

ISOLATION AND IDENTIFICATION OF COLOURS USED IN FOOD ADJUNCTS

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One hundred and forty samples of food adjuncts were collected from shopkeepers and restaurants and the food colours extracted were identified by subjecting them to thin layer chromatography (TLC) along with standards. 22.9% samples were found to contain amaranth a food colour whose listing was terminated by the United States Food and Drug Administration (US-FDA) in 1976. 23.6% samples were found to contain colours not permitted by US-FDA as synthetic food colours.

Key words : Food, Colours, Toxicity.

Introduction

The fact that colour is very important factor in determining food acceptability has stimulated the manufacturers to develop and retain the best possible colour in food products offered for sale. There is no particular objection to the use of permitted colours in food when used to satisfy the aesthetic sense. However, there is the danger that the addition of colours to a food product may make the food appear better than it really is e.g. the addition of red colour to tomato paste is deemed as an adulteration. A greater danger exists in the indiscriminate use of colours which have harmful or toxic effects when ingested. These factors have necessitated the enactment of laws preventing the addition of colours to certain food-stuffs and the need for proper labelling of foods containing added colours. In Pakistan, colours are used without any let or hindrance which prompted the authors to undertake these studies in order to assess the prevailing situation in the market.

Materials and Methods

Collection of samples. One hundred and forty samples of jellies (30), jams (30), custards (30) and ketchups (18) were collected from local shop keepers. Additional ketchup samples (32) were also collected from snack-bars and restaurants.

Extraction of food colours from food materials. Jams and Jellies. The sample was dissolved in 30 ml water and acidified with 2-3 drops of glacial acetic acid.

Custards and ketchups. 10 Gram of each sample was thoroughly blended with 50 ml of 2% ammonia in 70% alcohol, was allowed to stand for 2-3 hrs and then centrifuged. The supernatant was poured into a dish and evaporated to dryness. The residue was taken up in 30 ml water and acidified with 2-3 drops of glacial acetic acid.

Extraction of the colours from aqueous solution. Unbleached white knitting wool was cut into 20 cm strips. These were boiled in dilute ammonia (8-10 drops of 0.88% ammonia in 50 ml water). The strips were rinsed and boiled again in water. One strip of wool was placed in about 30 ml of colour

mixture acidified with 2-3 drops of glacial acetic acid and boiled for 10 mins. to transfer the colour onto wool fibre. The wool was washed with cold water and transferred to a small beaker and was then boiled gently in dilute ammonia (2-3 drops, 0.88% ammonia in 20 ml water) to extract the colour. The liquid was evaporated to obtain a concentrated solution suitable for TLC [1].

Identification of colour. The concentrated solution was spotted on to silica gel plates 1.5 cm from the bottom along with the standard colours. The plates were developed in isopropanol: ammonia mixture (4:1) and food colours were identified by comparing their R_f values with those of standard FD and C food colours [2].

Discussion

One hundred and forty samples were collected from different shops, snack-bars and restaurants around Lahore, Pakistan. Synthetic food colours were found to be present in all the samples. It was observed that natural colours were not employed in colouring the food products. This may be due to the fact that natural colours are less stable in the presence of preservatives as in case of jams and ketchups. All the samples contained mixtures of food colours.

Erythrosine (FD and C red No. 3). 13.3% of the jelly samples were found to contain this colour. Jams, custards and ketchups were found to be free of this colour. Erythrosine is in use in the USA since 1907. An IRDC study showed its adverse effects i.e. higher incidence of thyroid tumours in the male rats receiving the highest dose (at 4% level) of the colours [3]. It was found that erythrosine increases the secretion of thyrotropin by the pituitary glands which stimulates tumour formation. A no effect level for tumour formation process has been established at 0.5% (302 mg/kg/day). However, studies on human beings have failed to identify these adverse effects following ingestion of FD and C Red No. 3 [4, 5]. Earlier studies also indicated that ingestion of this colour causes neurotoxicity. However, no conclusive evidence was

TABLE 1. INCIDENCE OF COLOURS IN FOOD ADJUNCTS.

Commodities	Source	No. of samples	Certified					Uncertified		
			Erythrosine	Allura	Tartrazine	Sunset	Fast	Ponceau SX	Amaranth	Unknown
			R-3 %	red R-40 %	Y-5 %	yellow Y-6 %	green G-3 %	R-4 %	R-2 %	%
Jellies	Shops	30	13.3	13.3	26.7	46.7	—	—	30.0	—
Jams	Shops	30	—	—	—	70.0	—	—	20.0	—
Custards	Shops	30	—	—	46.7	50.0	23.3	23.3	23.3	—
Tomato ketchup standard products	Shops	18	—	—	—	100	—	—	33.3	5.6
Tomato ketchup local concoctions	Restaurants	32	—	—	—	18.8	—	—	12.5	100
Total ketchup		50	—	—	—	48.0	—	—	20.0	66.0
Total		140	2.9	2.9	15.7	52.9	5.0	5.0	22.9	23.6

presented to confirm possible adverse behavioural effects. The use of this colour in foods is permissible in Pakistan [6].

Allura red (FD and C red No. 40). This colour also was found only in jelly samples (13.3%). Its use is approved in the USA and Canada. However, its use is not permitted in the European Economic Community (EEC). This colour is not an approved colour in Pakistan [6].

Tartrazine (FD and C yellow No. 5). 15.7% of the samples were found to contain this colour. It was found in jellies (26.7%) and custards (46.7%). Tartrazine is an approved colour in nearly 60 countries including USA. Many studies have shown that the aspirin sensitive patients, asthmatics and those suffering from chronic urticaria may show allergic reaction to this colour [7-11]. It has been suggested that impurities in the colourant, rather than the tartrazine itself were responsible for the allergic reaction [12]. However, this has not been well documented. This colour is permitted as food colour in Pakistan [6].

Sunset yellow (FD and C No. 6). This food colour was present in 52.9% of the samples. 46 to 50% of jellies, custards and ketchup and 70% of jams contained this colour. All the commercial (Standard brand) tomato ketchup samples were found to contain this colour, while 18.8% locally prepared (concocted) samples contained this colour. In a study by US-FDA, a dose equivalent to 3926 mg/kg/day resulted in proliferative renal lesions in female rats [13]. However, the maximum anticipated human consumption has been placed at only 0.15 mg/kg/day. Another report concluded that this colour was quite safe at lower consumption rates (upto 1860 mg/kg/day [13]). Thus US-FDA concluded that FD and C yellow No. 6 was not a safe food additive. This food colour is permitted in Pakistan [6].

Fast green (FD and C green No. 3). It was found to be present only in custards (23.3%). This colour is approved by the US-FDA as a food colour. Its use is also permitted in Pakistan [6].

Ponceau SX (FD and C red NO. 4). Only 5% of the total samples were found to contain this colour. It was only present

in 23.3% of custard samples. US-FDA has never certified this colour because insufficient studies have been carried out to determine the extent of its safety as a food colour. This colour has been permitted as food colour since 1976 in Austria, Canada, Mexico and Turkey [14]. Its use as food colour is permissible under the West Pakistan Pure Food Rules, 1965 [6].

Amaranth (FD and C red NO. 2). 22.9% of the samples were found to contain Amaranth. On the basis of studies initiated in 1970 in Russia, it was alleged that this colour is carcinogenic and embryotoxic. The FDA confirmed the results, thus paving the way for delisting of the colour in 1976 [15]. This colour was found to be present in all types of samples i.e. jellies (30%), jams (20%), custards (23.3%) and ketchups (20%) respectively. One-third samples of standard brands contained this colour and only 12.5% of local concoctions contained it. The use of this food colour is still permissible in Pakistan [6].

Uncertified colours. These were found to be present only in tomato ketchup samples (66%). Only 5.6% of standard brand tomato ketchup samples contained uncertified colours. However, all the local concoctions contained these colours. Their R_f values differed from those of standard colours. These may be uncertified synthetic colours or some local concoctions.

The results indicate that the type of food colour used was mostly commodity specific. Erythrosine (R-3) and allura red (R-40) were present only in jelly samples, while Green (G-3) and Ponceau SX (R-4) were present only in custards. Uncertified colours were present only in tomato ketchup samples. This indicates that some local restaurants formulate their ketchup samples with uncertified food colours. This is an extremely dangerous practice. It is being carried out without any let or hindrance and needs immediate attention of the authorities.

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