ESTIMATION OF SUGAR IN SOFT DRINKS

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ABSTRACT

The quality control and assurance studies on the available brands of soft drinks sold in different parts of Abakaliki, Ebonyi state, was carried out. The research was done to quantitatively determine the type and quantity of sugar present in each of these brands of soft drinks. Two different batch samples of each brands' selected at random shops located in different parts of the state were procured and their comprehensive documentation to show batch number, manufacturing dates, Expiry date and NAFDAC number. Preliminary quantitative investigation was done using alkaline copper is sulphate solution. The pH and densities were estimated by conventional methods, while the type of sugar present was determined by Knight and Alien EDTA methods. Results obtained showed that all the brands of soft drinks tested contained sucrose as the only sugar present and that the sugar level as well as the densities varied through the brands in the order: Pepsi > Coke > Gold Sport > Limca > Sprite > 7up > Fanta >!Vliranda. The mean sugar concentration for all soft drinks in Ebonyi State was 32.4856mg. Though there were differences between the sugar values, it still falls within acceptable limit. The soft drinks were all acidic at room temperature.

KEYWORDS: Soft drinks sold, room temperature, Knight and Alien EDTA methods.

INTRODUCTION

After working oneself to tiredness coupled with the increasing global warming resulting in
increased global warming and frequent thirst, humans need to replenish this water loss. To meet this, human must drink. But homo sapiens is not very fond of plain water and prefers flavoured fluids such as fruit juices, teas, wines, soft drinks etc. (Head, 1983). These soft drinks are expected to quench thirst and cool the hot body. Most atimes, this objective are hardly achieved. Has it ever occurred to you why this experience? But before then, what are soft drinks.

According to encyclopedia of science and technology, soft drinks have been defined as non-alcoholic beverages generally containing fruit acids, sweetening agents and natural or artificial flavorings and colourings. In the 19th century, carbonated water (Soda water) was developed in imitation of effervescent spa water or mineral water. This was the antecedent of carbonated water made by absorption of carbon (iv) oxide pressures, a gas which gives a pleasant, slightly acidic taste and acts as a preservative (Bryndolfaswon, 1982). Sweetening agents, ling to same encyclopedia of science and technology are substances to sweeten foods and drinks. The commonest are the sugar, especially sucrose and glucose which are themselves foods. Artificial sweetener are also present, though with no food value but many times sweeter than sugars are sometime used (Geoffrey, 1987).

Sugar is the sweet soluble carbohydrate (general formula C\textsubscript{X}(H\textsubscript{2}O\textsubscript{µ}). sugar is in fact a generic name to a host of carbohydrates which are the most abundant and widely distributed food component. These carbohydrates includes.

(a) Monosaccharides: These are polyhydroxyl aldehydes and ketones (Ezeugwu, 2001); their empirical formula is (CH\textsubscript{2}O)n, where the smallest value for n is 3 (for glyceraldehyde and dihydroxyacetone) through 7 (heptoses). The most abundant natural monosaccharide are the hexoses, H\textsubscript{12}O, (including glucose) and the pentoses (including xylose). Generally monosaccharides cannot be further degraded by hydrolysis and contain a single chain of carbon atoms.

b) Disaccharides: These are two monosaccharide units joined by an 0-glycosidic bond (oxide bridge). The chemical and physical properties of the disaccharides are similar to those of the monosaccharides. The most important and abundant disaccharides are the sucrose, lactose and the maltose. Sucrose consist of glucose and fructose units joined by their omeric carbon. Consequently, sucrose lack a free reducing group (an aldehyde or ketone); in contrast to all other sugars. Actually, it is one that is pure and in crystalline form and it is consistently
sweet without any other flavour. It is rapidly utilized in the organism serving as an easily assimilated source of energy. (Alais et al., 1999) Lactose consists of a galactose unit joined to a glucose unit by β-1,4-glycosidic bond. It's hydrolysis is effected by an enzyme lactase. Maltose, on the other hand, consists of two glucose units joined by same β-1,4-glycosidic linkage and it's hydrolysis is effected by the enzyme maltase.

The most important property of sugar is its sweetness and this vary in accordance with their solubility. The table below shows the common sugars and some of their characteristics.

Table 1.1: The relative sweetness of saccharin compared to sucrose with value of 100 is 55000 (Jenkins, 1981).

<table>
<thead>
<tr>
<th>S/NO</th>
<th>Sugar</th>
<th>Relative Sweetness</th>
<th>Natural Sources</th>
<th>Products of Digestion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sucrose</td>
<td>100</td>
<td>Refined from cane sugar and sugar beet</td>
<td>Glucose and fructose</td>
</tr>
<tr>
<td>2</td>
<td>Lactose</td>
<td>30</td>
<td>Milk and milk products</td>
<td>Glucose and galactose</td>
</tr>
<tr>
<td>3</td>
<td>Maltose</td>
<td>33</td>
<td>Malted foods</td>
<td>Glucose and glucose</td>
</tr>
<tr>
<td>4</td>
<td>Glucose</td>
<td>50</td>
<td>Fruits and honey</td>
<td>-</td>
</tr>
<tr>
<td>15</td>
<td>Fructose</td>
<td>170</td>
<td>Fruits and honey</td>
<td>-</td>
</tr>
</tbody>
</table>

The unimportant group of carbohydrates (with respect to soft drinks) are the polysaccharides. They may be separated or are part of rigid structures in plant. The nutrient polysaccharide, starch, are metabolic reserves in plant whereas glycogen are metabolic reserves in animal. D-glucose occur in blood of animals, in the sap of plants and many fruit juices. Fructose is found in fruit juices and honey. An abundant source of both glucose and fructose is the disaccharide sucrose (Ezeugwu, 2001).

Apart from its unavoidable role and contribution to the manufacture of soft drinks, sugars also have many functions such as its role in metabolism within animal leody, its storage function in both animals and plants, its supportive function in plant, and so on (Davidson, et al., 1980). Apart from these advantages of sugar; its presence has been linked to tooth decay, ever weight and obesity, diabetes, and heart disease (Geofrey, 1987). Sinclair prepared an advertisement as part of the HEC (Health Education council) "look after yourself" campaign.

The sugar advertisement was designed to convey some fundamental points to the it public These include.
(i) Sugar contains no nourishment; it only contains calorie. The last thing a sedentary body needs is a calorie without nourishment.

(ii) All types of processed sugars, lumps or grain, brown or white, come to the same thing from health point of view; they are all empty calories.

(iii) Sugar is liable to make you fat. Overweight people are more likely to develop high blood pressure and eventually heart attack.

(iv) Sugar rot teeth. A sweet tooth can become no tooth at all. The very worst thing for children is eating or drinking sweet foods between meals.

(v) Sweet food contain lots of sugar. It is stated that a can of colas drink contains up to ten lumps of sugar.

For many years, the greatest opposition to use of sugars has been from chemicals, which have greater sweetness, but without the calories of sugar. The best known of these are saccharin and cyclamates. However tests on laboratory animals rather suggest that both chemicals are possible cause of cancer (Geoffrey, , 1987).

**Scope of Work**
This work aims to analyze a number of selected industrial soft drinks which are common to our localities (Nigeria). Among these products include.

(i) Coca-Cola
(ii) Fanta
(iii) Sprite
(iv) Limca
(v) Gold Spot
(vi) 7up
(vii) Pepsi
(viii) Mirinda

The first three drinks are products of Nigerian Bottling Company, PLC, while the 4th and 5th drinks are products of Limca Bottling Company, whereas the last three are products of Seven-up Bottling Company PLC. All these product are registered and licensed in Nigeria by their respective companies.
Below is table showing some facts about the soft drinks

<table>
<thead>
<tr>
<th>S/NO</th>
<th>BRAND</th>
<th>NAFDAC REG. NO</th>
<th>Constituents claimed by respective manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Coca-Cola</td>
<td>01-0259</td>
<td>Carbonated water, sugar, caramel, colour, phosphoric acid, flavouring and caffeine.</td>
</tr>
<tr>
<td>02</td>
<td>Fanta</td>
<td>01-0260</td>
<td>Carbonated water, sugar, citric acid and ascorbic acid, stabilizer, flavouring, sodium benzoate, colourants, sunset yellow and tartrazine.</td>
</tr>
<tr>
<td>03</td>
<td>Sprite</td>
<td>01-0261</td>
<td>Carbonated water, sugar, citric acid, flavouring, sodium salt, sodium benzoate.</td>
</tr>
<tr>
<td>04</td>
<td>Limca</td>
<td>01-0545</td>
<td>Carbonated water, sugar, citric acid, &lt; antioxidant, gum arabic, sodium benzoate, lime and lemon flavouring.</td>
</tr>
<tr>
<td>05</td>
<td>Gold Spot</td>
<td>01-0305</td>
<td>Carbonated water, sugar, citric acid, gum arabic, orange flavours, sodium benzoate, artificial colour and antioxidant.</td>
</tr>
<tr>
<td>06</td>
<td>7up</td>
<td>01-0164</td>
<td>Carbonated water, sugar, citric acid, sodium citrate, natural lemon and lime flavours.</td>
</tr>
<tr>
<td>07</td>
<td>Pepsi</td>
<td>01-0163</td>
<td>Carbonated water, sugar, caramel, colour, phosphoric acid, caffeine, gum Arabic and natural flavour.</td>
</tr>
<tr>
<td>08</td>
<td>Mirinda</td>
<td>01-0159</td>
<td>Carbonated water, sugar, citric acid, gum Arabic, sodium benzoate, ester gum, natural flavours, yellow No. 6 (sunset yellow), ascorbic acid, yellow NO. 5 (tartrazine), propylene glycol.</td>
</tr>
</tbody>
</table>

**Aims and Objective of Research**

(i) to determine the type of sugar present in these soft drinks

(ii) to estimate quantitatively the sugar in each sample of these industrial drinks.

(iii) This work also aims at establishing some facts, e.g. pH range, about these soft drinks taken in our country and advice the public about their intake since there are some dangers associated with frequent and excessive consumption of these soft drinks.

**MATERIALS AND METHODS**

**Sampling Methodology**

Soft drink bottles of different brands and flavours were purchased from various markets in Abakaliki, Ebonyi State of Nigeria during the month of May 2004. Sugar analysis was carried out at the samples at Federal Medical Centre, Abakaliki during the same month alongside with the determination of parameters like pH, density and taste. Two samples of each of the different brands were analysed for sugar and the above mentioned parameters. Details of the
samples purchased and analyzed at FMC, Abakaliki, are given in tables of each analysis sub-topic.

**Determination of Sugar Level in Soft Drink**

The method used for the analysis is Knight and Alien EDTA method. This method is suitable for the determination of low reducing sugar content. Equipment/Apparatus.

- Meteler P160 and manually operated weighing balance
- Water bathes
- Pestle and mortar
- Beakers and conical flasks
- Spatula
- Burette (100ml)
- Stirrer
- Pipette (automatic and manual)
- Measuring cylinder
- Tripod stand and bunsen burner.

**Chemicals and Solvent**

- Copper (u) tetraoxosulphate (vi) pentahydrate salt (6.00g)
- Sodium trioxocarbonate (iv) pentahydrate salt (25.00g)
- Sodium potassium tartrate (Rochelle salt) (25.00g)
- Sodium hydroxide (10.00g)
- Ethylene diamine tetraacetate (EDTA) (0.93g)
- Methylene blue (0.15g)
- Sodium chloride (40.00g)
- Distilled water

**Principle**

When a solution of the sugar is heated in a boiling water with an alkaline copper reagent, the copper (II) ions is reduced to copper (I) oxide by the sugars present. The CuSO4.5H2O in the mixture is such that it is in excess, and it is the residual copper (II) tetraoxosulphate (vi) pentahydrate that is monitored by the titration of the excess copper (ii) ions against the EDTA using murexide as an indicator.
Sucrose itself is not a reducing sugar and hence cannot be tested directly with benedict solution. Hence, it must first be hydrolysed to its monomers. Sucrose, under appropriate condition is hydrolysed to glucose and fructose which are reducing sugars. This is effected by a strong acid (HCl). This acid incorporate water into the, disaccharide and causes its hydrolysis into its constituent monosaccharide $C_{12}H_{22}O_{11}$ $\text{H}^+ \cdot \text{H}_2\text{O} \rightarrow 2 C_6H_{12}O_6$ (Fructose and glucose).

It is this sugar that the test (Knight and Alien EDTA method) employs.

In the presence of any quantity of reducing sugar, Cu$^{2+}$ ions (from $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$) is reduced to Cu$^+$ ions. This solution which is blue in colour due to the presence of the hydrated copper (11) salt on heating in the presence of strong acid with the sugar solution changes to orange, brick- red or red precipitate indicating the reduction of Cu$^{3+}$ to Cu$^+$ ions $\text{Cu}^{2+} + e^{-} \rightarrow \text{Cu}^{+}$

Blue colour, Red, brick red or orange colour depending on sugar concentration. This test really differentiate a disaccharide from a monosaccharide in that in the test for monosaccharides, the acid is not introduced, and the reduction of copper 11 salt is direct (on heating). But for sucrose, without the introduction of the acid which initiate the hydrolysis, the test would not effect any colour change in contrast to reducing sugars.

Procedure 2ml of each sample of soft drinks at each instance and 2ml of alkaline copper solution was measured into a beaker and mixed together. The beaker and its content was suspended in a boiling water bath for about 5 minutes. The colour changed from grey to orange. The beaker was removed and immediately transferred into a cold water bath for cooling for about another 5 minutes. The beaker was then transferred into a white porcelain basin and approximately 0.1 Og of the indicator was added by means of spatula and stirred properly. The solution turned to green.

The resulting solution was then titrated with the EDTA solution while stirring with a glass rod. The EDTA solution is added gradually and the rate at which it is introduced is progressively reduced to get a sharp and reasonably correct end-point. The introduction of the EDTA is not stopped until the end-point is reached to avoid colour (formed) disappearance due to oxidation.

The colour change, at the end-point is from green to purple through grey. Every sample should be duplicably analysed to ensure accuracy. Calculation of sugar levels in g/35cl of
samples. In calculating the amount of sugar in any given samples, the following steps were followed.

Reaction Equation.

\[ \text{Cu}^{2+} + \text{reducing sugar} \rightleftharpoons \text{Cu}^+ + \text{Reduced sugar} + \text{Cu}^{2+} \text{(excess)} \]

And

\[ \text{Cu}^{2+} + \text{EDTA} \rightarrow \text{Cu} + 4\text{H}^+ \]

NB: The first equation shows the reduction of copper (ii) salt by a reducing sugar when heated while the second equation is the titration between the excess copper (ii) tetraoxosulphate (vi) and EDTA.

To find the sugar level, the mathematical relations are used;

\[ M_s = M_o - M_c \]

Where \( M_s \) = Mass of CuSO\(_4\).5H\(_2\)O which reacted with sugar in the Sample

\( M_o \) = Original mass of CuSO\(_4\)/5H\(_2\)O in g/2ml 
\( M_c \) = Mass of CuSO\(_4\).5H\(_2\)O(in gram) that reacted with standard solution of EDTA. This can be determined from the following sets of equations.

\[ C_e V_e = \text{Mole ratio} \]

\[ C_c V_c \]

Where \( C_e \) = Molarity of EDTA

\( V_e \) = Volume of EDTA used

\( V_c \) = Volume of CuSO\(_4\).5H\(_2\)O complexed with EDTA

\( C_c \) = Molarity of CuSO\(_4\).5H\(_2\)O in mixture

But \( C_c \) = Original molarity of CuSO\(_4\).5

Dilution factor

1dm\(^3\) or 1000cm\(^3\) contains \( C_c \) moles of CuSO\(_4\).5H\(_2\)O

Then \( V_c \) cm\(^3\) will contain \( C_c \times V_c \) in moles

\[ 1000 \]

\[ M_c = \text{Moles} \times \text{Molar mass of CuSO}_4.5\text{H}_2\text{O} \]
PH Analysis
- Digital Orion pH-metre
- Stirrer
- Beaker
- Water to cleanse and standardize the pH-metre.
- Sufficient quantity of soft drinks.

Procedure
The hydrogen ion concentration of each of the samples was determined using a pH metre standardized at pH 7.0 using distilled water. This was done at room temperature (25°C or 298°K). The determination was effected by pouring sufficient quantity of each soft drink into a beaker (5ml), dipping the electrode of the pH metre into the soft drink and turning it on for measurement. The sample in the beaker is continually stirred to ensure uniform distribution of the hydrogen ions of the sample in the beaker.

- Density Determination Materials
- Meteler P160 automatic weighing balance
- Pipette
- Beaker
- Water for cleansing
- 10ml quantity of soft drinks

Procedure
This was effected by weighting empty beaker and measuring 10ml of the soft drinks into the beaker. The weight of the beaker and 10ml of the sample was again measured. The density of the drink was determined using the relation.

\[
\text{Density (g/l)} = \frac{(\text{weight of beaker} + 1 \text{ Oml of drink (gl)}) - (\text{weight of beaker alone (g)10ml (of soft drink)})}{10}\]

Qualitative Analysis-Sugar
- Materials
- Beaker
- Tripod stand and Bunsen burner
- Water bath
- Copper (II) tetraoxosulphate (vi) pentahydrate
- Hcl
- soft drinks samples Procedure

1ml of 2W1 Hcl was introduced into a beaker to which 2ml of soft drink and 2WI of CuS0₄ .5H₂O solution have been mixed. The mixture was then introduced into a boiling water bath for about 5 minutes after which it is allowed to stand for about 30 minutes after heating. The colour change of yellow or orange precipitate after cooling indicate the presence reducing sugar (glucose and fructose) both of which are hydrolysis products of sucrose.

RESULTS
In all, eight original brands of soft drinks were analysed and each of these brands had two batches bringing the total number of samples to sixteen (16). Below are the brands.

Table 4:1 List of soft drinks analysed Of these samples, these parameter; pH, density, type an level of sugar were determined and data collected recorded.

<table>
<thead>
<tr>
<th>S/NO</th>
<th>Brands</th>
<th>FNAFADAC REG. NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Coca-cola</td>
<td>01-0259</td>
</tr>
<tr>
<td>02</td>
<td>Fanta</td>
<td>01-0260</td>
</tr>
<tr>
<td>03</td>
<td>Sprite</td>
<td>01-0261</td>
</tr>
<tr>
<td>04</td>
<td>Limca</td>
<td>01-0545</td>
</tr>
<tr>
<td>05</td>
<td>Gold Spot</td>
<td>01-0305</td>
</tr>
<tr>
<td>06</td>
<td>Tup</td>
<td>01-0164</td>
</tr>
<tr>
<td>07</td>
<td>Pepsi</td>
<td>01-0163</td>
</tr>
<tr>
<td>08</td>
<td>WHrinda</td>
<td>01-0159</td>
</tr>
</tbody>
</table>

Sugar Content Analysis
In sugar content analysis, the procedure stated for sugar in the proceeding chapter was carried out on these samples at room temperature and pressure of 1 atm and the results in table 4 obtained.

According to the qualitative test carried out on these samples, it was discovered that the type of sugar in these soft drinks is sucrose while the results obtained from the qualitative analysis are shown in Table 5.
Table 4.2 Type and levels of sugar in soft drinks analysed

<table>
<thead>
<tr>
<th>S/NO</th>
<th>Brand</th>
<th>Batch NO</th>
<th>Type of Sugar</th>
<th>Quantity of Sugar (g/35cl)</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Coca-cola</td>
<td>AE202:27</td>
<td>Sucrose</td>
<td>34.65</td>
</tr>
<tr>
<td>02</td>
<td>Coca-cola</td>
<td>-</td>
<td>Sucrose</td>
<td>34.65</td>
</tr>
<tr>
<td>03</td>
<td>Fanta</td>
<td>AQ122:40305</td>
<td>Sucrose</td>
<td>28.35</td>
</tr>
<tr>
<td>04</td>
<td>Fanta</td>
<td>Nil</td>
<td>Sucrose</td>
<td>26.78</td>
</tr>
<tr>
<td>05</td>
<td>Sprite</td>
<td>AE223:09</td>
<td>Sucrose</td>
<td>31.24</td>
</tr>
<tr>
<td>06</td>
<td>Sprite</td>
<td>AE210:03</td>
<td>Sucrose</td>
<td>33.86</td>
</tr>
<tr>
<td>07</td>
<td>Limca</td>
<td>AY15:40</td>
<td>Sucrose</td>
<td>33.075</td>
</tr>
<tr>
<td>08</td>
<td>Limca</td>
<td>AY16:34</td>
<td>Sucrose</td>
<td>33.075</td>
</tr>
<tr>
<td>09</td>
<td>Gold Spot</td>
<td>AY17:40</td>
<td>Sucrose</td>
<td>34.205</td>
</tr>
<tr>
<td>10</td>
<td>Gold Spot</td>
<td>AY16:-38</td>
<td>Sucrose</td>
<td>34.128</td>
</tr>
<tr>
<td>11</td>
<td>7up</td>
<td>07END12.-14</td>
<td>Sucrose</td>
<td>36.71</td>
</tr>
<tr>
<td>12</td>
<td>7up</td>
<td>12END23.-16</td>
<td>Sucrose</td>
<td>34.65</td>
</tr>
<tr>
<td>13</td>
<td>Pepsi</td>
<td>05END14.-12</td>
<td>Sucrose</td>
<td>37.50</td>
</tr>
<tr>
<td>14</td>
<td>Pepsi</td>
<td>05END07.-17</td>
<td>Sucrose</td>
<td>42.50</td>
</tr>
<tr>
<td>15</td>
<td>Mirinda</td>
<td>06END69.-49</td>
<td>Sucrose</td>
<td>22.05</td>
</tr>
<tr>
<td>16</td>
<td>Mirinda</td>
<td>03END19:14</td>
<td>Sucrose</td>
<td>28.35</td>
</tr>
</tbody>
</table>

pH Determination

The pH of the soft drinks were analysed using a digital orion pH metre at room temperature set at 25°C and pressure of 1atm.

The results of the analysis are shown in table 4.2

Table 4.2 pH of soft drinks analysed

<table>
<thead>
<tr>
<th>S/NO</th>
<th>Brand</th>
<th>Batch No</th>
<th>PH</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Coke</td>
<td>AE 202:2T</td>
<td>1.32</td>
</tr>
<tr>
<td>2</td>
<td>Coke</td>
<td>-</td>
<td>1.31</td>
</tr>
<tr>
<td>3</td>
<td>Fanta</td>
<td>AQ122:40505</td>
<td>1.73</td>
</tr>
<tr>
<td>4</td>
<td>Fanta</td>
<td>Nil</td>
<td>1.74</td>
</tr>
<tr>
<td>5</td>
<td>Sprite</td>
<td>AE223:-09</td>
<td>2.24</td>
</tr>
<tr>
<td>6</td>
<td>Sprite</td>
<td>AE210:03</td>
<td>2.22</td>
</tr>
<tr>
<td>S/NO</td>
<td>Brand</td>
<td>Batch NO</td>
<td>Weight of Beaker (g)</td>
</tr>
<tr>
<td>------</td>
<td>------------</td>
<td>------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>01</td>
<td>Coca-cola</td>
<td>AE202:27</td>
<td>25.125</td>
</tr>
<tr>
<td>02</td>
<td>Coca-cola</td>
<td>-</td>
<td>25.125</td>
</tr>
<tr>
<td>03</td>
<td>Fanta</td>
<td>AQ1 22:40305</td>
<td>25.125</td>
</tr>
<tr>
<td>04</td>
<td>Fanta</td>
<td>Nil</td>
<td>25.125</td>
</tr>
<tr>
<td>05</td>
<td>Sprite</td>
<td>AE223:09</td>
<td>25.125</td>
</tr>
</tbody>
</table>

Though in most cases, the difference between the pH of same are narrow, there are still some with a relatively wide range of difference.

From table 2, the pH of the soft drinks analysed are very low which implies that it has a high hydrogen ion concentration and are therefore acidic.

**Density Determination**

The density determination was performed at room temperature and latm and the results of the analysis shown in table 3.

**Table 4. 4: Density of soft drinks analysed**
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From table 3, it can be seen that the drinks are of low density (almost near that of water at 4°C) and according to consultant "Bosotex" wine production 2002, the more dense samples was a result of richer nutritional value. This means that the samples either contain nutritional contents with either low nutritional value or that they are equally of low densi

**DISCUSSION**

The soft drinks that were analysed include Coca-Cola, Fanta, sprite, Limca, Gold-Spot, 7Up, Pepsi and Mirinda as shown in table 4.1. The analysis were carried out at room temperature (25°C) and atmospheric pressure.

Table 4.1 show the type and amount of sugar present in each bottle of soft drinks. The type of sugar confirmed in this soft drinks after analysis is sucrose, a non reducing sugar, whose reducing property can be elicited only when hydrolysed in the presence of traces of strong acid (HCl). The sugar level varies from 22.05g to 42.50g and mean sugar level variation of 25.2g to 40.Og. Pepsi, however, contained the highest mean percentage of sugar level per 35cl (10.8773%) while mirinda contains the least mean percentage of this sugar (6.8738%). The sugar level in this analysed soft drinks vary in the order of Pepsi > Coca-Cola > Gold sport> 7up> Limca > i Sprite > Fanta > Mirinda. The mean (x) of the result of sugar level is 32.4856 having its confidence limit (p< 0.05). The result of the Fcal (12.19206) at degree of freedom 0.05 shows that there is a significant difference among the average of each of the
drinks analysed. In general, the soft drinks contained high quantity of sugar which contributes to the flavour associated with these soft drinks.

The mean density of the analysed soft drinks from table 4.3 ranges from 1.017g/ml to 1.050g/ml in the increasing order of Limca<Fanta<Coca-Cola<Sprite<GoldSpot<Mirinda<Pepsi whereas their mean pH from table 4.4 ranges from 1.28 to 2.285 in the increasing order of Pepsi<Coca-Cola< Mirinda<Fanta<Gold-Spot< Sprite<Limca.

CONCLUSION
From the results obtained in table 4.4, the following conclusion can be drawn;
(i) The only type of sugar in these soft drinks is sucrose, a non-reducing sugar whose presence was confirmed on hydrolysis in the presence of trace of strong acid (HCl).
(ii) Though the quantity of sugars in these soft drinks is within acceptable limits, the quantity of sugar in relation to the standard is generally reduced.
(III) These soft drinks are general highly acidic.
(IV) These soft drinks are indeed of low density.

REFERENCES