PRODUCTION AND SENSORY EVALUATION OF HOMEMADE DATE SYRUP AS ALTERNATIVE SWEETENER IN POST COVID19: A PRELIMINARY STUDY

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Abstract
Date fruits (phoenix dactylifera) belongs to the palm tree family Arecaceae. The date fruits and seeds are rich in vitamins, minerals, antioxidants and fiber and contain both essential and non-essential amino acids. Date is naturally sweet and can be processed into syrup and used as healthy alternative to table sugar. Eating healthy for sustaining a healthy life in post COVID19 is the wish of every human being but with the changing lifestyle and palates for sweeten food, healthy living may be compromised. COVID-19 pandemic had enormous impact on the eating habit of the general population with visible effects in post COVID19 leading to major behavioral changes in eating habits especially high calorie diets which may promotes extra weight gain and exacerbates their risks of developing health complications, severe disease cases, and mortality. This paper examined the production and sensory evaluation of homemade date syrup as alternative sweetener in post COVID19. Specifically, the study produced syrup from date fruits, conducted sensory evaluation and acceptability of tea using the syrup as sweetener and studied the keeping quality of the homemade syrup at room temperature. Findings revealed that, the syrup was rated high in all the sensory attributed measured and had no significance difference at P < 0.05 with the control. People of all ages should be encourage to include date syrup in their diet especially in beverages and breakfast cereals as this will help increase essential nutrients intake that are present in date fruits and also reduce their risks of developing health complications such as dental carries, obesity, type 2 diabetes, insulin resistance and fatty liver disease.

Keywords: Date Syrup, Sensory Evaluation, Post COVID19

Introduction
Date fruits (phoenix dactylifera) known as Dabino by the Hausa tribe, belongs to the palm tree family Arecaceae (Obiegbuna, 2013). They are one-seeded oval-cylindrical shape that has a bright yellow colour when ripe and matured and brown when dried. Tang, Shi, and Aleid, (2013) noted that date is one of the oldest cultivated tree crops, and has been grown for thousands of years. Date fruit is consumed throughout the world and it is an important food crop in the Middle East, North Africa and West Africa especially northern Nigeria (Sokoto, Jigawa, Kebbi and others). The fruit contributes to the economy and social life within these regions (Sadiq, Izuagie, Shuaibu, Dogoyaro, Garba, & Abubakar, 2013; Awofadeju, Awe, Adewumi, & Adeyemo, 2021).

Date fruits and seeds are rich in vitamins, minerals, antioxidants and fiber (Samira, 2022) and contain both essential and non-essential amino acids (Sadiq et al, 2013) they are very good sources of mineral elements such as K, Na, Ca, Mg, Zn, Fe and P (Tammam, Salmanb, & Abd-El-Rahima, 2014). In addition, dates are a good source of vitamins C, B6, and A (Panoff, 2019). They also contain antioxidants such as flavonoids, tannins, saponins, cardiac glycosides and steroids in both pulp and seed (Sadiq, et al.,2013), which may help prevent the development of certain chronic illnesses, such as heart disease, cancer, Alzheimer’s and diabetes (Elliott, 2018).

The seed of the fruit can be roasted and ground into powder to make a coffee-like beverage, called date coffee (Babarinde et al., 2016; Samira, 2022). Mature date pulp has been used more as a sugar source than as a fruit. Date sugar is produced by pulverizing dried dates into powder form and is great
Eating healthy for sustaining a healthy life in post COVID19 is the wish of every human being but with the changing lifestyle and palates for sweeten food, healthy living may be compromised. The COVID-19 pandemic had enormous impact on the eating habit of the general population with visible effects in post COVID19. The pandemic resulted in panic, stress, depression, anxiety and sedentary lifestyle among the general population. Indeed, COVID-19 lockdowns brought major behavioral changes in eating habits especially high calorie diets which may promotes extra weight gain and exacerbates their risks of developing health complications, severe disease cases, and mortality.

Table sugar (fructose) has been linked to several negative health effects, including obesity, type 2 diabetes, insulin resistance and fatty liver disease. Consuming fructose may also increase feelings of hunger and sugar craving (Babarinde, et al., 2016; Groves, 2018). Common table sugar is heavily processed to get to a point of consumption. Table sugar is mostly made from beets, or sugarcane, neither of which can be eaten as sugar without a significant amount of processing that is usually very different from the original nature. Table sugar is mostly void of any nutritional benefit except for calories. Considering the nutritional importance of date fruits and its health benefits, production of date syrup could serve as alternative to table sugar and synthetic sweeteners in our daily food and beverage. Babarinde et al. (2016) opined that the production of date syrup as alternative sweetener will increase its potential, diversify its use and also reduce the problem associated with consumption of table sugar and synthetic sweeteners.

There are limited studies on sensory evaluation of date syrup as sweetener; therefore, the objective of this study is production and sensory evaluation of homemade date syrup as alternative sweetener in post COVID19. Specifically, the study is aimed at producing syrup from date fruits, conduct sensory evaluation and acceptability of tea using the syrup as sweetener and studied the keeping quality of the homemade syrup at room temperature

**Research Questions**

The following questions were answered in this paper:

1. What are the mean ratings of judges in terms of sensory evaluation (appearance, colour, flavour, taste and consistency) among tea sweetened with date syrup, sugar and honey?

2. What are the mean ratings of judges in terms of overall acceptability among tea sweetened with date syrup, sugar and honey?

**Hypothesis**

**H0:** There is no significant difference among tea sweetened with date syrup, sugar and honey in terms of sensory evaluation (appearance, colour, flavour, taste and consistency)

**H0:** There is no significant difference among tea sweetened with date syrup, sugar and honey in terms of overall acceptability.

**Material:**

Matured date fruits were purchased at the local market in Warri, Delta State., recycled bottle container jars, stainless sauce pan, bowls, cooking spoons, and gas cooker were used to prepare the date syrup.

**Method of Sample Preparation**

Mature fruits of uniform size, free of physical damage and injury from insects and fungal infection, were selected and used for this experiment. 550gm of date fruits was measured, washed, pitted and chopped to pieces. The dates were allowed to soak
in two liters of hot water for about two hours to allow them to soften up. After two hours, the soaked date plus the water was transferred into a stainless pot and boiled on high heat for about 10 minutes and then left to simmer for 30 minutes. After which the cooked date was filtered through a cheese cloth and hand pressed to remove the liquid. The liquid was returned to the saucepan and then simmer until a thick consistency was formed then cooled in cold water bath and bottled. No additives or any preservative was added.

The date syrup was stored from 2\textsuperscript{nd} August, 2022 to 22\textsuperscript{nd} August, 2022 while constantly checking to see if there was any physical microbial growth or change in colour and appearance.

**Population for Study**
The population of this study was made up of both male and female members of staff of School of Vocational Education, Delta State College of Education, Mosogar. There are thirty five members of staff (20 male and 15 female) in School of Vocational Education, Delta State College of Education, Mosogar (Office of the Dean, 2022) as at the time of this study.

**Sample for the study**
Ten male and female (five male and five female lecturers) that are familiar with sweetened hot beverages were purposively selected to make up the panel of judges.

**Instrument for data collection**
A questionnaire was used to collect data for this study. The questionnaire was designed to measure the attributes of the date syrup in terms of attributes. The questionnaire was employed to measure judges’ preference in terms of Appearance, Colour, Flavour, Consistency, Taste, After Taste and Overall Acceptability, among tea sweetened with date syrup (DST), sugar (SST) and honey (HHT). The questionnaire was a Nine – Point Hedonic Scale.
which were as follows: (1) dislike extremely, (2) dislike very much, (3) dislike moderately, (4) dislike slightly, (5) neither like nor dislike, (6) like slightly, (7) like moderately, (8) like very much, and (9) like extremely. Dislike extremely being the lowest (1) scale and like extremely (9) being the highest scale. The cut-off mark was 5 (neither like nor dislike).

Data collection techniques
Ten copies (10) of the questionnaire were printed and given to each of the ten judges. Hot tea was prepared and served to each of the judges. The judges were requested to sweeten the tea according to their taste with date syrup (DST), sugar (SST) and honey (HHT) in term of appearance, colour, taste, flavour consistency, taste, mouth feel and overall acceptability. The judges were given a bottle of clean water to rinse their mouth after tasting each sample.

Data analysis
The data obtained from the sensory evaluation scores of the date syrup (DST), sugar (SST) and honey (HHT) from the respondents was analyzed and the mean obtained. Data obtained were subjected to analysis of variance (ANOVA) and significant means discriminated by Turkey’s LSD test (Gomez and Gomez 1984). Significance differences were accepted at p < 0.05.

MEAN = \frac{N}{n}

Where N is = Total Mark Scored; n = Total Numbers of Responses (Judges)

Results
Research Question 1: What are the mean ratings of judges in terms of sensory evaluation (general appearance, Colour, consistency and overall acceptability) among tea sweetened with date syrup, sugar and honey?

Table 1: Mean ratings of sensory evaluation of DSS, HHS and SSS

<table>
<thead>
<tr>
<th>Samples</th>
<th>Appearance</th>
<th>Colour</th>
<th>Consistency</th>
<th>Taste</th>
<th>Flavour</th>
<th>After Taste</th>
</tr>
</thead>
<tbody>
<tr>
<td>DSS</td>
<td>8.11&lt;sup&gt;a&lt;/sup&gt;</td>
<td>8.56&lt;sup&gt;a&lt;/sup&gt;</td>
<td>8.78&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.56&lt;sup&gt;a&lt;/sup&gt;</td>
<td>8.67&lt;sup&gt;a&lt;/sup&gt;</td>
<td>8.11&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>HSS</td>
<td>8.33&lt;sup&gt;a&lt;/sup&gt;</td>
<td>8.67&lt;sup&gt;a&lt;/sup&gt;</td>
<td>8.67&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.89&lt;sup&gt;a&lt;/sup&gt;</td>
<td>8.78&lt;sup&gt;a&lt;/sup&gt;</td>
<td>8.22&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>SSS</td>
<td>8.56&lt;sup&gt;a&lt;/sup&gt;</td>
<td>8.78&lt;sup&gt;a&lt;/sup&gt;</td>
<td>8.44&lt;sup&gt;a&lt;/sup&gt;</td>
<td>8.00&lt;sup&gt;a&lt;/sup&gt;</td>
<td>8.56&lt;sup&gt;a&lt;/sup&gt;</td>
<td>8.66&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

Key: DSS: Date Syrup Sample; HSS: Honey Sample; SSS: Sugar Sample

*Samples with different superscripts are significantly different (P < 0.05).

The results revealed that taste of tea samples was rated as DSS 8.00; HHS had the mean rating of 7.89 and SSS had 7.56. The table also revealed that the mean rating of judges for After-Taste for DSS was 8.11, HHS was rated as 8.22, while SSS had 8.66 respectively.

Research Question 2: What are the mean ratings of judges in terms of overall acceptability among tea sweetened with date syrup, sugar and honey?

Table 2: Mean rating for Overall Acceptability DSS, HHS and SSS

<table>
<thead>
<tr>
<th>Samples</th>
<th>DSS</th>
<th>HSS</th>
<th>SSS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>8.56&lt;sup&gt;a&lt;/sup&gt;</td>
<td>8.33&lt;sup&gt;a&lt;/sup&gt;</td>
<td>8.11&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

Key: DSS: Date syrup; HSS: Honey sample; SSS: Sugar sample

*Samples with different superscripts are significantly different (P < 0.05).

Table 2 shows that the mean rating for DSS was 8.56; HHS had 8.33 while the mean rating for SSS was 8.11.
was 8.11, which means that tea sweetened with date syrup sample was more acceptable by the judges than sugar and honey sweetened tea.

**H0**: There is no significant difference among tea sweetened with date syrup, sugar and honey in term of Appearance.

### Table 3: ANOVA test for Appearance of DSS, HHS and SSS

<table>
<thead>
<tr>
<th>SOURCES</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F- VALUE</th>
<th>STD ERROR</th>
<th>LSD</th>
<th>REMARK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Samples</td>
<td>2</td>
<td>0.6</td>
<td>0.3</td>
<td>0.670</td>
<td>0.223</td>
<td>0.892</td>
<td>ACCEPT</td>
</tr>
<tr>
<td>Judges</td>
<td>9</td>
<td>10.033</td>
<td>1.115</td>
<td>2.489</td>
<td>0.149</td>
<td>0.450</td>
<td>ACCEPT</td>
</tr>
<tr>
<td>Error</td>
<td>18</td>
<td>8.057</td>
<td>0.448</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>29</td>
<td>18.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The hypothesis testing in ANOVA Table 2 revealed that the calculated F- (F-cal) value for samples was 2.489 which is less than the F- critical (F- crit.) value of 3.55 at P ≤ 0.05. Hence there is no significant difference among tea samples. The null hypothesis was upheld.

### Table 4: ANOVA test for Colour of DSS, HHS and SSS

<table>
<thead>
<tr>
<th>SOURCES</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F- VALUE</th>
<th>STD ERROR</th>
<th>LSD</th>
<th>REMARK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Samples</td>
<td>2</td>
<td>0.2</td>
<td>0.1</td>
<td>0.351</td>
<td>0.178</td>
<td>0.712</td>
<td>ACCEPT</td>
</tr>
<tr>
<td>Judges</td>
<td>9</td>
<td>5.49</td>
<td>0.61</td>
<td>2.140</td>
<td>0.197</td>
<td>0.939</td>
<td>ACCEPT</td>
</tr>
<tr>
<td>Error</td>
<td>18</td>
<td>5.13</td>
<td>0.285</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>29</td>
<td>10.8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The hypothesis testing in ANOVA Table 3 revealed that the calculated F- (F-cal) value for samples was 2.140 which is less than the F- critical (F- crit.) value of 3.55 at P ≤ 0.05. Hence there is no significant difference among tea samples. The null hypothesis was upheld.

### Table 5: ANOVA test for Consistency of DSS, HHS and SSS

<table>
<thead>
<tr>
<th>SOURCES</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F- VALUE</th>
<th>STD ERROR</th>
<th>LSD</th>
<th>REMARK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Samples</td>
<td>2</td>
<td>0.47</td>
<td>0.24</td>
<td>1.509</td>
<td>0.133</td>
<td>0.532</td>
<td>ACCEPT</td>
</tr>
<tr>
<td>Judges</td>
<td>9</td>
<td>16.04</td>
<td>1.78</td>
<td>1.113</td>
<td>0.133</td>
<td>0.532</td>
<td>ACCEPT</td>
</tr>
<tr>
<td>Error</td>
<td>18</td>
<td>2.86</td>
<td>0.16</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>29</td>
<td>19.36</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The hypothesis testing in ANOVA Table 3 revealed that the calculated F- (F-cal) value for samples was 1.509 which is less than the F- critical (F- crit.) value of 3.55 at P ≤ 0.05. Hence there is no significant difference among tea samples. The null hypothesis was upheld.

STD error was 0.133 and the LSD was 0.532. This shows that, there is no significant difference among tea sweetened with date syrup, sugar and honey, which implies that the null hypothesis of no significant difference is upheld.
The calculated F-cal (F-cal) value for judges was 0.164 which is less than the F-critical (F-crit) value of 3.55 at P ≤ 0.05. This indicates that there is no significant difference among judges preference. Therefore, the null hypothesis was accepted. The STD error was 0.261 and the LSD was 1.044. This revealed that, there is no significant difference among tea sweetened with date syrup, sugar and honey, which implies that the null hypothesis of no significant difference is upheld.

The calculated F-cal (F-cal) value for samples was 0.955 which is less than the F-critical (F-crit) value of 3.55 at P ≤ 0.05. This indicates that there is no significant difference among samples. Therefore the null hypothesis is accepted. The STD error was 0.25 and the LSD was 1.00. This revealed that, there is no significant difference among tea sweetened with date syrup, sugar and honey. The null hypothesis of no significant difference is upheld.

The hypothesis testing in ANOVA Table 2 revealed that the calculated F-cal (F-cal) value for samples was 0.877 which is less than the F-critical (F-crit) value of 3.55 at P ≤ 0.05. This indicates that there is no significant difference among samples. Therefore the null hypothesis is accepted. The STD error was 0.25 and the LSD was 1.00. This revealed that, there is no significant difference among tea sweetened with date syrup, sugar and honey. The null hypothesis of no significant difference is upheld.
date syrup, sugar and honey. The null hypothesis of no significant difference is upheld

Findings also revealed that date syrup show no sign of visible spoilage for three weeks, but at the forth week, there was increase in the product an foam like substance covered the syrup which may be due to fermentation

Discussion of Results
Tea sweetened with date syrup compared favorably in all the attributes measured with sugar and honey tea, this may be due to the fact that consumers are now becoming aware of the negative effects of sucrose (table sugar) in the diet. Result indicates that all the samples have a mean rating between 6.66 and 8.78, which was above the acceptable mean of 5.0 on a 9 – point Hedonic scale. This means that all the samples were rated from moderately liked to very much like. The table showed that Date syrup tea was rated higher in terms of consistency, flavour, taste and over all acceptability than Honey tea and sugared ted. The appearance and colour of Date syrup tea was similar to that of organic honey when added to the tea prepared. Sugared tea had the highest mean score in appearance and colour while Date syrup tea had the least score. There were no significance difference (P<0.05) in the mean rating of appearance and colour of tea samples. The results agree with Babarinde et al., 2016 who also recorded no significance difference in colour in a similar study and El-Sharnouby, et al (2014). There were no significant differences among all studied date syrup, and honey in their color, taste, consistency.

The consistency of tea sweetened with date had the highest mean rating than both honey and sugar. Results indicates that there was no significance difference at P<0.05 among judges’ preference. Flavour is another attribute that influences the acceptance of food even before they are tasted. Flavour is the main criterion that makes the product to be liked or disliked (Ogbonyomi, 2018). The mild pleasant flavour of date syrup appeals to people of all age groups. The mean score for flavour revealed that Date syrup tea compared favorably well with tea sweetened with honey and sugar and even had the highest mean score. Findings revealed that there were no significant difference (P<0.05) in flavour of all the samples. The result also agreed with Babarinde et al., 2016; El-Sharnouby, et al., (2014) (syrup from different date species) and Shahein, et al., (2022) (date syrup in fermented camel milk) who recorded high mean rating in flavour preference in there samples.’

Findings also revealed that date syrup tea was rated higher in taste preference than honey and sugar tea. Sugar may be sweeter than dry dates in taste, yet the judges preferred date tea than honey and sugar tea. The researchers believe that this may be due to the fact that consumers are beginning to be aware of the negative effects of sucrose (table sugar). In After Taste, findings from the results shows that date syrup tea had the least mean rating by the judges and there was no significant difference at P < 0.05 among judges preference among the samples. In overall acceptability, findings revealed the judges mean rating for date syrup tea was higher than both sugar and honey tea, which mean that date syrup tea was very much liked by the judges than both sugar and honey tea

The date syrup was also examined for physical changes. Finding indicates that there were no visible changes in date syrup until after three weeks of storage at room temperature. After three (3) of storage, there was fermentation of the syrup which causes a foaming substance on the syrup. After four week, the syrup was no longer good for consumption. This means that homemade date syrup is safe for consumption up to three weeks at room temperature without preservative and refrigerator.

Conclusion
The research concludes that with loaded nutrients in date fruits and its products especially date syrup, there is a strong possibility of using date syrup as alternative sweetener. This innovation will serve as a means of increasing the nutritional value of food when added to the diet as well as reduce the consumption of table sugar. It will also reduce the risks of developing health complications such as dental carries, obesity, type 2 diabetes, insulin resistance and fatty liver disease.

Recommendations
1. The use of homemade date syrup as alternative sweetener should be encouraged in Nigeria especially among adults. This will reduce the amount of table sugar consumed daily in the diet, either directly hidden in other foods
2. People of all ages should be encouraged to include date syrup in their diet especially in
beverages and breakfast cereals as this will help increase essential nutrients intake that are present in date fruits and also reduce their risks of developing health complications such as dental carries, obesity, type 2 diabetes, insulin resistance and fatty liver disease.

3. Youths and especially women should be encouraged to invest in the production of homemade date syrup as this can serve as an avenue to generate income in post COVID19 thereby curbing unemployment in the country. 

4. Government and private investor should introduce date syrup into product that requires sugar such as bottled beverages, fruit juices, breakfast cereals and others, as this will increase the diversification of date fruits thereby increasing date fruit production and also reduce importation of sugar and other artificial sweeteners.

References


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