to turmeric was found to be more effective in overcoming the toxic effect of Na-K tartrate than pre- exposure and post- exposure. Further studies in this context are needed to understand the different mechanisms by which the rhizome extracts of *Curcuma longa* perform the protective role against harmful food additives.

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