Standardization of Protocol for West Indian Cherry (*Malpighia glabra* L.) Squash

R. Navya Rani*, Laxman Kukanoor, Manjula Karadiguddi, N. Srinivas, K.H. Nataraja and Sumangala Koulagi

1 Department of PHT, 3 Department of FSC, 4 Department of Plant Pathology, KRCCH, Arabhavi, Karnataka, India
2 Department of FSC, COH, Bidar, Karnataka, India

*Corresponding author

### Abstract

A study was conducted during 2018-2019 in the Department of Post Harvest Technology, Kittur Rani Channamma College of Horticulture, Arabhavi (UHS, Bagalkot), Karnataka. The experiment was consisted with nine different treatments viz., fruit juice concentration (25, 27.5 and 30%), TSS (40, 45 and 50º B) and acidity level (1.0%) are kept constant, each treatment was replicated thrice in completely randomized design. The results of west Indian cherry squash shows that there was a marginal decreasing trend with respect to parameter like TSS (45.00 to 36.10 ºBrix), titratable acidity (1.58 to 1.25 %), ascorbic acid (965.41 to 702.96 mg/100 ml), anthocyanin (3.94 to 2.18 mg/100 g), total sugars (35.53 to 34.92 %) and antioxidant property (93.51 to 67.40 %), whereas increasing in the pH (3.10 to 3.41) during the three months after storage.

### Keywords

West Indian cherry juice, Anthocyanin content, Titratable acidity

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### Introduction

Barbodas cherry or Acerola or West Indian cherry (*Malpighia glabra* L.) is a promoting tropical and sub-tropical fruit. The presence of highest natural ascorbic acid content in West Indian cherry fruits aroused interest in this plant among horticulturist as well as food supplement industries. On the other hand, West Indian Cherry pulp have attractive colour and the richest source of vitamin C, vitamin A, lycopene and other antioxidants. Furthermore, they also contain an adequate amount of minerals and electrolytes such as potassium, manganese, copper, iron and zinc (Pareek and Vishal, 2006).

The fruits may be consumed fresh or its pulp can be used for preparation of juice, jam, jelly, preserve, syrup *et c.* The juice or pulp may also be used to increase ascorbic acid contents of various other products. Its juice can be used to blend with other fruit juices to give delicious mixed fruit cocktails and to improve their nutritive value. This crop has not gained
popularity because of lack of awareness of its
cultivation, nutritional value and standard
methods to make the processed products
(Singh et al., 1999). Fruit juice and squash
consumption has been increasing, due to
public perception of fruit juices as a healthy
natural source of nutrient. As West Indian
cherry is highly perishable in nature and has a
very limited shelf life of just one – two days
and it not so commercially cultivated, hence it
must be utilized for processing. If these fruits
are processed into commercial value - added
products, they form an important nutritional
product for all the age group people (Jakhar et
al., 2012). The developing of processing
technology will help in better utilization of
West Indian cherry fruits through value added
products preparation like juice, squash, jam,
puree, etc. Hence, the present investigation
was undertaken to standardize the protocol for
west Indian cherry (Malphigia glabra) squash,
with different concentration of juice and TSS,
also to study their storage behavior.

Materials and Methods

An experiment was carried out in the
laboratory of the department of Post-Harvest
Technology, Kittur Rani Channamma College
of Horticulture (University of Horticultural
sciences, Bagalkot), Arabhavi, Gokak taluk
and Belagavi district of Karnataka state during
2018-19. The experiment was laid out in
completely randomized design with 9
treatments and 3 replications, in which the
treatment varies with fruit juice concentration
(25, 27.5 and 30%) and TSS (40, 45 and 50º
B).Ripe fruits are harvested from the college
orchard, fruits of uniform shape, size, ripened
and free from damage were selected and
washed in clean water to remove adhering dirt
and crushed with the help of basket press for
extraction of juice. The extracted juice was
taken to prepare squash. Prepared squash was
used for analysis of TSS by using an Erma
Hand Refractometer, total sugar content,
titratable acidity was determined by the
procedure given by Ranganna (1997), pH by
using digital pH meter, ascorbic acid by using
2,6-dichlorophenol indophenols (2,6-
DCPIP),anthocyanin content was recorded by
taking an absorbance (O.D) at 510 nm, total
phenols were estimated by Folinciocalteau
reagent (FCR) method (Bray and Thrope,
1954) and antioxidant activity of juice was
determined by free radical activity of the
extract was measured in terms of radical
scavenging ability using the stable free radical
DPPH.

Results and Discussion

The mean value of TSS and total sugars of
squash showed a downward trend in the value
from initial to third month from 45.18⁰ Brix to
36.10⁰ Brix and 35.53 to 34.92 per cent
respectively. Here controversial results were
obtained for both TSS and total sugars, where
it decreased slightly throughout the storage
period. This result was like the findings noted
by Palaniswamy and Muthukrishnan (1974) in
jamun squash who also observed a slight
increase in TSS initially and then decrease
during storage. Jain et al., (1986) found that
there was no appreciable change in TSS value
during storage of phalsa, kaphal and litchi
squashes. The result obtained in this study
about this parameter is in conformity with the
findings of Hema (1997) in jamun squash and

Maximum titratable acidity value was
recorded in treatment T₈ (West Indian cherry
juice 27.50% + TSS 50º B) and minimum
value was recorded in T₁ (West Indian cherry
juice 25% + TSS 40º B). This might be due to
copolymerization of organic acids with
sugars and amino acids (Selvamuthukumaran
and Khanum 2013) or due to the chemical
interaction between the organic constituents
affected by the temperature and action of
enzymes (Malav et al., 2014).
The pH of the squash is responsible for its flavor and it is inversely proportional to acidity. In the present study the pH of the squash increase during the storage and their mean value varies from 3.10 at initial to 3.41 at the end of the storage. pH values affected by various treatments, storage intervals and storage conditions, pH value showed significant increase in present study. The results of present investigation are in line with the previous finding of Alaka et al., (2003) who observed that the total titratable acidity declined during storage for both fortified and unfortified samples of guava juice stored in different packaging treatments due to the breakdown of ascorbic acid and citric acid.

There was a significant reduction in vitamin C content of squash during storage from 965.41 mg per 100 ml to 702.96 mg per 100 ml by the 3rd month after storage. Since, vitamin C is a strong antioxidant, it oxidizes itself resulting in rapid reduction of vitamin C during storage. Kalra et al., (1991b) reported that during storage, vitamin C content decreased by 50 per cent in all market drinks except guava, in which the vitamin C retention was better.

**Table 1. Effect of treatments and storage period on TSS and total sugars of west Indian cherry squash**

<table>
<thead>
<tr>
<th>Treatments</th>
<th>TSS (° Brix)</th>
<th>Months after storage</th>
<th>Total sugars (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>T₁ - West Indian cherry juice 25% + TSS 40° B</td>
<td>40.33</td>
<td>36.07</td>
<td>32.10</td>
</tr>
<tr>
<td>T₂ - West Indian cherry juice 27.50% + TSS 40° B</td>
<td>40.67</td>
<td>36.13</td>
<td>32.20</td>
</tr>
<tr>
<td>T₃ - West Indian cherry juice 30% + TSS 40° B</td>
<td>40.33</td>
<td>35.20</td>
<td>31.17</td>
</tr>
<tr>
<td>T₄ - West Indian cherry juice 25% + TSS 45° B</td>
<td>45.10</td>
<td>40.20</td>
<td>36.10</td>
</tr>
<tr>
<td>T₅ - West Indian cherry juice 27.50% + TSS 45° B</td>
<td>45.07</td>
<td>40.07</td>
<td>36.20</td>
</tr>
<tr>
<td>T₆ - West Indian cherry juice 30% + TSS 45° B</td>
<td>45.06</td>
<td>39.10</td>
<td>34.10</td>
</tr>
<tr>
<td>T₇ - West Indian cherry juice 25% + TSS 50° B</td>
<td>50.03</td>
<td>46.20</td>
<td>45.10</td>
</tr>
<tr>
<td>T₈ - West Indian cherry juice 27.50% + TSS 50° B</td>
<td>50.03</td>
<td>45.10</td>
<td>43.10</td>
</tr>
<tr>
<td>T₉ - West Indian cherry juice 30% + TSS 50° B</td>
<td>50.01</td>
<td>45.23</td>
<td>43.13</td>
</tr>
<tr>
<td>Mean</td>
<td>45.18</td>
<td>40.37</td>
<td>37.02</td>
</tr>
<tr>
<td>S.Em ±</td>
<td>0.27</td>
<td>0.10</td>
<td>0.09</td>
</tr>
<tr>
<td>C. D. @ 1%</td>
<td>1.12</td>
<td>0.40</td>
<td>0.36</td>
</tr>
</tbody>
</table>

**Table 2. Effect of treatments and storage period on titratable acidity and pH of west Indian cherry squash**

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Titratable acidity (%)</th>
<th>pH</th>
<th>Months after storage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>T₁ - West Indian cherry juice 25% + TSS 40° B</td>
<td>1.32</td>
<td>1.24</td>
<td>1.20</td>
</tr>
<tr>
<td>T₂ - West Indian cherry juice 27.50% + TSS 40° B</td>
<td>1.62</td>
<td>1.45</td>
<td>1.32</td>
</tr>
<tr>
<td>T₃ - West Indian cherry juice 30% + TSS 40° B</td>
<td>1.58</td>
<td>1.50</td>
<td>1.46</td>
</tr>
<tr>
<td>T₄ - West Indian cherry juice 25% + TSS 45° B</td>
<td>1.42</td>
<td>1.36</td>
<td>1.27</td>
</tr>
<tr>
<td>T₅ - West Indian cherry juice 27.50% + TSS 45° B</td>
<td>1.65</td>
<td>1.53</td>
<td>1.50</td>
</tr>
<tr>
<td>T₆ - West Indian cherry juice 30% + TSS 45° B</td>
<td>1.48</td>
<td>1.23</td>
<td>1.18</td>
</tr>
<tr>
<td>T₇ - West Indian cherry juice 25% + TSS 50° B</td>
<td>1.66</td>
<td>1.51</td>
<td>1.35</td>
</tr>
<tr>
<td>T₈ - West Indian cherry juice 27.50% + TSS 50° B</td>
<td>1.81</td>
<td>1.60</td>
<td>1.56</td>
</tr>
<tr>
<td>T₉ - West Indian cherry juice 30% + TSS 50° B</td>
<td>1.66</td>
<td>1.52</td>
<td>1.43</td>
</tr>
<tr>
<td>Mean</td>
<td>1.58</td>
<td>1.44</td>
<td>1.36</td>
</tr>
<tr>
<td>S.Em ±</td>
<td>0.07</td>
<td>0.06</td>
<td>0.07</td>
</tr>
<tr>
<td>C. D. @ 1%</td>
<td>0.29</td>
<td>0.25</td>
<td>0.27</td>
</tr>
</tbody>
</table>
Table 3 Effect of treatments and storage period on ascorbic acid and anthocyanin content of west Indian cherry squash

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Total phenols (mg/100 ml)</th>
<th>Total antioxidant activity (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>T1- West Indian cherry juice 25% + TSS 40º B</td>
<td>2.32</td>
<td>2.10</td>
</tr>
<tr>
<td>T2- West Indian cherry juice 27.50% + TSS 40º B</td>
<td>2.34</td>
<td>2.14</td>
</tr>
<tr>
<td>T3- West Indian cherry juice 30% + TSS 40º B</td>
<td>2.74</td>
<td>2.51</td>
</tr>
<tr>
<td>T4- West Indian cherry juice 25% + TSS 45º B</td>
<td>2.93</td>
<td>2.60</td>
</tr>
<tr>
<td>T5- West Indian cherry juice 27.50% + TSS 45º B</td>
<td>2.65</td>
<td>2.39</td>
</tr>
<tr>
<td>T6- West Indian cherry juice 30% + TSS 45º B</td>
<td>2.68</td>
<td>2.44</td>
</tr>
<tr>
<td>T7- West Indian cherry juice 25% + TSS 50º B</td>
<td>2.50</td>
<td>2.30</td>
</tr>
<tr>
<td>T8- West Indian cherry juice 27.50% + TSS 50º B</td>
<td>3.29</td>
<td>3.07</td>
</tr>
<tr>
<td>T9- West Indian cherry juice 30% + TSS 50º B</td>
<td>2.75</td>
<td>2.54</td>
</tr>
<tr>
<td>Mean</td>
<td>2.69</td>
<td>2.46</td>
</tr>
<tr>
<td>S.Em</td>
<td>0.15</td>
<td>0.14</td>
</tr>
<tr>
<td>C. D. @ 1%</td>
<td>0.61</td>
<td>0.57</td>
</tr>
</tbody>
</table>

It clearly showed in table, that mean value decreased throughout the storage irrespective of treatments (3.94 to 2.18 mg/100 ml). Loss of anthocyanins in squash might be due to their high susceptibility to auto oxidative degradation (hydrolysis) during storage (Waskar and Khurdiya 1987). Similar results were recorded by Thakur and Thakur (2017) in box myrtle (Myricanagi) squash and Thakur et al., (2018) in wild pomegranate. The mean value of phenolic content was decreased slightly during the storage intervals from 2.69 mg/100 ml at initial to 1.97mg/100 ml at three months after storage. The decrease in the total phenol content of squash during storage might be due to their involvement in the formation of polymeric compounds by complexing with protein and their subsequent precipitations as also observed earlier (Abers and Wrolstad 1979). Similar results were observed by Kannan and Thirumaran (2001) in jamun squash, Thakur et al., (2018) in wild pomegranate squash. Among all the treatments mean value of antioxidant property of squash decreased from 93.51-67.40per cent during storage. This might be due to oxidation and release of free radicals or may be reduction in reductones such as ascorbic acid content in squash as compared to fresh fruit (Nagendran et al., 2005) or decrease could occur due to the antioxidant antagonism, which is related to
the presence of different bioactive compounds and their interactions, resulting in a decrease in antioxidant activity values (Ferreira-Zielinski et al., 2014). These findings suggest that most of juice samples should be treated as short shelf-life products and that they should be consumed within the first couple of days after opening.

In conclusion, organoleptically acceptable West Indian Cherry squash can be prepared by using West Indian cherry juice at a concentration of 27.50 per cent and maintaining of 50º B of TSS (T5) and it was followed by T4 (West Indian cherry juice 25% + TSS 45ºB).

References


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