Comparative Analysis of Water in Tender and Matured Coconut Fruits and Use as Oral Rehydration Solution

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Abstract  
In this research, comparative analysis of the amount of sodium, chloride and glucose present in coconut water of both tender and matured coconut fruits were done and compared with that of commercially available oral rehydration salt. Sodium in combined state, as sodium chloride is an active element for rehydration. It has ability to absorb water into the gut mucosa and aid the flow of fluid back into the body. Amount of sodium was determined using Flame emission Spectrophotometer. Chloride was determined by Mohr’s titration method and amount of glucose was determined using Lane and Eyon titration method. The result of the analysis revealed the potency of coconut water as a readily available oral rehydration solution for oral rehydration therapy. The tender coconut is most suitable, having relatively close amount of sodium, chloride and glucose with that of the commercially available salt. The mature coconut has higher concentration of glucose compare with that of commercially available oral rehydration salt.  

Keywords: Flame Emission Spectrophotometer, Coconut water, Oral Rehydration Solution, Titration methods.

1.1 INTRODUCTION

In recent years, diarrhoea has being one of the major causes of infant mortality. The main cause of diarrhoea is poor sanitation and contamination of food, especially in unhygienic environment. Diarrhoea which is passage of abnormal watery stools, has been reported to cause death fairly quickly and particularly among children under five years old (Kingpin (2005).  

In most acute diarrhoea, electrolyte such as chloride and sodium besides water are actively secreted from the gut mucosa and thus lost in stools. It has being observed that while water and sodium were being lost, nutrients such as glucose, amino acids and dipeptides continued to be absorbed into the body as an active enzyme mediated (Kingpin (2005).  

If an isotonic-osmolar solution of glucose and sodium is given orally, glucose and sodium are absorbed. Sodium absorption also promotes absorption of water. This is the physiological basis of oral-rehydration therapy, which is fascinating advancement of modern medicine and has probably saved more lives than any other treatment modality.  

In view of the deadly nature of the dehydration, which may be as a result of diarrhoea or excessive exercise, there is need for first aid measure to rehydrate the lost water in the body. Intravenous (IV) fluid, which would have being the classic approach to dehydration, is posed with problem of expertise and at the same time expensive. Oral rehydration solution can be highly effective, inexpensive and uncomplicated treatment for most forms of dehydrated. It requires no specialized skills or equipment uses ingredients that are ubiquitous and has a low risk of complications.  

Coconut water has being reported to be a natural isotonic beverage, with the same level of electrolytic balance as we have in our blood. During the pacific war of 1941-45, both sides in the conflict regularly used coconut water-siphoned directly from the nut to give emergency plasma transfusion to wounded soldiers (Duke, J.A. and Ducellier J.L, 1993).  

Coconut palm, Cocos nucifera L, is commonly found across the southern part of Nigeria, especially the coastal area. It has being found out that the electrolyte concentration and volume of water in the coconut fruit depend on the age of the fruit (Harries H.C 2001). For an ordinary man in Nigeria, the use of appropriate fruit may not be taking into consideration. It is therefore important to ascertain the specify type based on age of the Coconut fruit to be used for oral rehydration therapy.  

This research is aimed at examining the usage of Coconut Water as a readily available material for an emergency means of rehydration and being able to ascertain the specific Coconut fruit to be used even by
common people.

1.1.1 EXPERIMENTAL PROCEDURE
SAMPLE COLLECTION
Both the mature and tender coconut fruits were plucked and collected from the coconut tree for the analysis.

SAMPLE PREPARATION
The Coconut fruit were dehusked properly with the use of knife. The unplugged germ pore at the proximal end of the Coconut was pinched with the knife, so as to drain out the liquid. The volume and pH of the liquid were taken.

PREPARATION OF COMMERCIALY AVAILABLE ORAL REHYDRATION SOLUTION (STANDARD)
One sachet of the commercial oral rehydration salt, which is 22g, was dissolved in 1litre of distilled water.

DETERMINATION OF CHLORIDE CONTENT OF COCONUT WATER USING MOHR’S TITRATION METHOD
2ml of the coconut water was taken into 50ml volumetric flask and was made up to mark with distilled water. 25ml of the sample solution was titrated with 0.1M solution of sliver nitrate in the presence of potassium chromate indicator.

The solution was swirled constantly until the red colour formed by the addition of each drop began to disappear more slowly: This was an indication that most chloride has been precipitated. The addition was continued until faint but distinct colour change occurs from yellow to brick red with white precipitate. The average titre value of the titration was used to calculate the concentration of chloride precipitated by sliver nitrate.

DETERMINATION OF SODIUM CONTENT OF COCONUT WATER USING FLAME EMISSION SPECTROPHOTOMETER
The coconut water was firstly put into centrifuge for spinning and filter, so as to obtain a supernatant solution. This was done at 1000 revolution for 10minutes. 10ml of the clear was digested with 1% v/v Nitric acid in 50ml volumetric flask and made up to mark with the acid. The solution was then taken into flame emission spectrophotometer to determine the amount of Na\(^+\) present in the solution.

DETERMINATION OF GLUCOSE CONTENT OF COCONUT WATER USING LANE AND EYON METHOD
The determination was done according to Vogel A.J. (1960) procedure. Equal proportion of Fehling’s solution A and B were mixed together in a beaker. 10ml of the mixed Fehling’s solution was pipette into a conical flask and was titrated with the sample solution. The sample solution was added to the Fehling’s solution from the burette.

The titrated solution in the conical flask was heated on the heating mantle as the titration continues. Four drops of methylene blue solution was added after the liquid had boiled moderately for 1½ minute. The sample solution was added at a rate of 0.25ml per 15seconds and was completed within 3minutes from the commencement of boiling. The titration was carried out thrice in order to obtain an average titre value.

1.1.2 RESULT AND DISCUSSION
The results of the analysis were presented in the tables below. Table 1, 2, 3 and 4 contains the chloride, glucose, sodium concentration and the overall summary respectively.

According to the result of the analysis it was discovered that the tender coconut water contains 1.5504mg/100ml, the matured coconut water contains 2.0672mg/100ml and the commercial oral rehydration salt contains 1.7316mg/100ml of chloride.

The amount of glucose in tender coconut water is 147.25mg/100ml; matured coconut water is 154.32mg/100ml and the commercial oral rehydration salt contains 148.05mg/100ml.

Tender coconut contains 212.50mg/100ml of sodium; matured coconut contains 80.70mg/100ml of sodium while the commercial oral rehydration salt contains 204.0mg/100ml. The tender coconut has a relatively close amount of sodium with that of rehydration salt while the matured coconut water has lowest concentration of sodium.

The major constituents for oral rehydration are sodium and glucose. The sodium which cannot exit alone in Free State, occur in combine state as sodium chloride.

Comparing the amount of sodium and glucose in tender and matured coconut water with that of commercially available oral rehydration salt, the tender coconut water has a relatively close value with that of the rehydration salt, while the matured one has higher value of glucose and lower value of sodium compare to that of the oral rehydration salt.
The matured coconut water has highest concentration of glucose content and lowest concentration of sodium content. This may be as result of ageing as the coconut fruit becomes mature; there is decrease in volume of water with reduced concentration of glucose.

1.1.3 CONCLUSION
The result of this analysis has shown the importance of coconut water, especially tender coconut, as a readily available material for oral rehydration therapy and as a substitute for commercially available oral rehydration salt. Its sterile state makes it easier for it to be used as an emergency and first aid treatment in regaining the loss body fluid.

For a common man, the matured coconut water with higher concentration of glucose will not be suitable enough for rehydration due to high level of glucose in it. High intake of glucose can cause diabetes. During the analysis, it was observed that the samples undergo fermentation after two days at room temperature in the presence of air. This confirms the presence of yeast, which bring about fermentation. It is therefore necessary for the coconut water to be prepared and consumed by the patient within one day before fermentation.

REFERENCE

Table1. The average titre value of the chloride in all the samples

<table>
<thead>
<tr>
<th>Samples</th>
<th>Average Chloride Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tender Coconut</td>
<td>1.5504</td>
</tr>
<tr>
<td>Matured Coconut</td>
<td>2.0672</td>
</tr>
<tr>
<td>Commercial oral rehydration salt</td>
<td>1.7316</td>
</tr>
</tbody>
</table>

Table2. The average titre value of the Glucose in all the samples

<table>
<thead>
<tr>
<th>Samples</th>
<th>Average glucose Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tender Coconut</td>
<td>147.25</td>
</tr>
<tr>
<td>Matured Coconut</td>
<td>154.32</td>
</tr>
<tr>
<td>Commercial oral rehydration salt</td>
<td>148.05</td>
</tr>
</tbody>
</table>

Table3. The value of the sodium in all the samples

<table>
<thead>
<tr>
<th>Samples</th>
<th>Emittance</th>
<th>Mol/100ml</th>
<th>Mg/100ml</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tender Coconut</td>
<td>0.50</td>
<td>0.0250</td>
<td>212.5</td>
</tr>
<tr>
<td>Matured Coconut</td>
<td>0.40</td>
<td>0.0095</td>
<td>80.7</td>
</tr>
<tr>
<td>Commercial oral rehydration salt</td>
<td>0.49</td>
<td>0.0240</td>
<td>204.0</td>
</tr>
</tbody>
</table>

Table4. The summary of the results of all the samples

<table>
<thead>
<tr>
<th>Samples</th>
<th>Chlorides Mg/100ml</th>
<th>Glucose Mg/100ml</th>
<th>Sodium Mg/100ml</th>
<th>pH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tender coconut</td>
<td>1.5504</td>
<td>147.25</td>
<td>212.50</td>
<td>5.28</td>
</tr>
<tr>
<td>Matured coconut</td>
<td>2.0672</td>
<td>154.32</td>
<td>80.70</td>
<td>5.80</td>
</tr>
<tr>
<td>Commercial Oral rehydration salt</td>
<td>1.7316</td>
<td>148.05</td>
<td>204.00</td>
<td>7.40</td>
</tr>
</tbody>
</table>
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