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Nutritional Content of Malt Drinks Sold on the Ghanaian Market

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Abstract

Five different brands of malt drink sold on the Ghanaian market (Malta Guinness, Rasta malt, Vicco malt, Beta malt and Super malt) were analyzed for pH, conductivity, turbidity, total dissolved solids, protein, carbohydrate and minerals. All the malt drinks were quite acidic with pH ranging from 4.2 to 4.9. Malta Guinness recorded the highest conductivity of 1526.50 + 2.2 mS/cm and a TDS of 11.52 + 0.01 mg while Super malt recorded the lowest conductivity of 671.50 + 2.2 and 0.55 + 0.05. The protein content ranged between 0.175 g/L for Rasta Malt and 1.250 g/L for Malta Guinness. Comparing the carbohydrate content obtained in the malt drinks that ranged from 26.26 -36.29 g/L with the recommended daily intake of carbohydrate is 130 g/day, the carbohydrate content was found to be low. The order of concentration is Malta Guinness >Vicco malt > Super malt > Rasta Malt > Beta malt. Similarly, the levels of calcium, magnesium, potassium and sodium in the malt drinks were found to be generally low.

Introduction

A healthy diet is one that helps maintain or improve health. It is important for lowering many chronic health risks, such as obesity, diabetes, hypertension, cancer etc. A healthy diet involves consuming appropriate amounts of all essential nutrients and an adequate amount of water.

Nutrients are the components of food that an organism uses to survive and grow. Nutrients can be classified broadly as macronutrients and micronutrients. Macronutrients are those nutrients that the body needs in larger amount. They provide the bulk energy an organism needs to function while micronutrients are those nutrients that the body needs in smaller amounts to provide the necessary cofactors for metabolism to be carried out. Micronutrients are also used to build and repair tissues and to regulate body processes such as metabolism.

A healthy diet needs to have a balance of macronutrients calories to support energy needs, and micronutrients to meet the needs for human nutrition without inducing toxicity or excessive weight gain from consuming excessive amounts.

Methods of nutrient intake are different for plant and animals. Most plants ingest nutrients direct from the soil through their roots or from the atmosphere through their leaves. Animal and protists acquire their nutrients by feeding on plants and other species.

Animals and protists have specialized digestive system that work to break down macronutrients for energy and utilize micronutrients for both metabolism and anabolism. Consumption of beverage is one other popular feeding method practised by humans to improve upon diet quality and overall nutrition[1]. It is therefore not surprising to hear that Malted drinks are one of the most widely consumed beverages among children and adolescents in Asia[2,3].

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The non-alcoholic malt drinks are additional products to beer which are produced and marketed by several breweries in Ghana. Malt drinks are readily available sources of ingesting appropriate nutrients into the body. Malt drink draws more potential customers than beer due to its non-alcoholic nature and this is evident by the fact that most supermarkets have in stock several brands of imported malt drinks to subsidize the locally produced ones so as to meet the demands of the teaming consumer. The trends in beverage consumption among children, thus, have changed over the past several decades[4].

Malted drinks are beverages manufactured by mixing malt with other cereal and legume flour. It may involve the addition of milk or without whole milk or milk powder and cocoa powder[3]. Sometimes, cocoa power is used to replace milk powder. Malted drinks are positioned as nutritious beverages in the market[3]. They are often marketed as containing various nutrients, such as carbohydrate, protein, fats, vitamin A, B, C and E, calcium, iron, phosphorus and potassium[3].

Traditionally, fermentation is one of the oldest and most commonly used techniques employed by most breweries to make malt drinks.This is because fermentation is an inexpensive technology which preserves food, increases nutritional value, shelf life, texture, sensory propertiesand other attractive properties of malt. Fermentation may also lead to detoxification, destruction of undesirable factors in the raw material such as phosphate, phytates, cyanides, polyphenols etc. However, the brewer's success in this regard can be attributed to the fermentation technique employed. It is no doubt that, at present many brands of malt drinks in Ghana are advertised and marketed as having been fortified with essential micro-nutrients. This is commendable since it is in line with the global effort at eradicating micronutrient deficiency in human nutrition through the widespread fortification of foods.

More importantly, malt-based drinks have developed a reputation over the centuries for their nutritional value. However, the nutritional and health benefit of malt drinks on the market cannot be guaranteed without periodical checks and monitoring.

This work was therefore carried out to determine the level of some nutrients in five (5) different brands of malt drinks sold on the Ghanaian markets. The parameters examined were protein, carbohydrate and some essential minerals.

Experimental

Five different brands of malt drink on the Ghanaian market were analyzed. Samples of each brand were purchased from different supermarkets in Cape Coast Municipality. Prior to the analysis, the malt drinks were stored in a refrigerator to about 4°C.

Determination of minerals

A 20 ml each of the five (5) different malt samples were pipetted into different 100 ml conical flasks.

A 10 ml of concentrated nitric acid was added to each sample and digested in a fume hood at 350°C for 20-30 minutes. The digested samples were allowed to cool at room temperature for 20 minutes and then diluted with distilled water to the mark.A 10 ml each of the digested samples were pipetted into different 20ml test tubes and were topped up to the mark with distilled water.These solutions were then analyzed for calcium, magnesium, potassium and sodium using atomic absorption spectrophotometer at 422.7nm, 285.2nm, 766.5nm and 589.3nm respectively and their corresponding absorbance's recorded.The concentrations of sodium, potassium, magnesium and calcium in the solution were calculated by comparing the absorbance values with those of the standard.

Estimation of carbohydrate

A 1 ml of the different malt drinks were pipetted into a 50 ml volumetric flask and were topped up with distilled water to the mark.A 5 ml of each of the solutions were pipetted into a different 50 ml volumetric flask and were topped up to the mark with distilled water. A 2 ml of each of the solutions were pipetted into a 20 ml test tubes and 10 ml of the Anthrone reagent was added to each test tube. These solutions were heated on a water bath for 10 minutes at 100°C which then changed color to blue green and cooled in an ice for 10 minutes. The intensity of the blue green color was measured at 623 nm and the corresponding absorbance recorded.The concentration of carbohydrate in the solutions was calculated by comparing its absorbance value with those of the standard.

Estimation of protein

A 5 ml of each of the malt drinks were pipetted into a different 100 ml test tube and 20 ml of 80% Sulfuric acid was added to the sample solutions. The sample solutions were then digested in a fume hood at 350°C for 3 hours. The digested samples were cooled for one hour and the content transferred into a 100 ml conical flask and diluted with distilled water to the mark.A 20 ml of the sample solutions in the conical flask was pipetted and added to 15 ml of sodium hydroxide to convert the ammonium sulfateto ammonia gas. The ammonia gas that was formed was collected into a receiving flask containing 5 ml of dilute boric acid solution. The solution obtained was titrated against 1/140 M hydrochloric acid from which the concentration of nitrogen was obtained.

Preparation of the standard Solutions

Standard solutions of D-glucose, calcium, magnesium, potassium and sodium were prepared and the various intensities measured at the respective wavelengths to obtain the corresponding absorbance.

Results and Discussion

The physicochemical parameters of the various brands of malt drinks determined are presented in Table 1. The various enzymes in the human body require a slightly alkaline medium i.e pH level near 7.4 to function properly. This is needed to maintain good health. All the beverages showed pH values of low acid foods (less than 5.0) similarly to that reported by (Obuzor and Ajaezi, 2010)for some commercial carbonated non-alcoholic malt beverages (pH 4.4 – 4.6). Malta Guinness, Rasta malt, Vicco malt, Beta malt and Super malt has pH of 4.7, 4.55, 4.3, 4.2 and 4.9 respectively. Even though, these values are below 7. 4 needed for proper functioning of the body enzymes, the pH values compare pretty well to the general pH range of 3.5 - 5.0 suggested for malt beverages[4].

All measurements were done in triplicate and the mean calculated. Standard deviation of each sample is given in brack-

et.Conductivity is the ability of electricity to pass through water, using the impurities contained in the water as the "conductor." These impurities are usually mineral ions present in solution.All the malt samples contain various amounts of different mineral ions. Hence, the malt samples can be referred to as electrolytes capable of conducting electricity. Comparing the mineral compositions of the various malt samples in Table 1 with their ability to conduct electricity, the malt brand with the highest concentration of minerals will be most useful medium for conductivity. The order of conductivity, which is also the order of TDS in this study is Malta Guinness >Vicco malt >Rasta malt > Beta malt > Super malt. It is not surprising for this trend since conductivity is often used to estimate total dissolved solids (TDS)content of water samples[5]. Similarly, except Super malt, there is parallel increase in Total dissolved solids and carbohydrate among the malt samples. To some extent, the result is in agreement with the statement that total solids are largely composed of sugar, dextrin, nitrogen compounds and salts[6].

The protein content ranged between 0.175 and 1.250g/L which approximatelyequals three (3) bottles of malt drinks (330 ml). Storage proteins are known to be enclosed in the endosperm cells of the barley and sorghum raw materials. These proteins are classified into albumin (4%), globulin (31%), hordein (36%) and glutein (29%). Hordein and glutein are the major proteins broken down during malting whereas albumin and globulin are mainly enzyme proteins (Palmer, 1989). In adults, the FAO/WHO/ safe intake of proteins has been reported to be 0.80 g/kg for females and 0.85 g/kg for males[7]. For a 70 kg man, this translates into a protein requirement of 59.5 g/day. Thus, the contribution of malt drinks to the daily requirement of protein appears to be minimal. The concentration of carbohydrate ranged from 26.265 -36.294 g/L. The order of concentration is Malta Guinness >Vicco malt > Super malt > Rasta Malt > Beta malt. Previous report gave the amounts of reducing sugar in unspecified brand of malt drinks that ranged from 603.66 - 943.45 mg/dl (Okon and Akpanyung, 2005). The major sources of sugar in malt drinks are through the enzymatic hydrolysis of the starchy raw materials (saccharification) and formation of flavor, color complexes and fortification which also take place. The added sugar is used to increase fermentable extraction fraction and to sweeten the drink. The accumulative sugar for these malt drinks supplies more than eight (8.0) grams of carbohydrate per standard bottle of 330 ml. This carbohydrate level serves as a source of instant energy for immediate utilization for athletes, convalescents, hypo glycaemia patients and other persons involved in heavy physical activity but, diabetic patients should exercise restraint since the high level of sugar in malt drinks could lead tocomplications in this disease condition. The recommended daily intake of carbohydrate is 130 g/day. Comparing this with the amount of carbohydrate obtained in the various malt drinks clearlyindicates substantially low levels.

Another important fortificants are minerals, which are inorganic substances that are essential to the functioning of organ systems and the entire body[8]. Some of these mineral substances exist in large amounts in the body. Examples are calcium, magnesium, potassium and sodium.The levels of calcium, magnesium, potassium and sodium in the malt drinks were found to be generally low.

In the malt drinks, calcium ranged in value between 19.78 and 132.88 mg/L. Calcium concentration of the malt drinks is in the order Malta Guinness > Beta malt >Vicco malt > Rasta malt > Super malt. Calcium is needed for the formation andmaintenance of bones, the development of teeth and healthy gums. It is necessary for blood clotting, stabilizes many body functions and is thought to assist in preventing bowel cancer (Attieh, 1999)[9,10]. It has a natural calming and tranquilizing effect and is necessary for maintaining a regular heartbeat and the transmission of nerve impulses. The required amount include: 1,000 mg/day for people aged 19 - 50 years and 1,200 mg perday for people over the age of 51 years. The maximum level of calcium is 2.5 g/day[8]. The amount of calcium recorded in the malt drinks is very low (Table 1).

Table 1: Physicochemical characteristics and nutrients in some selected malt drinks in Ghanaian market.

Parameters	Malta Guinness	Rasta malt	Vicco malt	Beta malt	Super malt
pH (degassed)	4.70(0.01)	4.55 (0.05)	4.30 (0.02)	4.20 (0.03)	4.90 (0.04)
Cond(us/cm)	1526.50 (4.30)	988.00 (2.89)	1101.50 (4.8)	798.00 (3.1)	671.50 (2.2)
TDS(mg/L)	1.52 (0.01)	1.18 (0.008)	1.33 (0.09)	1.05 (0.21)	0.55 (0.05)
Protein(g/L)	1.25 (0.32)	0.175 (0.02)	0.63 (0.10)	1.19 (0.01)	0.630 (0.11)
Carbohydrate(g/L)	36.294 (0.31)	28.65 (0.74)	31.997 (0.38)	26.265 (0.930	31.041 (0.980
Calcium(mg/L)	132.88 (4.2)	35.35 (0.35)	49.23 (0.42)	68.89 (1.36)	19.78 (1.32)
Magnesium(mg/L)	131.65 (3.99)	29.23 (0.41)	77.13 (1.39)	6.38 (0.20)	21.28 (0.41)
Potassium(mg/L)	74.20 (3.8)	20.23 (0.62)	16.87 (1.21)	96.12 (1.92)	52.23 (1.94)_
Sodium(mg/L)	124.71 (2.23)	31.74 (0.53)	61.62 (1.82)	98.10 (1.92)	76.51 (1.34)

Magnesium in the malt drinks, ranged in value between 6.38 and 131.65 mg/L. magnesium concentration of the malt drinks is in the order Malta Guinness >Vicco malt >Rasta malt > Super malt >Beta malt. Magnesium plays a role in over 300 enzymatic reactions within the body, including the metabolism of food, synthesis of fatty acids and proteins, and the transmission of nerve impulses. The recommended daily intake of magnesium for men is 400-420 mg and for women is 300-320 mg; comparatively, the malt drinks do not contain the needed required amount of magnesium.

Potassium in the malt drinks were found ranging from 16.87 to 96.12 mg/L. The concentration of Malta Guinness, Vicco malt, Rasta malt, Super malt andBeta malt was found to be 74.20, 16.87, 20.23, 52.23 and 96.12 mg/L respectively. Guidelines issued by the Institute of Medicine of the National Academies of Science encourage adult to consume at least 4700 mg of potassium every day. Once again, the study recorded low values ofpotassium in the malt drinks.

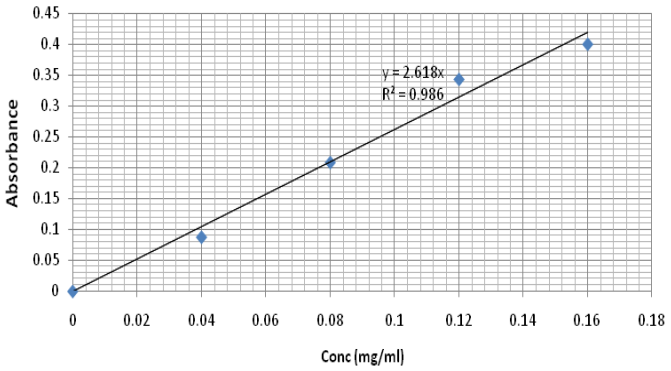
Sodium in the malt drinks were found ranging between 31.74 to 124.7 mg/L. The body needs a small amount of sodium

to help maintain normal blood pressure and normal functioning of muscles and nerves. Sodium intake is recommended to be less than 3,000 mg daily. One teaspoon of table salt contains about 2,000 mg of sodium. This clearly indicates that the amount of sodium in the malt drinks is very minimal and therefore needs to be fortified.

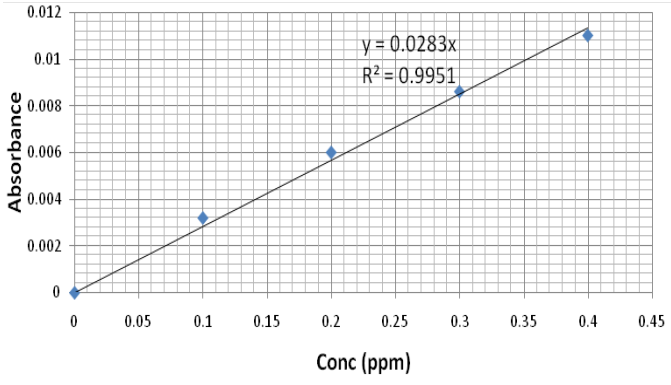
Conclusion

The study has shown that malt drinks (Malta Guinness, Vicco malt, Rasta malt, Super malt andBeta malt) on the Ghanaian market used for this study are acidic and also not as rich in nutrients (minerals, Protein) as being advertised by the manufacturers and retailers. However, it is necessary to establish a standard fortificant and concentration for all malt producers to adhere to. According to the 2005 Dietary Guidelines for Americans (Dietary Guidelines for Americans, 2005), "nutrient needs should be met primarily through consuming foods. Foods provide an array of nutrients and other compounds that may have beneficial effects on health. The wide variations in the level of these nutrients in the malt drinks call for regular supervision and control measures by state agencies for proper standardization. The study also observes the need to consider additional fortification of malt drinks with essential mineral nutrients.

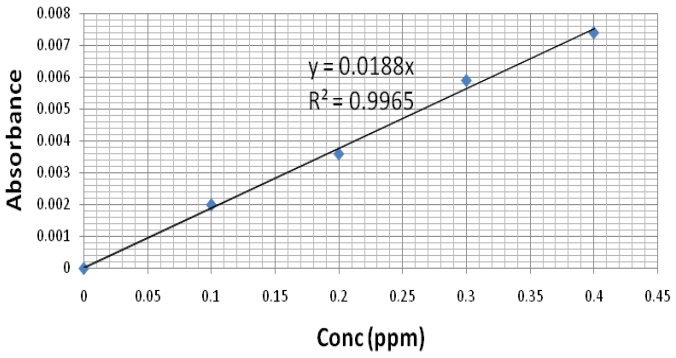
Similarly, protein and minerals levels in all the drinks should be fortified further to meet the required daily needs and also make them more wholesome. Also proper labelling must be put on the bottles and cans of these products to inform consumers. On the other hand, consumers should be careful with the brand of malt they purchase from the market.



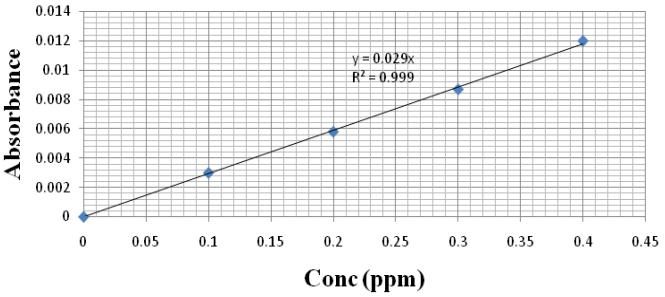
Carbohydrate standard calibration curve at 623 nm



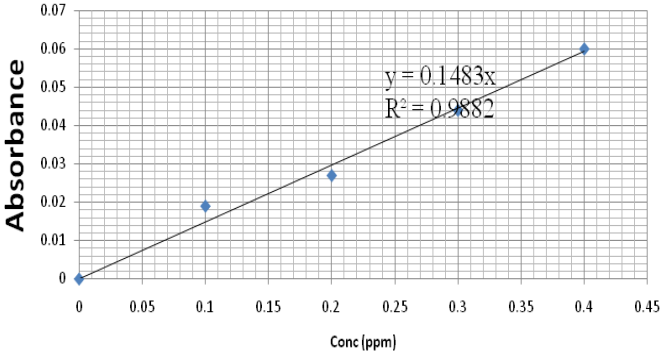
Calcium standard calibration curve at 422.7 nm



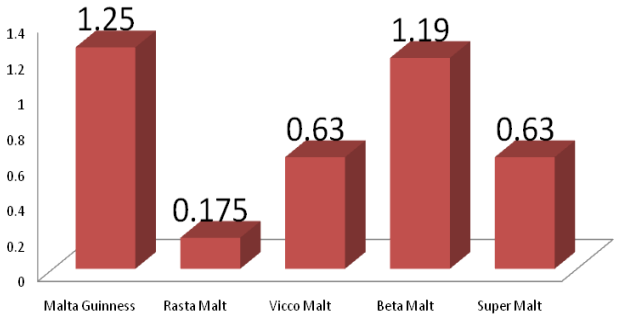
Magnesium standard calibration curve at 285.2 nm



Potassium standard calibration curve at 766.5 nm



Sodium standard calibration curve at 589.3 nm



Protein concentration in the brands of malt drinks (g/L)

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