

Physical Characteristics of Yellow Coloured Jelly Available in Indian Market and Mineral Contents Therein

R.A. RANE and B.H. MEHTA*

*Department of Chemistry, University of Mumbai
Vidyanaigari, Santacruz (East), Mumbai-400 098, India*

Yellow coloured jellies of different forms and brands were analysed for their physical characteristics such as pH, loss on drying, ash, degree brix, refractive index, acidity calculated as citric acid and content of tannin. The mineral contents such as Fe, Cu, Zn, Sn, Pb, Cr and Cd were analysed by atomic absorption spectrophotometer (AAS). Sn and Cr were found to be below detectable level and Cd was found to be less than 0.007 mg/100 g. All other elements were present in variable concentration at ppm level.

Key words: Characteristics, yellow coloured jelly, mineral, Indian market.

INTRODUCTION

The third millenium demands unending speedy actions at every step of life. It has deeply affected the food habits of the individuals. Readily available and nourishing food—processed and packed—has become a bare necessity and a essential part of today's food habits. Jams and jellies of various fruits make a vital part in this category.

Natural fruits are rich in carbohydrates, vitamins, minerals etc. but are seasonal and perishable. The processed forms of the same like jam, jelly, juice and marmalade can be readily available round the year but run the risk of getting contaminated with some trace elements during processing. The environmental pollution, handling, processing, containers and packing materials used for storage etc. are the possible sources for the elements like Fe, Cu, Zn, Pb, Sn, Cd and Cr etc. to enter in traces in these food products.

Out of different forms of processed fruit products, 'jelly'—processed from different fruits—is more popular among consumers because of its aesthetic colour, lovely taste and beautiful and attractive packing. It is nutritious, tasty and can be easily carried hygienically even in the pocket from one place to another without any damage or loss. Jellies in different colours, flavours, packed in variable packing materials with different shapes are available in the market.

Yellow coloured jellies mainly constitute either pineapple/peach/lemon/ mango fruit juices or they can be prepared by using pectin gel and appropriate fruit flavour instead of fruit juice. The literature¹ reports the use of pineapple fruit in improving digestion.

In selecting fruit for jelly, a mixture of slightly underripe fruit should be used. The fruit should be washed and spoiled portions removed. Boiling is necessary to extract the pectin. Large fruits should be cut in small pieces or grinded; berries should be capped and stemmed. A minimum of water and cooking is used to extract the juice and to preserve the characteristic flavour of the fruit.

For best results in cooking, the measured juice and sugar should be placed in a large flat-bottomed pan, heated to the boiling point, then cooked to the jelly stage. Fruits that are low in pectin but well flavoured may be used for jelly. A good jelly has an excellent colour; it is transparent and palatable and retains its shape when removed from the mould. The texture is tender—easily cut with a spoon but sufficiently firm so that angles produced retain their shape.

Pineapple/lemon/peach/mango jelly contains sugar, vitamins and various trace metals. Food colours can also contribute the trace elements in the final product. The analysis of trace metal content will provide a vital information on metal toxicity of the finally prepared jelly. The metal toxicity from the food product is very well documented in the literature^{2,3}. Trace metals are desirable only when they are present within permissible limits. Hence, it is essential to monitor the level of trace metals and also the physico-chemical characteristics of the yellow coloured jelly available in the local Indian market. The object of this research can indicate the suitability of yellow coloured jelly available in the market. It is therefore worthwhile analysing locally available yellow coloured jelly for its various metal contents.

EXPERIMENTAL

Various forms and brands of Indian as well as imported jellies consumed by local population are available in the Indian market, *viz.*, jelly in chocolate form—fruit jelly, Mapro, Rainbow and Wonder; jelly in scoop form—Gollum, Skippy, Jolly Jolly, Popocup Jelly and Mala; jelly in two-piece form—Assorted, Tenten, Cocon; and jelly in drink form—Jelly Belly fruit jelly drinks. They are available in different packings, *i.e.*, wrapped in a plastic paper in chocolate form or sealed in plastic scoops, or it may be packed in different attractive shaped plastics.

All the chemicals and solvents used for analysis were of AR grade. Samples of different brands were collected from the local market. Each sample was labelled and preserved for analysis.⁴ The samples were then analysed for pH, loss on drying at 105°C, ash content at 520°C, degree brix reading, refractive index, acidity as citric acid and content of tannin and trace metal contents.

pH was determined by preparing 5% w/v solution in decarbonised distilled water by little warming and subjecting the same to Elico model LI-120 pH meter after attaining the room temperature. Loss on drying at 105°C was determined by weighing accurately about 1 g of sample in a tared LOD bottle and heating in an oven at 105°C till constant weight. Ash was determined by weighing an appropriate quantity of sample accurately. Initially the sample was heated at low temperature on the hot plate and gradually the temperature was raised. Partially dehydrated product was then transferred to the furnace maintained at 520°C and continued heating for about 5 h till constant weight.

Direct degree brix reading and refractive index were recorded on Abbe's refractometer. While acidity was determined by using the procedure reported in the literature⁵.

The content of tannin was estimated on spectrophotometer by using Folin Denis reagent given in the literature⁶.

Mineral estimation was done by digesting the ash of jelly sample in 40 mL aqua regia on hot plate, at low temperature. The digested sample was then diluted to 50 mL using distilled water. The diluted solution was then directly aspirated in Atomic absorption spectrophotometer model AA203, supplied by M/s Chemito. Various heavy trace metals like Fe, Cu, Zn, Sn, Pb, Cr and Cd were analysed from this solution. The instrument was standardised for each metal using Hollow Cathode Lamp of respective element, against the reagent blank. Standard solutions of individual metals were prepared from 1000 ppm stock solution of each metal ion supplied by M/s Merck Ltd.

RESULTS AND DISCUSSION

Two different shades of yellow colour were observed in different brands—yellow and dull yellow. Mahadeviah *et al.*⁷ have reported that colour variation in the final product is due to significant loss of carotenoid pigment. Various processing methods are responsible for such loss of carotenoid pigment which results in different shades of colours in the different brands of jellies. However, in some jellies, colour variation is properly made to distinguish pineapple, peach and mango by incorporating edible food colours in different concentrations.

The results of experimental findings are detailed in Tables 1 and 2.

TABLE-1
PHYSICO-CHEMICAL CHARACTERISTICS OF YELLOW JELLY

Brands	pH of 5% w/v solution in water	Loss on drying at 105°C (%)	Ash at 520°C (%)	Brix at 20°C	Refractive index at 20°C	Acidity calculated as citric acid in g/100 g	Tannin content in ppm
Fruit Jelly	3.72	11.460	0.407	85.00	1.5040	0.675	139.110
Mapro	3.55	14.330	0.371	81.00	1.4935	1.088	211.111
Rainbow	3.68	22.187	0.292	78.20	1.4860	0.747	138.388
Wonder	3.66	17.197	0.466	81.00	1.4930	1.209	346.000
Gollum	3.50	74.827	0.234	26.00	1.3740	0.261	53.632
Skippy	4.59	75.652	0.375	25.00	1.3720	0.299	16.286
Jolly Jolly	4.52	76.666	0.323	23.00	1.3690	0.171	18.827
Popocup	3.83	77.186	0.379	28.90	1.3790	0.378	28.795
Mala	3.45	72.215	0.285	31.00	1.3830	0.261	27.803
Assorted	4.00	75.805	0.381	26.00	1.3740	0.409	95.003
Tenten	4.41	81.492	0.359	18.50	1.3610	0.144	14.734
Cocon (Peach)	3.66	74.233	0.360	25.00	1.3720	0.358	58.139
Cocon (Mango)	3.60	74.946	0.367	23.00	1.3690	0.376	54.916
Jelly Belly (Mango)	4.29	76.739	0.494	26.00	1.3740	0.375	56.107

TABLE-2
TRACE METAL CONTENT IN YELLOW JELLY SAMPLES

Brand	Fe (mg/100 g)	Cu (mg/100 g)	Zn (mg/100 g)	Pb (mg/100 g)
Fruit jelly	0.7881	0.0146	0.0265	0.1564
Mapro	0.4451	0.0198	0.0340	0.0511
Rainbow	1.0884	0.0256	0.2278	0.0095
Wonder	1.4407	0.0073	0.0628	0.0372
Gollum	0.2136	0.0118	0.0303	0.0196
Skippy	0.0728	BDL	0.0188	0.0337
Jolly Jolly	0.1194	0.0041	0.0113	BDL
Popo cup jelly	0.0940	0.0331	0.0206	0.0210
Mala (yellow)	0.3161	0.0063	0.0151	BDL
Assorted	0.1807	0.0184	0.0185	0.0644
Tenten	0.1245	0.0122	0.0214	0.0241
Cocon (peach)	0.1174	0.0206	0.0242	0.0211
Cocon (mango)	0.1834	0.0253	0.0259	0.0411
Jelly Belly Fruit Jelly Drink	0.0812	0.0071	0.0126	BDL

BDL = Below Detectable Level

The pH of 5% w/v solution has value in the range 3.45 to 4.59. Low pH in Mala brand jelly indicates its acidic nature compared to other brands.

Loss on drying (LOD) at 105°C shows greater degree of variation from brand to brand, as the 'set' of jelly of each brand is different. LOD ranges from 11.460 to 81.492%. The highest LOD observed in Tenten brand indicates its softest nature, which dissolves in mouth easily. Whereas, fruit jelly sample covered with sandy sugar is comparatively hard showing the minimum loss on drying.

Ash of jelly samples varies from 0.234 to 0.494%. The lowest ash in Gollum Soft Jelly scoop form indicates that it contains more of organic substances and less of inorganic residue, while the highest ash in Jelly Belly Fruit Jelly Drink indicates the presence of highest quantity of inorganic residue.

Degree brix at 20°C determines the soluble solid content in the product. It shows inverse relation with loss on drying which is indicated graphically in Fig. 1. The lowest degree brix reported in the softest Tenten jelly was 18.50 and the highest degree brix recorded in the hard Fruit Jelly was 85.00. Refractive Index varies as per the degree brix. Hence corresponding lowest refractive index reported is 1.361 in Tenten brand and 1.504 in sugar coated Fruit Jelly brand.

Acidity calculated in terms of citric acid shows lower value in two-piece jelly packed in a plastic scoop (0.144 g/100 g) and higher value in sugar coated chocolate form Wonder brand (1.209 g/140 g). The higher value of acidity indicates more amount of citric acid added in the product. Sugar-acid ratio imparts characteristic flavour to the product. Dryden and Hill⁸ reported that optimum sugar-acid ratio is important for bringing out the olfactory element in flavour.

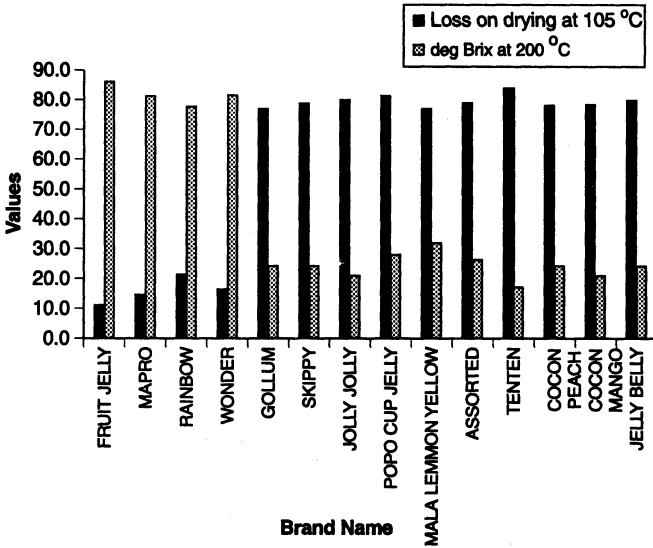


Fig. 1. Degree brix and loss on drying relation in different brands of yellow jelly

Tannin content varies from 14.734 ppm of Tenten brand to 346 ppm reported in sugar coated chocolate form jelly of Wonder brand. Jelly Belly Fruit Jelly Drink shows 56.107 ppm tannin irrespective of LOD. Machado⁹ reported condensed tannin, the most abundant in fresh skin of litchi. Variation in tannin content in different brands of jelly is illustrated in Fig. 2 .

All the above physico-chemical characteristics are not in acceptable limits

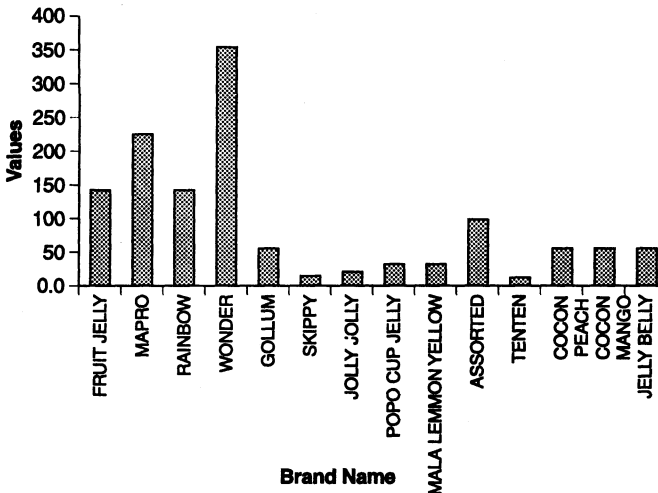


Fig. 2. Tannin content in different brands of yellow jelly

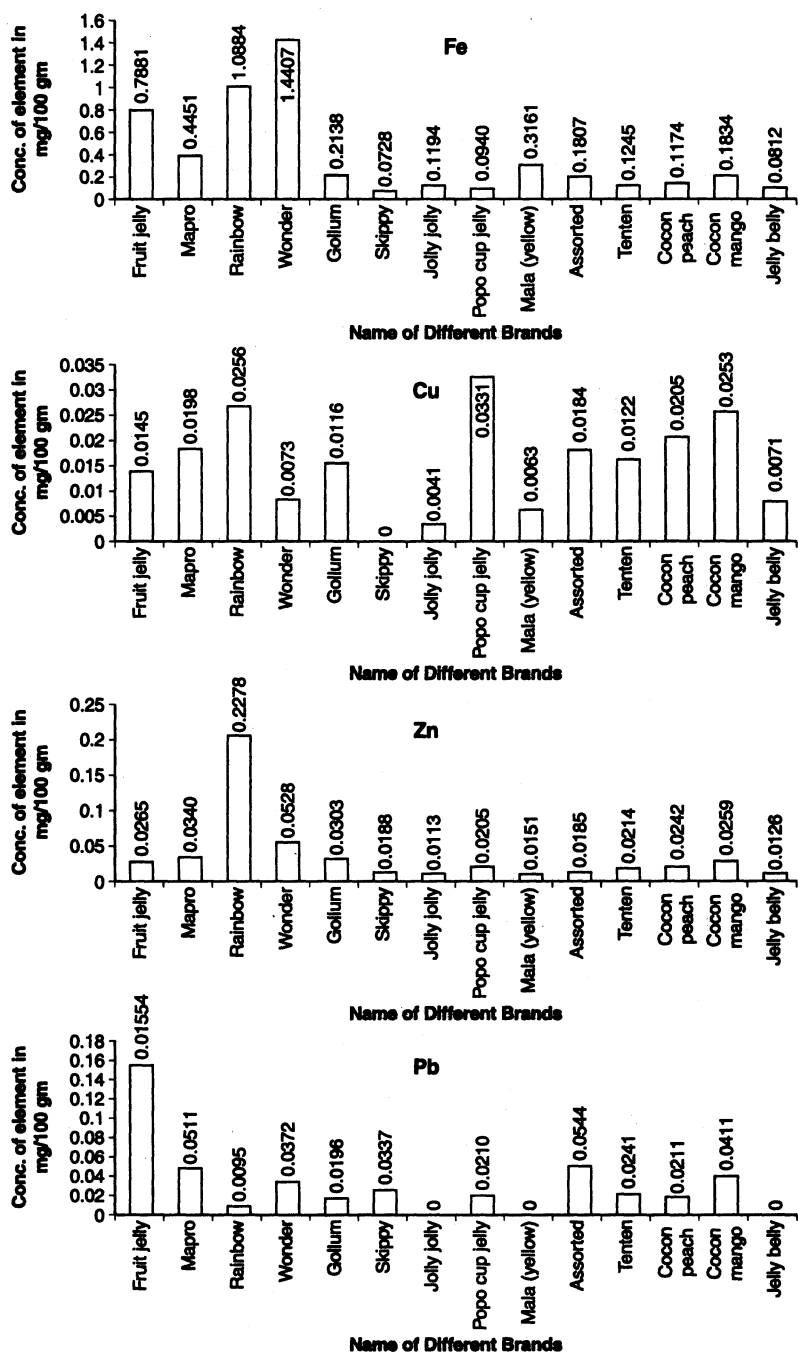


Fig. 3. Trace metal content in different brands of yellow jelly

reported in literature (ISI 93 and Joint FAO/WHO standards 1976) because there is a lot of variation in the 'set' of Indian jelly and imported jelly (especially jelly from Malaysia and Thailand).

Variation in metal contents of jelly may be observed due to the environment, different quality pineapple, peach, lemon and mango fruit juices, colours and artificial flavours used, equipments and containers used for manufacturing and different storage methods. Mean mineral content in mg/100 g of yellow jelly are summarised in Table-2. The contents of different trace metals are also represented as bar diagram in Fig. 3.

Chocolate form Wonder Jelly shows higher amount of iron (1.4407 mg/100 g) whereas scoop form single piece Skippy brand shows lower amount of the same (0.0728 mg/100 g). Higher amount of iron may be attributed to the higher amount of iron from the fruit. According to Barwal and Kalia¹⁰ the possible reasons might be that iron gets extracted in the juices and concentrated during evaporation. Copper content in different brands ranges from 0.0041 mg/100 g (Jolly Jolly brand) to 0.0256 mg/100 g (Rainbow brand). In Skippy brand, the copper is found to be below detectable level, while zinc ranges from 0.0113 mg/100 g (Jolly Jolly brand) to 0.2278 mg/100 g (Rainbow brand). These metals probably enter into the product through the containers used in the manufacturing process. Powari *et al.*¹¹ have reported that copper and zinc find a passage into the food products through containers made of aluminium alloy.

The amount of tin was found to be below detectable level in all brands except in Jelly Belly Fruit Jelly drink, where it is reported to be 0.0250 mg/100 g. This tin content may be due to its presence *in situ* of the fruit or may have entered into the finished product during the manufacturing process. However, permissible limit for tin is 100 ppm (10 mg/100 g) and analysed value is much below this level.

Lead is found to be present in many raw materials. It can enter into the fruits through the lead contaminated soil which nourishes the trees and fruits. Yellow jelly of Rainbow brand has 0.0095 mg/100 g of lead, while it is maximum for Fruit Jelly brand, *i.e.*, 0.1564 mg/100 g.

Cadmium and chromium were found to be below detectable level in all brands. The products did not show any objectionable value of metal content. The amounts of all trace metals in the products were below the permissible limits given in Food Standards, like ISI 93 and Joint FAO/WHO standards. Though the physico-chemical parameters of all brands do not conform to the standards given by ISI or WHO, the quality analysed and mineral composition estimated therewith allow them for consumption. Hence yellow jellies of all brands can be recommended for consumption without any toxic effect of trace metals and can be used as one of the supplementary nutritious products in our daily diet.

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