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A COMPARATIVE STUDIES OF SOLUBLE SUGAR CONTENT IN DIFFERENT TWO SELECTED VARIETIES OF MANGIFERA INDICA LTD

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ABSTRACT

The chemical analysis of sugar content in the different cultivars of mango fruit showed significant changes at four different ripening stages of mango cultivarsie. 0 day, 2nd day, 4th day, and 8th day. All these changes were depended on the habit and habitat, and the maturity of Mango fruit. The quantification of the sugar composition from the ethanolic extract of two mango cultivars showed that the Dasheri had the highest reducing and non-reducing sugar than Langra varieties. The sugar content at maturity showed variability among the species. At the ripened stages, the highest titrable acidity (0.22%) was found in Langra, whereas Dasheri had the lowest content of titrable acidity (0.17%). Malic acid concentration changed marginally at the beginning in citric acid concentration was observed 2 to 6 times lesser during the ripening stages. Fructose and glucose concentration (w/w) was found 32.60 % and 23.37% respectively. The environmental conditions, age and maturity affect the physiological characters and the biochemical changes were taken place at the ripening phases. The total percentage of sugar in mango was 22.06 % in the artificially induced maturity while naturally ripened mango showed 21.06 % sugar.

Keywords: Mangifera indica L. Fruit, Amino Acid, Soluble Sugar, Langra, Dasheri, Sugar, Minerals

1. INTRODUCTION

Mango, the king of the fruits is an inhabitant of tropical reason. It contained various supplements like vitamins, minerals, reducing, non-reducing sugars and different antioxidants. It is the most popular fruits1-3 due to the rich nutritional values and health benefits. It has a mild amount of soluble sugar but high value of acidity during harvesting stage. Ripened fruits were soft, flavored and edible. 4-9 The Indian subcontinent is very rich for mangoes biodiversity. India is a leading producer in the world and hold the share of 50 % of total production in the world's market. It coverers one of the largest fruit market in the world. Agronomically, the area of mango crop is covered about 1.23 million hectares. Utter Pradesh is the leading state of India which produces about 4500000 tons per annum. The popular varieties of the state are Chounsa, Dashehari, Langra, Malika, Fazli, Gulab Khas, Amrapali, Ratol etc.10-13

Mango tree blossoms during March and April in Northern and eastern Indian region. The fruits maturity is taken about two or three months. It changes the colour up to ripened stage in the market. In the northern area of India it is mostly harvested during the months of July- August. In the present studies, we have selected Dasheri and Langra varieties

of mangoes. The experimental results will contribute a step towards the standardization and control of the soluble sugar content of mango cultivar for the fruit pulp and its qualitative studies14. The standardization of chemical content, dietary fibers and the byproducts amount calculation is necessary for the commercial purpose.

2. MATERIALS AND METHODS

The fruit samples were harvested from the western districts of Uttar Pradesh, Ghaziabad and Meerut. of U.P. The best quality cultivars viz. Langra and Dusheri were taken for the present study. The harvested fruits were fully mature. They were kept at 25±2 oC temperature. Then the fruits were analyzed at 0 day and after 6 to 8th day.

Sugar estimation: For the sugar estimation 100 ml mango pulp is taken. For the sugar estimation, clarification and neutralizing 45% neutral lead acetate and 22% potassium oxalate are mixed so that it could be neutralized. The test for reducing sugar tests the Fehling's solution and Methylene blue is used to indicate the indicator. The pH was tested by the paper strip method found 3.0 pH. For the further studies sock solution was prepared in which 100ml mango pulp is taken in a volumetric flask. In the flask 23.75 gm pure sucrose, 120 ml water, 9ml HCl is mixed. This stock solution is kept in a volumetric flask (250 ml.) for eight days.

Inversion Test: Distilled water is added for the inversion test to perform the reducing sugar test. 200ml water is added in the stock solution to hydrolyze and perform the inversion test. HCl is used to test the amount of sugar in the stock solution. These tests are performed according to Rangana1986)15. 150 gm disodium phosphate heptahydrate was assimilated in the distilled water (850ml) potassium ferric cyanide is also mixed in the solution. Then this solution was heated. For the further studies arsenomolybedate was dissolved in distilled water and HC (21 ml) and sodium arsenate is also dissolved in the distilled water this aqueous solution was heated in water bath (at 55;C for 35 minutes. 2NH2SO4, 10N NaOH were also added in the solution.

Sugar test: ferric acid (as oxidizing agent) is used for ferrocyanide estimating by colorimeter. Methulene blue was used (as indictor) during titration of the reducing sugar. The titration is performed for sugars viz. glucose, fructose. Galactose, lactose etc. all these tests were made as Nelson-Somangyi method 16-19.

Calculation

% Reducing sugar

$$= \frac{\text{mg of invert sugar} \times \text{dilution} \times 100}{\text{litre and wt.of the sample} \times 100} \quad \frac{\text{mg of invert sugar} \times \text{dilution} \times 100}{\text{litre and wt.of the sample} \times 100} \quad \frac{\text{mg of invert sugar} \times \text{dilution} \times 100}{\text{litre and wt.of the sample} \times 100}$$

1) % total sugar as invert sugar = calculated as in (a) making use of titer. The value obtained in the determination of total. Sugar after inversion.
2) % total sugars = (% reducing sugar +% sucrose).
3) % sucrose (N.R.S.) = (% total sugar - % reducing sugars)×0.95

After removal of peeling and kernel, the edible pulp was collected. The pulp is prepared for the further analysis and ethanol is used for readings in soxhlet extractor. Extract was evaporated for the deposition of sugar and organic acid, 160 gm of anhydrous sodium carbonate and 150 gm of disodium phosphate heptahydrate dissolved in distilled water (850 ml) along with potassium ferri-cyanide (4 gms). It is prepared one litre alkaline ferricyanide solution by heating.

Arsenomolybdate solution is prepared as follw

Ammonium tetra hydrate (2.5 g) + distilled water (450 ml) + con sulphuric acid (20 ml) + aqous sodium arsenate (3 g) $\xrightarrow{55oCfor30Minute}$ Arsenomolybdate solution.

3. RESULTS AND DISCUSSION

Mango cultivars have a wide range of developmental periods. The fruit have been reaching physiological ripeness during summertime. Basic physiological characterization of two mango cultivars ie. dasheri and langra have different weights in kernel and pulp. We found that the average fresh weight of langra (306 gm) was quite higher than Dasheri (160 gm). Lower kernel weight is a good criterion for the fruit quality and in this result, it was found to be superior in Dasheri (~ 10.18 %), followed by langra (13.88 %).

Fig No 1. Different basic steps in the sample preparation for the physiochemical analysis are shown in the schematic picture (Kumar, 2012)

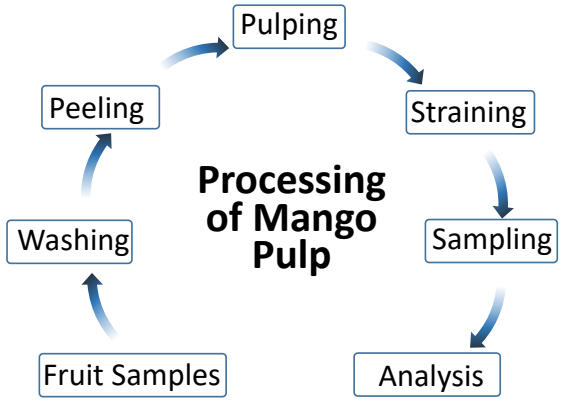


Figure 1 Graphical different steps of the physiochemical analysis in the sample preparation32

The fruits have enough fructose & glucose which were identified as principle monosaccharides. The ripened pulp has glucose, fructose, maltose, xylose, and sucrose18. The ripening phase so the various biochemical alterations. In the present studies, we saw the findings from 7.35% to 13.20% as total sugars in the selected mango varities. The total sugar showed variations in between 23 - 32% (fresh weight) as presented in table No. 1.

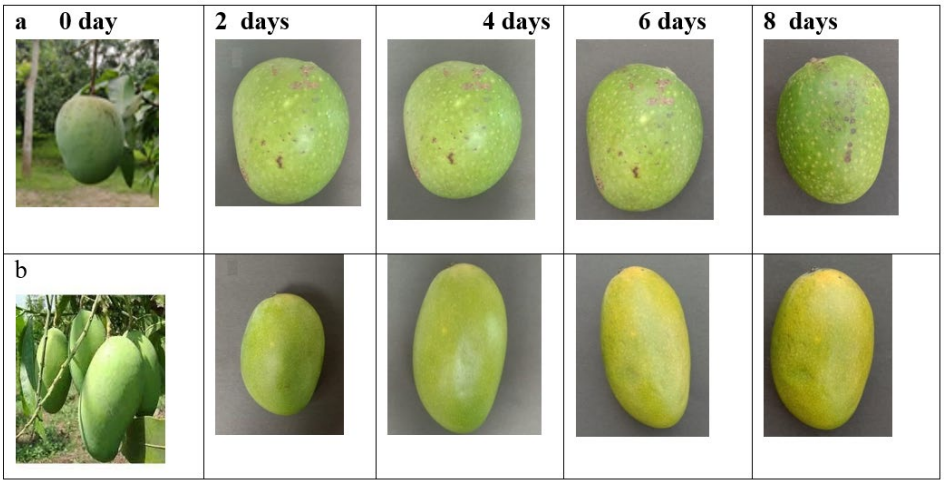
Table 1: Qualitative amount of reducing and non-reducing sugar in Dasheri and Langra fruits

Mango Var	Total (%)	Reducing (%)	Non-Reducing (%)
Dasheri	32.00	12.45	19.55
Langra	23.00	8.46	14.54

Many workers studied on the effect of a growing stages of trees and sugar compositions in fresh & stored mango fruits (D.N. Tyagi et al)19. Both the types of fruits showed no significant differences. Many workers showed much more amount of sugars which were differ from the present findings (D. K. Tandon and S. K. Kalra)20. Its main causes were different varieties and their climatic changes.

The fruits of Dasheri had the highest reducing sugar (12.45 %) and non-reducing sugar (19.55 %) and Langra had the lowest reducing sugar (8.46 %) and non-reducing sugar (14.54 %) content. The biochemical changes mainly sugar and organic acid are taking place at the ripening phase of mango fruits21. There were many variation in morphological appearance in the both mango cultivars viz. Langra and Dasheri we considers two stages at maturity / harvesting stage i.e. zero day and one week (Figure No. 2).

Figure 2 Morphological structure of Studied varieties showing different days stages



It is interesting to further study chemistry, metabolism, and structure-activity relationship of sugars in fruits.22 Sucrose glucose and fructose are gradually increased in the unripe to ripening stage, at the eating ripe stage. On the Keitt" mangoes, and Israeli mangoes an increasing trend in Glucose and Fructose contents is reported in the previous report 23-25.

In our Comparative study, all three-sugar contents at the different ripening stages on the both mango crops (Dasheri & ,Langra) have been carried out. The quantitative variation in these three soluble sugars during the different ripening stages of two mango varieties is tabulated in Table 2. In the case of Dasheri, we observed that the sucrose and glucose are significantly enhanced at the initial ripening stage (2nd day), whereas the fructose is increased according to days' intervals. A similar trend is observed for Langra, sucrose and glucose are enhanced at the initial ripening stage (2nd day). The fructose is increased gradually with the days of ripening. Interestingly, at the initial ripen sugar % sucrose level is relatively high in dasheri but at the full ripening stage, it was found to be lower with respect to Langra. In the case of Glucose and Fructose, it is observed that Glucose and Fructose are almost the same at the beginning but at the full ripening stage % amount of Glucose and Fructose found to be significantly higher in dasheri the as shown in Table 2. At the eating ripe stage, Langra had maximum sucrose (1.80 %) and Dasheri had minimum (1.60 %) but the glucose content in Dasheri had maximum (7.8 %), Langra had minimum (6.0 %). The percentage of fructose in Dasheri is maximum (6.12 %), lowest in Langra (5.10 %). The Glucose Fructose ratio had a maximum (1.36) in Dasheri and minimum in Langra (1.02). The starch and sugars are estimated at the different ripening stages at zero day; raw fruit, at after two days (50 % matured) at sixth day (75 % ripened) and after eight day as fully ripened fruit (Table-2)

Table 2. Variations of starch and sugars during the different ripening stages of two mango varieties:

Cultivars	Days after harvest	Sucrose (%)	Glucose (%)	Fructose (%)	Glucose-Fructose ratio
Dasheri	0	0.18	2.06	2.20	0.90
	2	0.88	6.28	3.14	1.42
	6	1.30	6.92	4.88	1.40
	8	1.60	7.80	6.12	1.36
Langra	0	0.11	2.06	2.00	1.12
	2	1.60	5.00	3.60	1.10
	6	2.20	5.40	4.40	0.88
	8	1.80	6.00	5.10	1.02

In the developing stage of mango fruits, metabolic changes take place, which plays a crucial role to control the acidity level. Acidity level is decrease gradually during the maturity time. In the meantime, the starch is converted into sugars.26. The unripe fruit contains citric acids, malic acids, and other organic acids such as oxalic acids and succinic acids, whereas

the ripe mango is rich in malic acids. Variation in acidity and acid content during the different ripening stages. In the both verities we have observed both the qualitative & the quantitative changes in carbohydrate chemistry and the % amount of these acidity levels are tabulated in Table 3 at the different ripening stages. It has been assumed that the sugars are produced at the expense of the starch. Experimental values of percentage of sugars indicate that fruit plants contain other carbohydrates or carb-derivatives that may not be of nutritional value 27 but are of immense importance in the development of a mass of fruit parts. These compounds include mainly cellulose, hemicelluloses, pectin, or fiber. The changes of fruit after harvest are numerous and include the changes in respiration, water content, carbohydrate composition, organic acid & pH28. The results were recorded and presented in the table no. 3

Table 3 Variation in acidity and acid content during the different ripening stages:

Cultivar	Days after harvest	Acidity (as citric acid %)	Citric acid (mg %)	Malic acid (mg %)	Citric acid malic acid ratio
Dasheri	0	1.53	390.2	44.0	9.20
	2	1.20	180.0	32.0	6.30
	6	0.30	91.2	42.2	2.24
	8	0.17	78.4	48.8	1.80
Langra	0	1.30	502.2	80.0	138
	2	1.02	422.4	48.2	154
	6	0.40	168.9	44.0	140
	8	0.22	122.7	48.6	120

A significant change in citric acids was observed during ripening. Langra and Dusheri varieties showed low amount of citric acid and malic acid during ripening stage of fruits i.e. from 0.17% to 0.22% acidity. There was a remarkable reduction in between citric acid and malic acid ratio at fully matured stage.In case of pulp pH, dasheri contained the highest pH (5.28) while the lowest pH contained was found in langra (4.96). The above results also correlated with the finding of Hossain et al and Kashyap.30-32.

4. CONCLUSIONS

Majority of investigated data showed that the soluble sugar from ethanolic extracts. A detailed biochemical analysis of mango pulp soluble sugar content is carried out at four different ripening stages of two mango cultivars viz. Langra and Dasheri. Soluble sugar composition from ethanolic extract of two mango cultivars viz. 1 and 2 were determined by quantitative determination of reducing sugar. In addition, its physical property weight (gm), length, fruit diameter (cm) juice weight, and fiber (%) were systematically studied. The analysis showed that the fructose and glucose concentration (w/w) are 32.60 % and 23.37% respectively. It was found that environ age and maturity affect the characters. The rapid biochemical changes arefound at the ripening phases. Comparative study of maturity of mangoes ie. artificially induced and naturally developed showed significant changes. The total percentage of sugar is induced in mango was 22.06 %, while naturally ripened mango showed 21.06 %.

5. DECLARATION

The present work is original which is completed in the laps of IARI Pusa New Delhi Department of Chemistry, MMH College Ghaziabad. There is no conflict of interest.

CONFLICT OF INTERESTS

None.

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