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Trace Elements in Pineapple Jam from India

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Pineapple jams of different brands were analysed for Fe, Cu, Zn, Sn, Pb, Cr and Cd content by atomic absorption spectrophotometer (AAS). The physico-chemical characteristics such as pH, loss on drying, ash, degree brix, refractive index and acidity calculated as citric acid were also determined in all brands. On the basis of experimental data, fitness of the pineapple jam for consumption is recommended.

INTRODUCTION

Nutritious food is essential for good health. Fats, proteins, carbohydrates, vitamins and minerals provide nutrition to our body. These can be gained from different vegetables, cereals, grains, tubers, fruits and so on. Fruits are good source of vitamins and minerals. They are seasonal and perishable products of nature. Hence, these can be made available as and when required, by processing, *viz.*, pulping, or by preparing jams, jellies, juices, squashes, marmalades etc.

Literature[1] reports use of pineapple fruit in improving digestion due to the enzyme *Bromelain*. Such enzymes add to the activity of natural secretion of gastric enzymes.

Various combinations of different varieties of fruits can be formulated in which use of pineapple fruit is advantageous for blending because of its characteristic flavour and acidity. The pineapple fruit is a useful source of vitamins and enzymes. Hence, it is suggested to consume pineapple as a raw fruit. However, pineapples are available in the typical winter season. Hence, it is worthwhile processing pineapple into different acceptable products for its year-long cosumption. Pineapple can be processed and marketed throughout the year in the form of pineapple juice, pineapple slice or pineapple jam.

Pineapple jam is the most popular among the consumers. It can be prepared by boiling pineapple fruit pulp with sufficient quantity of sugar to a gelatinizing consistency, which is firm enough to hold the fruit tissue in position. Pectin, either present *in situ* or added artificially, helps to give good taste.

Pineapple jam contains sugar, fibres, vitamins and various trace metals. Equipments and containers used in the manufacturing process and different methods of storage are the sources of official impurites for trace metal contamination. Trace metals are desirable only when they are present within the permissible limits stated in ISI[2] and WHO[3] standard. Therefore, it becomes

necessary to monitor the amount of trace metals and also the physico-chemical characteristics of the pineapple jam available in the local Indian market.

EXPERIMENTAL

All the chemicals and solvents used for analysis were of AR grade. Samples of nine different brands were collected from the local market. Each sample was labelled and preserved for analysis by following the analytical method.[4] These samples were then analysed for pH, loss on drying at 105°C, ash content at 520°C, direct degree brix, refractive index and acidity as citric acid.

pH was determined by preparing 5% w/v solution in decarbonised distilled water and testing the same on Elico model LI 120 pH meter. Loss on drying 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 the jam sample accurately about 20 g. Initially, the sample was heated at low temperature on a hot plate and gradually the temperature was raised. Partially dehydrated product was then transferred to the furnace maintained at 520°C and heating continued for about 5 h till constant weight. Direct degree brix reading and refractive index were recorded on a suitable refractometer. Acidity was determined by following the procedure reported in the literature.[5]

Trace metal analysis was done by digesting the ash of the jam sample in 40 cm^3 aqua regia on hot plate, at low temperature, to about 10 cm^3. The digested sample was then diluted to 50 cm^3 using distilled water. The diluted solution was then directly aspirated in atomic absorption spectrophotometer supplied by M/s Chemito, model AA 203. 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 solution of individual metal was prepared from 1000 ppm stock solution of each metal ion supplied by M/s Merck Ltd.

RESULTS AND DISCUSSION

Table-1 summarises physico-chemical characteristics of pineapple jam. Various manufacturing units like Kissan, Sil, Mapro, Noga, Panama, Ruche, Century, Kalyert, Noble etc. market pineapple jams, which are consumed by local population. They are available in two different packings, a glass bottle with metallic cap and a plastic pack. All brands have got soft texture. Two different shades of yellow colour observed in different brands are: yellow and dull yellow. The colour variation is correlated with the loss of carotenoid pigments.[6]

Samples are ashed at 520°C which give white to yellowish white ash. The pH of 5% w/v solution has value in the range 2.88 to 3.19 in glass bottled product, while it is 2.79 to 3.23 in plastic packed product. The acidity of the pineapple jam, calculated in terms of citric acid, shows lower value in plastic packed Noble brand (0.392 g/100 g), and higher value in plastic packed Century brand (1.045 g/100 g). It indicates that the product is acidic in nature.

Loss on drying at 105°C in all brands shows variation from 24% to 29%

TABLE-1
PHYSICO-CHEMICAL CHARACTERISTICS OF PINEAPPLE JAM SAMPLES

Brand name	Kissan	SIL	Mapro	Noga	Panama	Ruche	Century	Kalvert	Noble
Packing material	Glass bottle	Glass bottle	Glass bottle	Glass bottle	Glass bottle	Glass bottle	Plastic pack	Plastic pack	Plastic pack
Packing Batch No.	91412 A3	S02311	U01	4029	No	65	766	DJM 3000	12345
Packing date	Dec-99	Dec-99	Jul-99	Jan-00	Feb-00	Jan-00	Apr-00	Apr-00	Mar-00
Description	Yellow soft mass	Yellow soft mass	Dull yellow soft mass	Dull yellow soft mass	Dull yellow soft mass	Yellow soft mass	Light yellow soft mass	Yellow soft mass	Yellow soft mass
Colour of ash	Yellowish	Yellowish	White	Yellowish white	Yellow	White	Yellow	Yellowish white	Yellowish white
pH of 5% w/v in water	3.190	3.130	2.880	3.010	3.160	3.120	2.790	2.880	3.230
LOD at 105°C (%)	24.230	28.430	27.360	28.810	29.410	29.520	28.380	24.030	24.360
Ash at 520°C (%)	0.209	0.234	0.149	0.359	0.271	0.203	0.190	0.135	0.173
Degree Brix at 24°C	72.000	71.000	71.500	72.500	71.000	72.500	70.000	73.000	72.500
Refractive index at 24°C	1.470	1.468	1.469	1.472	1.467	1.472	1.466	1.474	1.471
Acidity, citric acid, g/100 g	0.653	0.587	0.783	0.979	0.848	0.718	1.045	0.653	0.392

depending upon the set of the jam. Ash content ranges from 0.135% to 0.359%, while degree brix at 24°C for pineapple jam averages to 71, with little variance. Similarly, the refractive index at 24°C is in the range of 1.466 to 1.474.

All the above physico-chemical characteristics are in acceptable limits reported in literature, ISI 93 and Joint FAO/WHO Standards, 1976.[3]

Variation in metal contents of the jam may be observed due to the environment, different quality pineapple fruit pulps, equipments and containers used for manufacturing and different storage methods. Mean mineral contents in mg/100g of pineapple jam are summerised in Table-2. The contents of different trace metals are also represented as bar-diagram in Fig. 1.

TABLE 2
TRACE METAL CONTENTS IN PINEAPPLE JAM SAMPLES

Element	Kissan	SIL	Mapro	Noga	Panama	Ruche	Century	Kalvert	Noble
Fe	0.6284	0.4626	0.2190	0.7475	0.4458	0.5098	0.3782	0.7067	0.5352
Cu	0.0201	0.0703	0.0362	0.0474	0.0196	0.0143	0.0147	0.0119	0.0154
Zn	0.0515	0.1011	0.0636	0.0668	0.0588	0.0767	0.0262	0.0219	0.0341
Sn	BDL	0.2000	0.3100	0.1700	3.5000	1.4700	7.9000	3.6100	4.8400
Pb	0.0258	0.0388	0.0710	0.0142	0.0149	0.0178	0.0205	0.0202	0.0179
Cr	0.0385	0.0248	0.0129	0.0129	BDL	BDL	BDL	BDL	BDL
Cd	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

Note: All metals are in mg/100 g.

Glass bottled Noga product shows higher amount of Fe (0.7475 mg/100 g), whereas glass bottled Mapro product shows lower amount of the same (0.2190 mg/100 g). Higher amount of iron may be attributed to the use of steel container in the manufacturing process. The product was analysed for its Cu and Zn content. Cu content in different brands ranges from 0.0119 mg/100 g to 0.0703 mg/100 g. Zinc content in plastic packed, Kelvert product has lowest value, 0.0219 mg/100 g whereas, it is 0.1011 mg/100 g in glass bottled, Sil product. These metals probably entered in the product through the containers used in the manufacturing process of jam. Powari *et al.*[7] have reported that Cu and Zn find a passage into the food product through containers made up of aluminium alloy.

The amount of Sn in different brands of pineapple jam has greater degree of variance. It ranges from 0.1700 mg/100 g to 7.900 mg/100 g. The greater variance in Sn content may be due to its presence *in situ* or having entered into the finished product during the manufacturing process. It is also reported that finished product might be fortified with tin based food colours to impart aesthetic and appealing appearance to the pineapple jam.[6] However, permissible limit for Sn is 100 ppm (10 mg/100 g) and analysed value is much below this level.

Pb is found to be present in many raw materials and even in most of the

finished products. The amount of Pb in the finished product is likely to vary and expected to be higher for a glass bottled product.[8] Pb is one of the major constituents of glass. The acidic nature of the product may accelerate the leaching process and increase the amount of Pb in the product. The pineapple jam of Noga brand has 0.0142 mg/100 g of Pb, while has maximum value for Mapro brand product.

Cr was found to be at trace level, ranging between 0.0129 mg/100 g and 0.0385

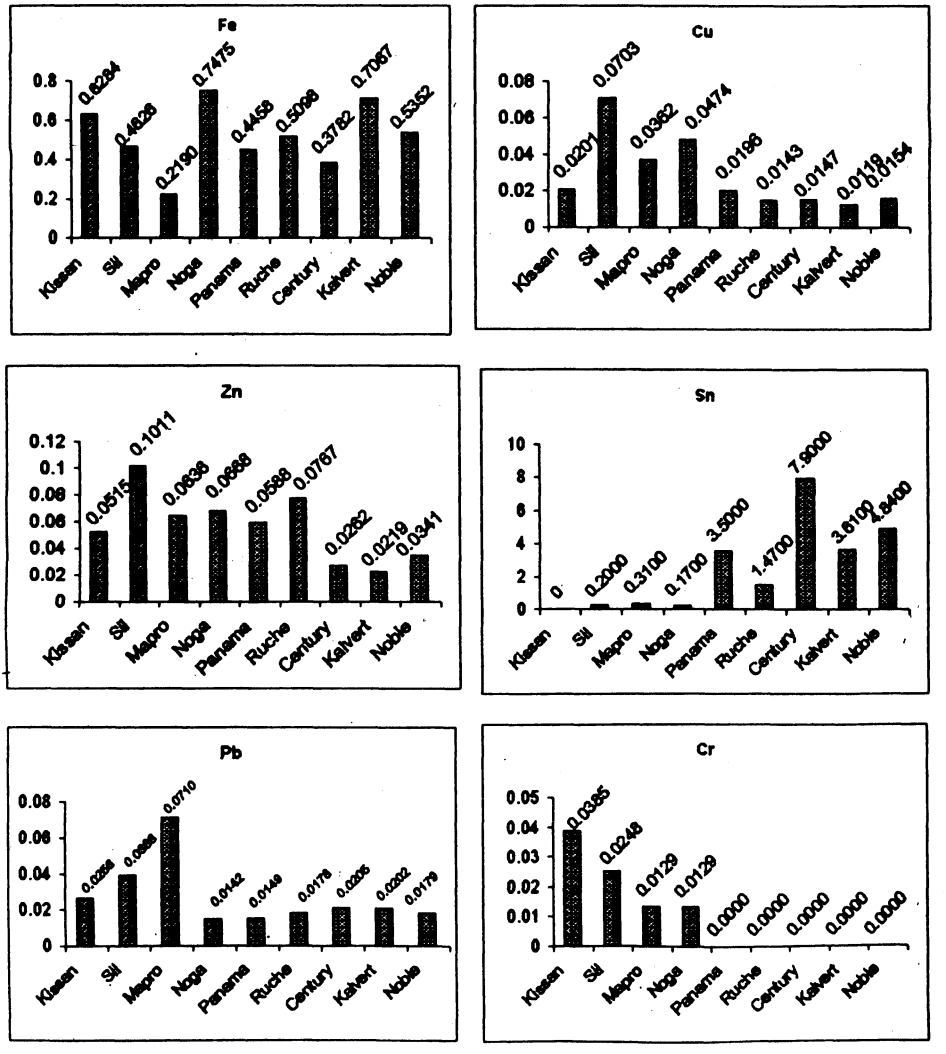

Fig. 1. Trace metal contents in different brands of pineapple jam

mg/100 g. The inclusion of Cr is probably due to the malfunctioning of the steel containers. The leaching of Cr from the steel container was reported by Reilly.[9] Cd was found to be below detectable limit in all the brands.

The products from individual batches do not have objectionable value as described by the standards. Conclusively, the amount of all trace metals in the product is below the permissible limits given in Food Standards, like ISI 93, Joint FAO/WHO standards. The pineapple jam of these different brands may be recommended for consumption without any toxic effect of trace metals.

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