ASSESSMENT OF THE PRESERVATIVE EFFECTS OF DIFFERENT LOCAL SPICES AND THEIR FLAVOR ACCEPTABILITY IN HIBISCUS SABDARIFFA CALYX DRINKS

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Abstract
Beverage drinks were produced from Hibiscus sabdariffa leaves, by hot water extraction using different local spices namely Piper guineense (Uziza), Zingiber officinale (ginger), Xylopia aethiopica (Udah), Monodoramyristica (Ehuru), Syzygium aromaticum (Cloves) and Aistoneiboonei (Ehu). The drinks were then dispensed into six (two litre) cans which were cooled in a refrigerator for sensory evaluation and into six (150 ml) plastic bottles which were stored on the shelf for six days. All samples were pasteurized first, allowed to cool, before storage. Their respective ph values were also recorded immediately. The sensory evaluation results showed the drink with Zingiber officinale having highest overall acceptability followed by Piper guineense while that with Xylopia aethiopica had the lowest acceptability. The ph readings were again recorded after six days. Their microbial counts were determined after six days of storage using standard methods. Results of the microbial counts showed that the Monodoramyristica sample has the highest preservative effect showing no visible growth after 48 hours while the Xylopia aethiopica sample had the highest microbial count indicating the least preservative effect.
Keywords: Hibiscus Sabdariffa, preservative effect, flavor acceptability, spices.

Introduction
Zobo drink is a traditional non-alcoholic beverage made from the reddish purple and acid-succulent calyces of the flower Hibiscus sabdariffa by mainly hot water extraction of the leaves (Olayemiet et al., 2011). The flower is highly cultivated in the Northern part of the country, probably due to the climate, it is used to produce various types of highly valued food and medicinal products in different parts of the world including Nigeria (Adesokan, et al., 2013). It is a widely consumed, popular health drink derived from the petals of the hibiscus flower and has been traditionally consumed for centuries by warriors and chiefs and lovingly served to growing children by mothers and caretakers. Zobo is commonly found hawked around in packaged transparent polythene sachets or plastic containers in most Northern and some Southern parts of Nigeria. The flowers of H. sabdariffa are rich in vitamins and other antioxidants (Kochlar, 1991). The proximate composition of zobo drink shows that it has 90% water, 0.7% protein, 8% carbohydrate, 1.4% fiber and 1.1 fat. Iron, niacin, riboflavin, thiamine, Betacarotene, phosphorous and calcium are also present in various proportions (Fasoyiro et al., 2005).

The medicinal value of the zobo plant has been claimed to include antihypertensive, antiseptic, astringent, diuretic, purgative activities, remedy for cancer, abscesses, cough, debility, scurvy and fever(Ogbo,2002). The economic and religious situation in Nigeria has made zobo drinks gain wide acceptance in different occasions because of its cheapness and non alcoholic content. It is used as refreshment, entertainment in parties or as appetizers before the main drink because it tastes like fruit punch and is low in sugar content. However, at present, the production is neither mechanical nor standardized, consequently the shelf life is less than two days (Omemu et al.,).

The simplicity in the production, availability of raw plant materials and the abject poverty in many rural communities as well as the new economic revamping policies of the Government has resulted in increased consumption and merchandise of many traditional foods at cottage levels in Nigeria, thereby making zobo drink a potential ready local alternative to both alcoholic and non-alcoholic beverages especially imported ones e.g. red wine (Egbere et al., 2007) The drink has been shown to have significant nutritional and health benefits (Adebayo and Samuel, 2009; Fasayiro, 2005), but at present the production processes are very crude that is neither mechanized or standardized due to poor hygienic practices and largely unregulated nature of the trade. Consequently the shelf life of the drink is less than two days (Raimi., 2013). This instability of zobo drinks stored at ambient temperatures shortly after production is a major hindrance to its large scale production and marketability and is largely due to the fact that Zobo drinks can ferment naturally due to microbial activity, if kept unpreserved, thereby making the drink a potential health hazard if consumed (Ukwuru and Uzodimma, 2010).

Spices have been known and used for ages especially for their aroma and to some extent for their preservative qualities (Dziezak, 1989). Garlic, Cinnamon and cloves have also been shown to inhibit bacterial and mould growth (Paster et al., 1995). The use of our cheap, readily available and largely underutilized local spices as an additive in zobo drink will have a dual effect of improving the taste as well as prolonging the shelf life. However, most of our local spices such as Piper guineense, (Uziza); Xylopia aethiopica, (Udah); Monodoramyristica, (Ehuru); Aistoneiboonei, (Ehu), etc. have not been well investigated for use in Zobo drinks for both flavor and preservative effects. This...
research therefore assessed the preservative effects of some local spices used in Nigeria and their flavor acceptability in Zobo drinks.

**MATERIALS AND METHODS**

Dry Calyxes of *Hibiscus sabdariffa*, *Piper guineense* (Uziza), *Xylopi aethiopica* (Udah), *Monodoramyristica* (Ehuru); *Syzygium aromaticum* (cloves) *Zingiberofficinale* (Ginger); *Aistoniaboonei* (Ehu) as well as sugar were purchased from a local market in Oko, Anambra State. The spices were sorted and cleaned using cold water, sun dried and milled into fine particles using an attrition mill.

**PREPARATION OF ZOBO DRINKS**

An Aqueous extract of *Hibiscus sabdariffa calyx* (800g) was prepared by boiling at 100° C for 15 minutes in twenty liters of water; it was cooled and filtered using a 0.25mm sieve. Sugar was added to taste (5g/liter). The drink was dispensed into six sterile two liter cans and six sterile 150ml pet bottles respectively. Four grams of each spice was added to each of the two liter kegs while 1g of each spice was added to each 150 ml pet bottle. The bottles were covered and pasteurization done at 75° C for ten minutes. The two liters kegs were refrigerated and used for sensory evaluation, while the 150ml pet bottles were kept at ambient temperature for six days.

**Analyses**

Microbial counts of each of the drinks immediately after production and after six days of storage were determined according to standard methods (Collins and Lynne, 1979). The pH readings were taken immediately after production and after six days of storage using a ph meter. Sensory evaluation of the refrigerated samples for flavor, aroma, taste, color and overall acceptability was carried out by ten semi-trained panelists drawn from the Polytechnic community using a 9-point hedonic scale.

The mean sensory evaluation scores of the spiced drinks are presented in table 1, indicating that the *Zingiberofficinale* (ginger) flavored drink had the highest acceptability (7.1), followed by *P.guineense*, (Uziza), 6.6, while *X.aethiopica* had the least overall acceptability. This disagrees with the work of Ukwuru and Uzodinma, 2010 in which *S.aromatica* (cloves) had the highest overall acceptability. This may have been due to the fact that different spice concentrations were used in both studies.

![Flow chart for Hibiscus sabdariffa drinks production](image)

**Results and Discussion**

The pH readings of the drinks after production and after six days are shown in table 2 and it is observed from the table that the pH readings generally decreased after six days which agrees with the work of Ukwuru and Uzodinma, (2010) who reported a general decrease in pH of the drinks after six days of storage. This may have been due to antimicrobial activity. The pH values of the drinks immediately after production as well as after six days are also represented in figure 1.
Table 2: ph readings of the drinks after production and after six days

<table>
<thead>
<tr>
<th>Samples</th>
<th>ph after production</th>
<th>ph after six days</th>
</tr>
</thead>
<tbody>
<tr>
<td>S.aromatical(cloves)</td>
<td>5.23</td>
<td>3.09</td>
</tr>
<tr>
<td>Z.officinable(Ginger)</td>
<td>5.62</td>
<td>3.06</td>
</tr>
<tr>
<td>P. guineense (Uziza)</td>
<td>5.63</td>
<td>2.96</td>
</tr>
<tr>
<td>A. boonei (Ehu)</td>
<td>5.63</td>
<td>2.96</td>
</tr>
<tr>
<td>X. aethiopica (Udah)</td>
<td>5.06</td>
<td>3.06</td>
</tr>
<tr>
<td>M.myristica (Ehuru)</td>
<td>5.58</td>
<td>3.2</td>
</tr>
</tbody>
</table>

Microbial count results immediately after production showed no growth for all samples while the results of microbial count after six days are shown in table 3. The microbial counts results showed that the Ehuru sample had no growth at all indicating highest preservative effects while the Udah-flavoured drink had highest microbial count showing the least preservative effect (90cfu/ml). The ginger, cloves, Uziza and Ehu also showed moderate preservative effects in the drinks as seen from table 3. This agrees with the work of Sagdic et al., (2003) who reported that Z. officinale (ginger), M.myristica, (Ehuru) and S. aromaticum decreased the microbial load of Zobo drinks with increase price concentrations. The microbial counts of the spiced drinks after six days of storage are also represented in figure 2. The M. myristica (Ehuru) sample which had the highest preservative effect shows that the spice has shown more antimicrobial activity than all the other spices under test. This may have been because the active component of these spices may have interacted synergistically with other factors to increase its preservative effect. The preservative effect of these spices is due to their chemical composition especially the essential oil fractions which are inhibitory to microbial growth. However these chemical compositions vary in spices, hence some kept the shelf life of the Zobo drinks longer than others as observed in the Ehuru, ginger and cloves drinks, hence the volatile oil in spices are responsible for their aroma and taste as well as their antimicrobial properties. Because of the concentrations of these compounds, it also affected their flavouring qualities (ZaiKa,1998). The results of this research showed that although flavour may be acceptable at a particular spice concentration; that concentration may fail to keep the shelf life of the drink for a long time. This is explained by the fact that though M.myristica (Ehuru) was less accepted than ginger uziza and cloves, in terms of flavour, it showed the highest preservative effect showing no growth at all meaning that microbial growth was completely inhibited by Ehuru. (table 3, fig 2). This also agrees with the work of Ukwuru and Uzodinma,(2010),who reported that although cloves appeared to be a good preservative at a particular spice concentration of 0.3%,its flavour at this point was least acceptable. However this disagrees with their work in the area of Udah having the least preservative effect as well as least flavor acceptability in the Zobo drinks. Other flavoring materials with antimicrobial properties such as lime juice have been used to prolong the shelf life of Zobo drink Nwachukwu et al., (2007)

Table 3: Microbial counts of the drinks after production/after six days

<table>
<thead>
<tr>
<th>Sample</th>
<th>Microbial Count (cfu/ml) After six days</th>
<th>Microbial count After production</th>
</tr>
</thead>
<tbody>
<tr>
<td>S.aromatical(cloves)</td>
<td>19</td>
<td>No growth</td>
</tr>
<tr>
<td>Z.officinable(Ginger)</td>
<td>6</td>
<td>No growth</td>
</tr>
<tr>
<td>P. guineense(Uziza)</td>
<td>29</td>
<td>No growth</td>
</tr>
<tr>
<td>A. boonei (Ehu)</td>
<td>32</td>
<td>No growth</td>
</tr>
<tr>
<td>X.aethiopica(Uda)</td>
<td>90</td>
<td>No growth</td>
</tr>
<tr>
<td>M.myristica(Ehuru)</td>
<td>No growth</td>
<td>No growth</td>
</tr>
</tbody>
</table>
Conclusion
Results of this research show that our local spices such as *Z. officinale* (ginger) *S. aromaticum* (cloves) and *P. guineense* (uziza), *M. myristica* (ehuru) had good flavour acceptability in zobo drinks, even though ginger had the highest overall acceptability. Also, *M. myristica* showed the highest preservative effects in zobo drinks after six days of storage at ambient temperature while *X. aethiopica* (udah) showed the least, even though all the spices under test had good preservative effect except the *X. aethiopica*. Zobo drink has become a popular non-alcoholic drink in Nigeria due to its low price, nutritional and medicinal properties. Various methods of improving its flavor to improve its consumption are being explored; however its instability when stored at ambient temperature remains a major hindrance to its large scale production. The spices under test in this work were good flavoring agents and they also had good preservative effects except the Udah sample, hence the use of our available and cheap spices as both flavouring and preservative agents in Zobo drinks so as to produce different varieties, increase its

![Figure 1: Results of the ph readings of the drinks](image1)

![Figure 2: Microbial Count After six days](image2)
marketability and acceptability as well as increasing its shelf life should be further explored. Further research should also be done on its potential as a probiotic food.

References


Olayemi, F. Adedayo, R. Muhummad, R. and