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FOUL ROLE OF A PERMITTED RED FOOD COLOUR

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ABSTRACT

Food dyes are one of the most widely used and dangerous additives. Food colours synthesized originally from coal tar and now petroleum have long been controversial because of their safety concerns. Many food colours have been banned because of their adverse effects on laboratory animals. Erythrosine is a permitted synthetic food colour in India.It is used in many food items . This study is an attempt to review the dangerous effect of erythrosine a commonly used permitted red food colour.

Key Words: DNA Damage, Erythrosine, Mutagen city/ Carcinogenicity, Permitted Food Colour

I. INTRODUCTION

In modern food industry with the development of technological advancement use of synthetic food colours is increasing day by day. The colour of our food plays an important role by visually stimulating our appetite. To meet the consumer demands manufacturers of different food products try to produce attractive foods. So they add synthetic food colours ignoring their ADI limit. Children are attracted more towards the coloured food items than adult so consumed foods containing colour additives more frequently. Synthetic food colours are used in baked goods, beverages, candies, gelatine, sodas, juices, pet foods, medicines etc. Synthetic food colours are superior than natural food colours and often added to foods to mask poor product quality or spoiled stock, natural variations in colour, protecting foods from colour loss, temperature, moisture, air and storage conditions. Synthetic food colours are more stable, cheap and easily available, so has occupied a leading position in all food additives now -a - days. Despite a number of benefits attributed to synthetic food colours ,scientist are concerned about risks of consuming these substances as all these are chemically synthesized and derived from aniline, a petroleum product that in pure form is toxic. Food safety and standard authority of India has set some rules and regulation for the use of these artificial food colours. However in spite of control demanded by different regulatory agencies, the manufacturers of different food industry are using synthetic food colours indiscriminately, ignoring their ADI (Acceptable Daily Intake) to produce attractive food. Eight food colours are permitted for use in India with their fixed ADI by FDA .

II. PERMITTED FOOD COLOURS IN INDIA

Following synthetic food colours are permitted to use in different food items in India (According to the Rule 28 of Indian PFA)

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S. No.	Colour	Common name	Other name	Colour Index
1.	Red	Ponceau 4R	Food Red 7	16255
		Carmoisine	Food red 3	17420
		Erythrosine	FD&C Red No. 3	45430
2.	Yellow	Tartrazine	FD&C Yellow No. 5	19140
		Sunset Yellow FCF	FD&C Yellow No. 6	15985
3.	Blue	Indigo Carmine	FD&C Yellow No. 5	73015
		Brilliant Blue FCF	FD&C Blue No.	42090
4.	Green	Fast Green FCF	FD&C Green No. 3	42053

These food colours are frequently available in the market in the form of blends of
Two or more dyes and are widely encountered in a variety of eatables from both urban and rural market [1].
The present paper is a review to study the dangerous effect of erythrosine, a commonly used permitted food colour on the basis of literature available.

III. ERYTHROSINE AS A CHOSEN FOOD COLOUR

Erythrosine is also known as **Red No. 3**. It is the disodium salt of 2, 4,5,7-tetraiodo fluorescein. Erythrosine is cherry-pink in colour. Its **Molecular formula is** C20H6I4Na2O5

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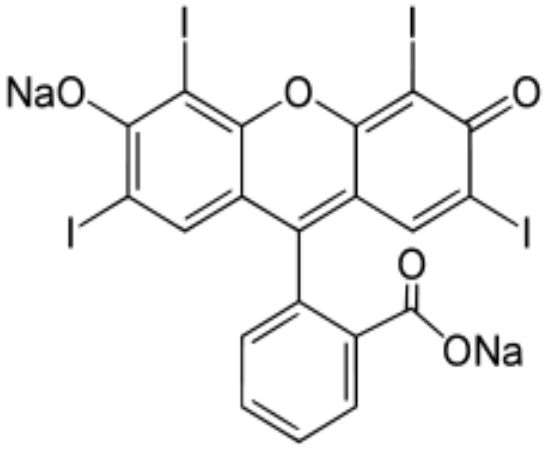

Molecular Structure of Erythrosine

Erythrosine is commonly used in sweets ,candies and popsicles, cake-decorating gels, pistachio shells ,beverages, canned cherries ,printing inks ,biological stain ,dental plaque disclosing agent , act as sensitizer for orthochromatic photographic films, medicines etc. The acceptable daily intake (ADI) of erythrosine in human is 0 to 7.5 mg/kg bw [2]. Erythrosine is a colouring agent permitted for use in food and in medicines for oral use in many countries around the world, including India ,Australia and New Zealand, but banned in Norway and U.S.

IV. ADVERSE EFFECTS OF ERYTHROSINE

4.1 Cytotioxicity , mutagen city, carcinogenicity and DNA Damage

[3]studied geotaxis and mutagenic effects of erythrosine B, a xanthene food dye, on HepG2 cells. They suggested erythrosine must be used carefully because it damages the DNA structure.

According to [4] erythrosine increased the yield of sporulation minus mutants of *Bacillus subtilis* excision repair-proficient strain 168 by approximately equal to 400% at a concentration of 1 mg/ml under ambient light conditions. This mutagenic response was dose-dependent (0-1 mg/ml).

Cytogenetic evaluation and DNA interaction studies of the food colourants amaranth, erythrosine and tartrazine was done by [5] they indicate that these food colorants had a toxic potential to human lymphocytes *in vitro* and it seems that they bind directly to DNA. Genotoxicity of related synthetic red tar dyes (amaranth - Red 2, allura red - Red 40, acid red - 106, new coccine - No. 18) was determined by [6] and they found colon DNA damage at very low doses.

Lifetime toxicity/carcinogenicity study of FD & C Red No. 3 (erythrosine) in rats was done by [7]. FD & C Red No. 3 was fed to Charles River CD rats as a dietary admixture in two long-term toxicity/carcinogenicity studies. In male rats receiving 4.0% FD & C Red No. 3 (2464 mg/kg/day) thyroid weights were increased, with a mean weight of 92 mg compared to 44 mg for controls, and statistically significant increases in the incidence of thyroid follicular cell hypertrophy, hyperplasia and adenomas were also recorded.

Chronic erythrosine ingestion may cause hyperthyroidism [8].Rats fed a 4% erythrosine diet for 30 months beginning in utero have an increased incidence of thyroid adenomas and adenocarcinomas. [9] treated male rats

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with a diet supplemented daily by the synthetic food colour erythrosine (0.08 and 0.4 g/kg diet) for 30 days. Results indicated that the two doses of erythrosine were found to be mutagenic .The observed chromosomal aberrations were centromeric attenuation, centric fusion, deletions, ring shaped, stickiness, end-to-end association, polyploidy, gaps and break. According to [10] site-specific DNA binding by p53 in RLE, HTB 125, HTB 133, and MCF-7 cells was increased when they were treated with erythrosine , which suggests that cellular DNA was damaged by this colorant. Consumption of erythrosine , which has estrogen like growth stimulatory properties and may be genotoxic, could be a significant risk factor in human breast carcinogenesis. Erythrosine was found to be negative in bacterial reverse mutation[11], in comet assay [12].

4.2 Serotonergic Activity

[13] Noticed short-term erythrosine B-induced inhibition of the brain regional serotonergic activity. It suppresses motor activity (exploratory behavior) of young adult mammals. Food dye erythrosin B inhibits ATP-dependent calcium ion transport by brain microsomes [14]. Erythrosine B, which has been implicated in minimal brain dysfunction in children was examined for its ability to increase membrane permeability to calcium ions by [15].They proposed the neurological effects of erythrosine to increased Ca^{2+} permeability in the lipid bilayer membrane and it was time dependent and increases with erythrosine B concentration raised to a high power (4 to 7).

4.3 Reproductive and neurobehavioral toxicity

Reproductive and neurobehavioral toxicity study of erythrosine (Red 3) administered to mice in the diet was done by [16]. Erythrosine was given in the diet to provide levels of 0 (control), 0.005, 0.015 and 0.045% from 5 weeks of age of the F(0) generation to 9 weeks of age of the F(1) generation in mice, and selected reproductive and neurobehavioral parameters were measured. In movement activities of exploratory behaviour, several parameters were significantly changed in the high dose group, and those effects were dose-related in adult females in the F(0) and F(1).

[17]did a study on the reproductive toxicity of erythrosine (Red No. 3) in male mice. The potential adverse effects of erythrosine (FD &C Red No. 3) on the spermatogenesis process were investigated in adult mice. The sperm count as well as the percentage of motile sperms were significantly inhibited by about 50% and 57% respectively. Moreover it increased the incidence of sperms with abnormal head by about 57% and 65% respectively. The induced increase in sperm abnormalities could enhance the spermatogenetic dysfunction and germ cell mutagenicity. These findings indicate that ER with used doses has a potential toxic effect on spermatogenesis in mice and in turn, it may affect its testicular function and reproductive performance.

4.4 Dopamine Transport

According to [18] erythrosine B inhibits dopamine transport in rat caudate synaptosomes. Erythrosin B also decreased non saturable binding of dopamine to the synaptosome membrane.

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V. CONCLUSION

The above discussion warn about foul role of erythrosine on human health . The inadequacy of much of the testing and the evidence for carcinogenicity, genotoxicity, and hypersensitivity, coupled with the fact that the dye do not improve the safety or nutritional quality of foods, indicates that erythrosine should be removed from the food supply and replaced by safer colourings. It is recommended that regulatory authorities require better and independent toxicity testing, exercise greater caution regarding continued approval of this dye. It is advisable that people should avoid the frequent use of erythrosine and switch over to natural dye a far as possible.

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