

EFFECT OF REPLACING SUCROSE BY DIFFERENT PROPORTIONS OF LIQUID AND POWDER GLUCOSE IN THE COVER SYRUP ON THE QUALITY OF CANNED MANGO SLICES

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Abstract. "Langra" mango slices were canned in 30°Brix syrup containing 100% sucrose, 100% maize "gur" white (powder glucose), 100% liquid glucose as well as the replacement of sucrose by maize "gur" white and glucose in different proportions. The effect of such replacements upon the quality of canned slices was studied during 180 days' storage at room temperature. Throughout the storage period there was a slight increase in the drained weight of canned slices under all treatments. Storage also caused an appreciable increase in total soluble solids and Brix/acid ratio in slices. During storage there was a considerable decrease in ascorbic acid. On the basis of organoleptic evaluation after 180 days of storage, it was observed that the replacement of sucrose by 25% liquid glucose or 25% maize "gur" white had a beneficial effect on the colour, taste, texture, and flavour of the canned mango slices.

Introduction

Nearly all fruits are canned in sucrose syrups of different concentrations and during storage various changes occur bringing about softness and consequently loss of texture. The type of sugar or sweetening agent and other additives used in the cover syrup are also the factors responsible in maintaining the quality of canned fruits. The relative translocation of sugars and water by the use of sugar types and fruit packs on the drained weight of canned fruits was studied by Rose.¹ The drained weight of the canned product was influenced by citric acid, various calcium salts, fill weight in the can and ripeness level of the fruit as observed by various workers.^{2,5} Different concentrations of sugar in the cover syrup had a marked effect on the drained weight of canned guavas during storage as well as on the ascorbic acid content of canned guavas, raspberries, gooseberries, and strawberries as reported in the literature.^{8,12} Factors influencing pectin during canning and storage of canned mango slices had been studied by Ahmad and Rahman.⁹

One of such sweetening agents now manufactured in Pakistan is liquid and powder glucose which is cheaper than sugar. The present study was, therefore, undertaken to investigate the effect of replacement of sucrose by these sweetening agents in the cover syrup on the quality of canned "langra" mango slices.

Material and Methods

A weighed quantity of ripe "langra" mango fruit was washed in running water, peeled with stainless steel peeling knives and cut into 1 m x 1.5 cm thick

slices. During peeling and slicing the cut slices were kept immersed in 2% brine. The slices were drained and a weighed amount was filled into No. 2 lacquered tin cans. The cans were already coded for different treatments. Hot syrup of 30° Brix containing different fractions (0, 25, 50, 75 and 100%) of solid/liquid glucose was added into different lots of tin cans leaving 1. cm head space.

The cans thus filled were steam exhausted to a central can temperature of 82°, sealed, processed for 20 min. at 10; and cooled to a can temperature of 38° in running cold water. These canned products were analyzed for various constituents at intervals of 0, 30, 60, 120, and 180 days during storage.

At each interval five cans at random were picked from each lot under different treatments. The contents of each of these cans were emptied on an 8-mesh screen and the fruit was drained exactly for 2 min. and then weighed. The drained weight was determined in individual can and the average results of five cans were reported. For the rest of the analysis, the drained slices of the five cans were mixed and osterized. The estimations in duplicate were made and average results were reported. Total soluble solids (°Brix) were determined, after straining the osterized samples through muslin cloth, by the A.O.A.C. method.¹⁰ The titratable acidity, ascorbic acid, and pectin contents were determined by the methods of Ruck.¹¹ The canned fruit was organoleptically evaluated after 180 days of storage for such attributes as flavour, colour, and texture following scoring technique described by Krum¹² against an arbitrary scoring scale ranging from 0 to 10.

Results and Discussion

Titratable acidity. The titratable acidity of the fresh fruit was 0.24% (Table I). The initial acidity of the canned slices ranged between 0.171-0.192% in the case of pure sucrose as well as in combination with maize "gur" white or liquid glucose used in the cover syrup. During the storage of products, there was a slight decrease in acidity and the final acid contents were between 0.166-0.182%.

This clearly shows that during the canning process, there was a considerable decrease in acidity in the slices of mango because the acid being soluble leached the cover syrup quickly. The loss in acidity was observed during storage. This loss of acidity might be due to the chemical reaction of various organic acids with the other constituents of the slices during storage. The decrease in the acidity was found to be in agreement with the results of other workers.^{7, 9}

Ascorbic Acid. The fresh slices contains 80 mg./100 g of ascorbic acid (Table I). The retention just after canning was between 40.00 to 47.00 mg./100 g. of slices where maize "gur" white in combination with sucrose or sucrose alone were used in the cover syrup. The initial retention has been observed to be lower in the case of sucrose syrup and a higher retention was observed in the case of 100% maize "gur" white. The percentage of retention in the slices processed by the use of liquid glucose in different proportions in the cover syrup was less and it ranged between 37.70 to 44.00 mg/100 g., the minimum being in the case 100% liquid glucose. During storage it is observed that there was a substantial decrease in the ascorbic acid contents of slices. After 60 days of storage, the ascorbic acid contents ranged between 22.50 and 35.00 mg./100 g. On further storage it has been observed that there was a very rapid decline in the ascorbic acid contents in the slices on 180 days, and the retention was only between 16.00 and 27.95 mg/100 g.

The initial loss of ascorbic acid on the zero day of storage may be attributed to heat treatment during the canning process and also due to leaching from slices to cover syrup. The rapid loss of ascorbic acid during storage may be due to the high temperature in the summer. The trend in loss of ascorbic acid was similar to those of others.⁶⁻⁷

Brix. The fresh slices had a °Brix of 13.5 (Table I).

TABLE I. ANALYSIS OF FRESH "LANGRA" MANGO FRUIT

Constituents	Quantities
Acidity (per cent)	0.24
Brix in degrees	13.50
Brix/acid ratio	56.25
Ascorbic acid (mg/100 g.)	80.00
Pectin (%)	0.54

These slices were canned in 30°Brix syrup containing maize "gur" white in combination with sucrose in

different proportions as well as liquid glucose in combination with sucrose in different proportions. Just after canning, there was a very slight increase in the °Brix of the slices under all these treatments and it ranged from 14.7 to 15.0. There was a substantial increase in °Brix upto 10 days of storage. This increase in °Brix may be due to the penetration of sugars from the cover syrup to slices by the process of osmosis. Thereafter the values increased insignificantly during further storage and on 180 days, the °Brix were between 22.7 to 24.8. The constant values thereafter indicates that after 10 days of storage an equilibrium was obtained between the °Brix of slices and the cover syrup. The F ratio in Table 2 indicates highly significant values for storage intervals and the treatments.

TABLE 2. F-RATIO VALUES FOR VARIOUS CONSTITUENTS IN CANNED "LANGRA" MANGO SLICES AS AFFECTED BY STORAGE INTERVALS AND TREATMENTS.

Due to	Acidity	Ascorbic acid	Brix	Pectin	Brix/acid ratio	Drained weight
	**	**	**	**	**	**
Storage intervals	78.00	73.81	87.97	59.36	34.60	11.80
	**	N.S.	**	**	**	**
Treatments	4795.00	1.62	36.26	20.22	509.16	3.60

N. S. = Non-significant.

** = Highly significant.

Brix/Acid Ratio. The Brix/acid ratio of the canned slices just after canning was between 77.07 and 86.55 in the products canned in syrup containing maize "gur" white or liquid glucose in combination with sucrose in different proportions as well as sucrose alone. There was a rapid rise in the Brix/acid ratio values upto 10 days of storage but thereafter a gradual and steady increase in these values was recorded. The final Brix/acid ratio values were 149.40, 135.83 and 129.54 for sucrose, maize "gur" white and liquid glucose alone respectively. For maize "gur" white in combination with sucrose the Brix/acid ratio values range from 132.41 to 145.75; and for liquid glucose in combination with sucrose they range from 139.41 to 144.57. The rapid rise in these values during the initial 10 days may be due to the transfer of sugar to slices from the cover syrup and the acid to the cover syrup from slices. There was a regular rise in the Brix/acid ratios of slices with the rise in the °Brix in the slices and in the same way a fall in acidity of slices throughout the storage period.

There was found to be a direct correlation between the Brix/acid ratio and °Brix and indirect relationship between the Brix/acid ratio and per cent acidity of the slices. The F ratio values given in Table 2 indicate highly significant differences due to storage intervals and different treatments of cover syrup.

Pectin. The pectin in the fresh slices was 0.54% (Table I), whereas immediately after canning the

pectin content was found to be in the range of 0.44 to 0.50% in all the treatments of the cover syrups. There was a steady loss of pectin during the storage of canned slices and after 180 days of storage the pectin content ranged from 0.32 to 0.41%. The loss of pectin during storage may be due to the leaching of water soluble pectin fraction from slices and the formation of the more water-soluble pectin from the insoluble pectin fraction. These results are comparable with the observations of others.^{7, 9} The statistical analysis of the data for pectic content was highly significant for different treatments of the cover syrup and also for the storage intervals (Table 2).

Drained Weight. There was a slight decrease in the drained weight of the slices under all the treatments initially just after canning. The retention in the drained weight in such cases was between 94.00-96.00%. The 100% retention in the drained weight occurred in the products with sucrose and "gur" white with different proportions within 30 days of storage, whereas in the case of liquid glucose and its combinations with sucrose the 100% retention in the drained weight was obtained within 10 days of storage. After this period a very slow increase was observed and the final retention in drained weight on 180 days of storage was between 102.5 and 107.5 %.

It is clear from the results that with increase in the °Brix of canned slices, there is a corresponding increase in the drained weight of the slices during storage. The F-ratio values shown in Table 2 indicate highly significant differences for storage intervals and treatments.

Organoleptic evaluation. On the basis of organoleptic evaluation of canned mango slices, it was observed that the replacement of sucrose by 25% liquid glucose or 25% maize "gur" white exercised a beneficial effect on the colour, taste, texture, and flavour of the slices after 180 days of storage at ambient temperature.

Though the mango slices were found to be acceptable at all the levels of replacement of cover syrup, yet the maximum mean score values were recorded for

TABLE 3. SHOWING THE MEAN SCORE VALUES FOR FLAVOUR, TEXTURE, AND COLOUR OF CANNED "LANGRA" MANGO SLICES UNDER DIFFERENT TREATMENTS.

Treatments	Flavour	Texture	Colour
100% sucrose syrup	6.7	6.7	6.7
25% maize "gur" white .. 75% sucrose	7.3	7.1	7.2
50% maize "gur" white .. 50% sucrose	6.2	6.3	6.5
75% maize "gur" white .. 25% sucrose	5.9	6.0	6.7
100% maize "gur" white syrup	6.1	6.7	6.9
25% liquid glucose+75% sucrose	7.4	7.0	7.3
50% liquid glucose+50% sucrose	6.7	6.9	6.3
75% liquid glucose+25% sucrose	4.7	5.9	6.5
100% liquid glucose syrup	5.3	5.9	6.3

texture, colour, and flavour with replacement of sucrose by 25% liquid glucose or 25% maize "gur" white as indicated in Table 3. A similar trend in the results has been reported in the literature.⁵

Processors as well as the consumers are both interested in the drained weight of the canned fruits. During canning due to the heat process the fruit loses its weight and the extent of such loss depends upon various other factors. It is, therefore, suggested that canned products must be stored for a certain period before marketing so that the products may attain the maximum drained weight or an equal drained weight to the raw material. The higher Brix/acid ratio is always preferred either in raw fruit or in the canned product as it makes the products more palatable and acceptable to the consumers. The data so observed corresponded with the organoleptic evaluation of the products as to better flavour, taste, texture as well as the colour of the slices under these treatments.

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