Changing scenario of food colours in India

Ramesh V. Bhat and Pultik Mathur

The scenario of usage of synthetic food colours in India is changing. Till recently, eight synthetic dyes were permitted to be added to specified food items at the maximum level of 200 ppm. Widespread prevalence of fraudulent practices like use of unpermitted colours or misuse of permitted colours and the inherent toxicity of these dyes has led the authorities to revise the regulatory provisions and make the laws pertaining to use of synthetic food colours more stringent. To fulfil the ultimate goal of reducing the total exposure to colours, data on dietary intake of food colours needs to be generated urgently in the country. Meanwhile, as the manufacturers are adding colour to food products to improve the appearance and consumer appeal, the consumers can play an important role in reducing their exposure to food colours by demanding foodstuffs free of artificial colour.

The trend of consumption of foods coloured with synthetic dyes has been increasing over the years. Traditionally, spices like turmeric, red chilli powder and saffron have been used not just for their colour but for the flavour they imparted to the foods and for their medicinal properties. Even the jilebi, a sweet which goes back nearly 600 years, was imparted a deep orange colour traditionally using saffron¹. Saffron is known for its stimulant and stomachic properties² while turmeric is a stomachic³ with antioxidant properties. It has been shown to lower lipid peroxidation by enhancing the activities of antioxidant enzymes⁴. Chilli is also used in several kinds of ailments like varicose veins, anorexia, liver congestion and vascular conditions as a prophylactic and therapeutic drug⁵.

Thus the traditional use of food ingredients was an integrated approach where one item served a variety of purposes. The modern system based on technological advancements in the food industry in developed countries on the other hand, believes in the use of different additives to serve different purposes. Thus the use of synthetic food colours which will impart only colour to the food item and serve no other function. Such an approach was probably adopted due to mass production technology and other advances in food processing technology. The cost and lack of availability of natural colouring materials and difficulty in incorporating these in the modern western technology of processing food might have resulted in the shift to using synthetic food dyes.

Regulatory measures in India

Presently, eight synthetic food colours, viz. erythrosine, carmoisine, ponceau 4R, indigo carmine, brilliant blue FCF, fast green FCF, tartrazine and sunset yellow FCF are permitted to be added to specified food items. The maximum permissible level of food colour that can be added to any food was 200 ppm and has been recently amended to a level of 100 ppm. It is mandatory to declare the addition of artificial colour on the label of the food item for sale. These specifications have been laid down by the Prevention of Food Adulteration (PFA) Act⁶. Those found violating the specifications are liable to prosecution.

In spite of the stringent regulatory provisions, surveillance studies have shown use of unpermitted synthetic colouring matters like textile⁷ and industrial dyes⁸. In a large proportion of cases where permitted colours are used, either they are added in excess of the statutory limit or they are added to foods in which they are not permitted. The non-permitted synthetic dyes commonly used are auramine (yellow), metanil yellow, lead chromate, rhodamine (pink), Sudan III and IV (red), orange II and malachite green. Such malpractices constitute a serious public health hazard.

Toxicity of colours used in foods

Unpermitted colours

The use of certain dyes has been banned as they are well known for their toxicity in experimental animals. Auramine was found to inhibit growth and lead to dysfunction of the liver and kidney⁹. Metanil yellow consumption could lead to degenerative changes in stomach, ileum, rectum, liver, kidney, ovary and testis¹⁰.¹¹. Rhodamine B was shown to cause retardation of growth, haemolysis of red blood cells and degenerative changes in liver and kidney¹². It also adversely affected the

The authors are in the National Institute of Nutrition, Jamai-Osmania PO, Hyderabad 500 007, India.
immune system\textsuperscript{13}. Sudan dyes were found to be toxic to the liver and produce kidney lesions\textsuperscript{14}. Orange II led to retardation of growth, increased mortality and haematological changes\textsuperscript{13}. Malachite green caused a decrease in food intake, growth rate and fertility rate. It also caused damage to organs like liver, kidney, heart and spleen as well as lesions of skin, eyes, lungs and bones\textsuperscript{9}. All the above colours are also mutagenic and most of them have been identified as potential carcinogens.

In humans, some of these dyes have been shown to lead to acute food poisoning outbreaks. Metanil yellow, the most commonly used non-edible, chemical dye, has been reported to cause symptoms of giddiness, weakness, vomiting and cyanosis. The people who developed these symptoms in two separate incidents had eaten foods like laddoo\textsuperscript{15} and biryani\textsuperscript{17} coloured with metanil yellow. Lead chromate added as a colourant to chilli powder caused lead poisoning among Gurkha soldiers with symptoms of epigastric pain, nausea, constipation and anaemia\textsuperscript{18}.

**Permitted colours**

The permitted colours are also not totally safe. High levels of erythrosine intake are known to cause thyroid tumours\textsuperscript{19}. Ponceau 4R, tartrazine and sunset yellow have provoked allergic reactions in several individuals even at low levels of intake\textsuperscript{20}. The allergic responses vary from urticaria to dermatitis, angioedema and exacerbation of the condition of patients with asthma. The incidence of tartrazine sensitivity appears to be higher in asthmatics. Persons who are sensitive to aspirin may also be sensitive to tartrazine and hence should avoid foods and even medicines having this yellow dye\textsuperscript{21}. Allergic reactions have also been seen in some people who consumed foods to which natural colours like annatto\textsuperscript{22} and carmine\textsuperscript{23} had been added. A study was conducted by National Institute of Nutrition in which school children consuming a particular brand of aniseed (saunf) exhibited symptoms of glossitis of tongue. Analysis revealed that the aniseed (saunf) had very high levels of ponceau 4R (ref. 24).

Thus, it is clear that even the permitted colours are not really safe. Their safety is a function of their total intake. For example, in a day a person may be exposed to synthetic food colours in the form of biscuits, confectionery items, cool drinks, sweetmeats and desserts including ice cream. In fact, for each of the permitted colours the Joint FAO/WHO Expert Committee of Food Additives (JECPA) has set an acceptable daily intake (ADI) based on toxicological studies on experimental animals and data from human clinical studies. The ADI has been defined as the amount that can be consumed everyday, throughout the life time of an individual without any harmful effect\textsuperscript{25}. The ADI for the permitted food colours varies from 0.1 mg/kg body weight for erythrosine to 25 mg/kg body weight for fast green (Table 1). The more toxic the food colours, the lower is the ADI.

The ADI can easily be exceeded by some individuals, especially children who are exposed to a variety of coloured confectionery (Figures 1 and 2) and savoury (Figure 3) items. A 20-kg child who consumes 100 ml of pink coloured ice cream or milk shake (with erythrosine added in the concentration of 200 ppm as is permitted in India) will be consuming ten times the ADI for erythrosine, i.e. 1 mg/kg body weight. And this is the situation when only a single source of erythrosine has been considered in his daily diet. The child can be exposed to erythrosine from a number of other foods like sugar candies, pastries, cakes, sherbets, etc. Besides, erythrosine is added to medicines, adding to the total exposure. The growing evidence of thyroid toxicity of erythrosine has caused the JECPA to lower its ADI from time to time. For example, in 1978, 2.5 mg/kg body weight was the ADI, which gradually reduced to 1.25 mg/kg body weight in 1984 and to 0.6 mg/kg body weight in 1986. The latest evaluation in 1990 further reduced the ADI to 0.1 mg/kg body weight\textsuperscript{26}.

It becomes extremely important to monitor the total daily intake of all food colours from the point of view that the ADI of none of the colours should be exceeded. Presently this data is not available in our country. The fixing of the maximum permissible level of synthetic colour and the foods in which it may be added is arbitrary and not based on the principles of risk assessment.

**Recent changes in regulations**

In 1988, there was a directive from the Indian Parliament to ban use of synthetic food colours mainly based on the evidences of indiscriminate use of non-permitted and permitted colours and their possible impact on human health. In order to implement the directive, the

<table>
<thead>
<tr>
<th>Colour</th>
<th>Name</th>
<th>ADI (mg/kg body weight)</th>
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</thead>
<tbody>
<tr>
<td>Red</td>
<td>Carmoisine</td>
<td>0-4</td>
</tr>
<tr>
<td></td>
<td>Erythrosine</td>
<td>0-0.1</td>
</tr>
<tr>
<td></td>
<td>Ponceau 4R</td>
<td>0-4</td>
</tr>
<tr>
<td>Yellow</td>
<td>Tartrazine</td>
<td>0-7.5</td>
</tr>
<tr>
<td></td>
<td>Sunset yellow FCF</td>
<td>0-2.5</td>
</tr>
<tr>
<td>Green</td>
<td>Fast green FCF</td>
<td>0-25</td>
</tr>
<tr>
<td>Blue</td>
<td>Brilliant blue FCF</td>
<td>0-12.5</td>
</tr>
<tr>
<td></td>
<td>Indigo carmine</td>
<td>0-5</td>
</tr>
</tbody>
</table>
Food Additive Sub-Committee of Central Committee for Food Standards (CCFS) suggested the deletion of three synthetic colours namely amaranth, fast red E and green S which were earlier permitted to be used in food. Further, an expert group was constituted to review the use of synthetic colours in food articles and to restrict their use to the barest minimum based on technological necessity, aesthetic appeal/traditional practices.

The group recommended restriction of the quantity of synthetic food colour that may be added depending on technological necessity from the existing uniform limit of 200 ppm. The use of synthetic food colours was to be prohibited in all dairy products except ice-cream, in sweets, savouries and wafers, in soup powder, flavouring agents, sweetened ice, milk-based beverages or food supplements and bottled or canned strawberries, cherries, tomato juice and processed or preserved papaya. These recommendations led to an amendment in the PFA Rules which were published vide Gazette notification dated 6 September 1994. A large number of representations were received against these restrictions from different associations of manufacturers because of which the notification was deferred by one year. Thereafter, another notification was issued deferring implementation of the

Figure 1. The variety of artificially coloured sweets and sugar-based confectionery items sold by vendors outside schools in Hyderabad.

Figure 2. The range of colours that are added to cakes.

Figure 3. Artificially coloured savoury items sold by vendors outside schools in Hyderabad.
amended rule by a period of nine months with effect from 6 September 1995 which expired on the 5th of June 1996.

Industry's perspective

The food processing industry and its various associations have been pointing out the various difficulties they would encounter, especially a loss of business if the amendments to the PFA rules came into force. They were of the opinion that sweets without colour would be unappetizing and hence unacceptable to the consumers. Besides, the rules were considered discriminatory since in non-traditional desserts like ice creams, custard, jelly, the addition of colours were permitted and not in traditional sweetmeats. Also natural colours, according to them, are not good alternatives for synthetic food colours as they are non-uniform, unstable, very expensive, not locally available, give undesirable odour to the final product and the shades available are very limited. It must be admitted that the point of view of the industry is partially true, however, the concern for the health of the consumers and not the economic perspective should be of paramount importance. According to the fragrances and flavours industry, the end users would have difficulty in identifying/differentiating among different flavours. However, this problem can easily be solved by the use of proper labelling or use of appropriately coloured bottles/caps. Use of synthetic colour in flavouring agents will lead to addition of synthetic colour in many articles of food through carry over, defeating the very objective of restricting colour addition in some foods.

The points raised by the industries were examined in depth during the second meeting of the Core Group of Experts. The group reconfirmed the fact that overall exposure to synthetic food colours needed to be reduced and hence recommended a long-term strategy to phase out the use of synthetic food colours. In addition, it recommended the initiation of a multicentric study on the dietary intake of food colours. The study would be conducted by National Institute of Nutrition, Hyderabad; Central Food Technological Research Institute, Mysore; Industrial Toxicology Research Centre, Lucknow and Voluntary Organization in the Interest of Consumer Education (VOICE), Delhi. After several deliberations, the experts arrived at the final form of the amended PFA Rules and recommended that a time period up to 31 December 1997 be allowed to the industry to switch over to the amended provision. The amended list of foods in which addition of synthetic colours is permitted and the revised maximum permissible level of colour for each food category is given in Table 2.

In the amended rules, the number of foods and the level at which colour may be added has been reduced. Although it must be admitted that the criteria used for the choice of foods to be included in the list or for setting the maximum permissible levels are arbitrary, the ultimate goal is to reduce the total exposure to colours. In fact, the amended regulations should be considered as a temporary measure for the next ten years which should culminate in a total ban on the use of synthetic food colours.

This is not an unrealistic dream as Norway and Sweden do not allow the use of synthetic food colours at all. If the food industry in these countries, where the variety of processed foods is much greater than India, can survive without synthetic food colours, why can't such a scenario be possible in India?

International scenario

At present there are variations in the food laws of different countries. Although there is a call for international harmonization of these laws to overcome trade barriers, currently little evidence exists even in the developed countries, with the countries of the EEC themselves differing in the type and number of food colours they permit. For instance, chrysosin S is permitted only in Germany and Spain and fast red E and ponceau 6R, only in Spain. The United Kingdom and Spain permit 11 colours, Denmark 13, Belgium, France, Germany and Italy 10 each and as already mentioned Norway and Sweden do not permit any synthetic colours.

With the Government's economic liberalization policy and a very rapid growth of the food processing industry in India, the Regulatory authorities are flooded with

<table>
<thead>
<tr>
<th>Foodstuff</th>
<th>Maximum permissible level of colour (ppm)</th>
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<tbody>
<tr>
<td>Ice cream, milk lollies, frozen dessert, flavoured milk, yoghurt, ice cream mix powder</td>
<td>100</td>
</tr>
<tr>
<td>Biscuits including biscuit wafer, pastries, cakes, confectionery, thread candies, sweets and savouries (viz. Dalmoth, Monga, Phulgudab, Sago papad, dal biji only)</td>
<td>100</td>
</tr>
<tr>
<td>Peas, strawberries and cherries in hermetically sealed containers, preserved or processed papaya, canned tomato juice, fruit syrup, fruit squash, fruit cordial, jellies, jam, marmalade, candied crystallized or glazed fruits</td>
<td>200</td>
</tr>
<tr>
<td>Non-alcoholic carbonated and non-carbonated ready to serve synthetic beverages, including synthetic syrups, sherbets, fruit bar, fruit beverages, fruit drinks and synthetic soft drink concentrates (quantity to be measured after dilution)</td>
<td>100</td>
</tr>
<tr>
<td>Custard powder.</td>
<td>100</td>
</tr>
<tr>
<td>Jelly crystal and ice-candy.</td>
<td>100</td>
</tr>
</tbody>
</table>
requests to liberalize food laws and permit the use of a greater variety of food additives. In addition, traders are going in for importing ready-to-eat foodstuffs with artificial colour. Here again the Indian food laws may vary from the laws of the exporting country. Also, in selected instances it may vary from the limits suggested by the Codex Alimentarius Commission which might infringe the World Trade Organization Agreement. Any decision in this regard needs to be taken after a thorough safety evaluation of the food additive with reference to the Indian scenario. The onus also lies on the Indian scientists to provide research data which will help the Government to resist pressures from transnationals as well as indigenous food industries and traders and to take decisions in favour of the safety of the general public.

Conclusion

There is valid scientific evidence to show that even permitted food colours can prove to be toxic if used/consumed indiscriminately. For the sake of consumer safety it is important that the use of synthetic colours in foods be slowly phased out. Consumers have an important role to play in ensuring their safety. The basic reason which manufacturers give for adding colour to food products is to improve the appearance and consumer appeal. Thus if the consumer demands food which is not artificially coloured, it will go a long way in solving the problem at hand. Manufacturers of processed foods and other users need to look for safer alternatives to synthetic food dyes.

Simultaneously, data on risk assessment of food colours need to be generated urgently to enable risk managers to finalize and implement regulatory measures. Also as a part of the risk communication process, the science-based regulatory decisions need to be made transparent.