

DETERMINATION OF BENZOIC ACID LEVEL IN SOME SELECTED SOFT DRINKS MARKETED IN DAMATURU, YOBE STATE NIGERIA.

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ABSTRACT

Soft drinks are taken in large amount in Damaturu to quench taste and cold the internal body temperature. Benzoic acid is added to stop or delay nutritional losses due to enzymatic and chemical changes of foods and to prolong its shelf life and quality, as one of the oldest chemical preservatives because of its role in increasing soft drinks shelf life and inhibiting the microbial growth. But short-term exposure to it can irritate the eyes, the skin and the respiratory tract. And long-term exposure or repeated exposure may cause skin sensitization. This research work was carried out to determine the level of benzoic acid in soft drinks marketed in Damaturu, and to compare with standard as given by the standard organizations. Twelve (12) different brands of soft drinks were analyzed with six(6) carbonated and six(6) non-carbonated drinks, using UV-visible spectrophotometer. Based on the findings of this analysis, the carbonated soft drinks have the highest value of 148 mg/l and the lowest value of 38.68 mg/l, while for non-carbonated 86.88mg/l was the highest value and the lowest is 55.26mg/l. However, the result for benzoic acid concentration was found to be within the standard limits as given by WHO and NAFDAC that is, 150mg/l. Its therefore recommended that, the Government should have a routine check-up on the various soft drinks, fruit juices, herbal products and other consumable products sold in the market to check the level of the preservative whether they are within the stipulated limits.

Keywords: *Carbonated, Concentration, Enzymatic, Levels, Lowest, consumable.*

INTRODUCTION

A soft drink is a drink that usually contains water (often carbonated), a sweetener, and a natural or artificial flavoring. The sweetener may be a sugar, fruit juice, a sugar substitute (diet drinks). Soft drink may also contain caffeine, colorings and preservatives (Kregiel, D. 2015). Soft drinks are called 'soft' in contrast with 'hard' alcoholic drinks. However, a small amount of alcohol may be present in a soft drink, but the alcohol content must be less than 0.5% of the total volume of the drink, if the drink is to be considered a non-alcoholic(<https://www.alcoholfree>, 2012). Carbonated soft drinks contain dissolved carbon dioxide, which becomes a gas when it warms the body temperature in the stomach. Non-carbonated soft drinks are soft drinks without carbon dioxide and sparkling taste and they include fruit punch, fruit drinks, ice tea, coffee with sugar, and sport drinks. Non-carbonated soft drinks do not undergo the carbonation process and do not have any sparkling flavor. (Badamasi. *et al.*, 2019). Food additives have become increasingly important in modern food technology (Saad *et al.*, 2005) as a result of the increase in the production of processed and convenience foods. Food additives have been used for centuries to enhance the quality of food products (Burdock and Carabin, 2004), with smoke, oil, vinegar, salt and spices being used to preserve food. With the increase in technological development and better living standards, additive usage in foods significantly increased during the late 1950's (McWilliams, 2005). More than 2000 different chemicals were used in foods by the early 1960s. The demand for new, tasty convenient and nutritious foods continued to increase from then until today (Sloan, 2004). It is estimated that over 2500 different additives are currently being used in foods (Branen *et al.*, 2002).

Food additives are used for various purposes, including preservation, coloring, and sweetening. The preservatives are added to stop or delay nutritional losses due to microbiological, enzymatic or chemical changes of foods and to prolong the shelf life and quality of foods (Cornelia and Elena, 2009). Benzoic acid is one of the oldest chemical preservatives used in food, cosmetics and drugs. Benzoic acid and its salts such as sodium, potassium and calcium benzoates are normally preferred and used as food preservatives. Other preservatives such as sorbic acid, methyl and propyl Darabens are used in the food and beverage industry (Cornelia and Elena, 2009). They are normally represented by E-numbers; E210-benzoic acid, E211-sodium benzoate, E212- potassium benzoate and E213-calcium benzoate. Benzoic acid is used as food

preservatives in beverages, fruit drinks, soft drinks, chemical leavened baked goods, condiments and canned foods. Benzoic acid inhibits the growth of mold, yeast and some bacteria. Benzoic acid is directly added or as its sodium, potassium or calcium salt. Sodium benzoate is used as a preservative in the soft drink industry. Benzoic acid (sodium benzoate) is one of the acceptable food preservatives that is allowed and used by the non-alcoholic beverage producers in Nigeria by the Nigeria Standard Authority. Other preservatives acceptable by Standard Authority are sulphur dioxide, orthophosphoric acid, sorbic acid and its salts. Benzoic acid is also used as a preservative in pickles, sauces and fruit juices. Benzoic acid can be used in combination with salicylic acid (Whitfield ointment) as a fungicidal treatment for ringworm. They are also used in other products, such as pharmaceuticals and herbal medicines preparation (Mosihuzzaman and Choudhary, 2008). Most of the herbal preparations have benzoic acid as a preservative agent (Demir *et al.*, 2008). Although benzoic acid is generally recognized as safe (GRAS), short-term exposure to benzoic acid can irritate the eyes, the skin and the respiratory tract. And long-term exposure or repeated exposure may cause skin sensitization. Children are at higher risks as they have high energy intake per kg body weight and different dietary patterns and food preferences compared with adults (Demir *et al.*, 2008). About 80% of benzoic acid and its salts exposure to children (youth) are from soft drinks and pre-packaged beverages (Fernando *et al.*, 2003). The fact, carbonated water-based flavored drinks, soft drinks and fruit drinks are major contributors to the benzoic acid exposure in teenagers because of their high consumption levels of these products. Adverse effects include asthma, urticarial, metabolic acidosis and convulsions (WHO, 2000) and (Tfouni and Toledo, 2002).

The development of Allergic reactions to benzoates in humans, lead to urticaria, non-immunological contact urticaria and asthma as has reported in some studies (Safford *et al.*, 1990). Under certain conditions (high temperatures and the presence of Cu (II) or Fe (III) ions), benzene can form in beverages containing benzoic and ascorbic acids. The presence of benzene in food can be attributed to several potential sources. Since the early 1990s, concerns about benzene contamination of food, especially soft drinks and fruit juices have been raised. Several sources can contribute to the occurrence of benzene in foods (Fernando *et al.*, 2003). The formation of benzene from benzoic acid and its salt in fruit juices and beverages is influenced by the presence of transition-metal catalysts

(for example, Cu (I) or Fe (II) ions) and is dependent on pH, UV light or temperature (Gardener and Lawrence, 1993; McNeal *et al.*, 1993; Barshick *et al.*, 1995). In 2006, the US Food and Drug Administration (FDA) and the UK Food Standard Agency (FSA) conducted surveys on benzene in soft drinks available in their countries. Results showed that benzene was found in a small range of beverages which contained either added or naturally occurring benzoates and ascorbic acid (Wallace, 1996).

The maximum accepted level of benzoates in beverages stipulated by national and European legislation is 150 mg/L (Bennett *et al.*, 2006). The permitted level of benzoic acid in concentrated soft drinks is 150 mg/L (WHO and NAFDAC, 2006). Preservatives are used in all processed foods to keep them from spoiling unfortunately most of these chemicals are extremely dangerous to our health the common soft drinks that are consumed have chemical preservatives of which some manufacturers have not stated the levels of benzoic acid in soft drinks to conform whether it is within acceptable limits or not (Badamasi. *et al.*, 2019). This work is justified as some manufactures do not state the level of the chemical preservation and the outcome will enlighten people the amount of benzoic acid they consume in these drinks.

Chemical preservatives play important role in increasing foods and beverage's shelf life by inhibiting or delaying microbial growth (Cornelia and Elena, 2009). Benzoic acid, which is used commonly as sodium benzoate, has been used for many years as chemical preserving agent in foods and beverages in order to kill or inhibit the growth of microorganisms (Gardner and Lawrence, 2013). It is found to be well absorbed and though the digestive track and metabolized in the liver; this led to the formation of carboxylic acid called hippuric acid which is excreted through the urine (Tfouni and Toledo, 2002). Therefore, this work is significant as it will show the level of benzoic acid in those drinks which are not stated by some manufactures. The aim and objectives of this work is to determine the benzoic acid level in common soft drinks sold in Damaturu (carbonated and noncarbonated).

METHOD

Different brands of soft drinks was purchased from open market in Damaturu, Yobe state, a total of 12 samples categorized as carbonated (6) and non-carbonated drinks(6) were chosen randomly as a representative

of what a consumer would find in the market place to remove CO₂ from the carbonated drink, 20ml of the drink was heated in a beaker on a water bath and then filtered through filter paper to remove any associated particles. The liquid will be allowed to cool, 4.00ml were measured into 100ml volumetric flask. Then 10.0ml of 0.10M HCl was added and diluted to the mark.

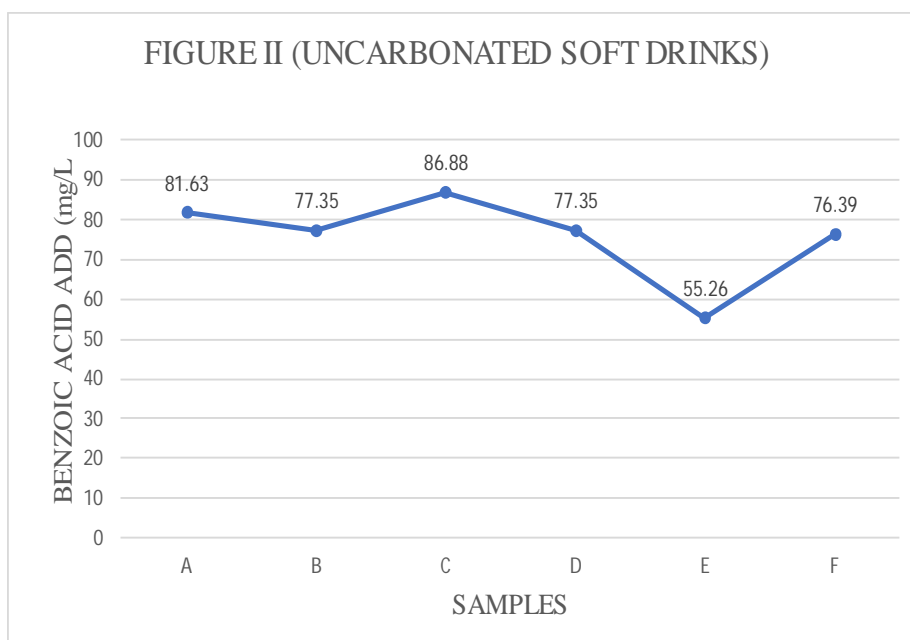
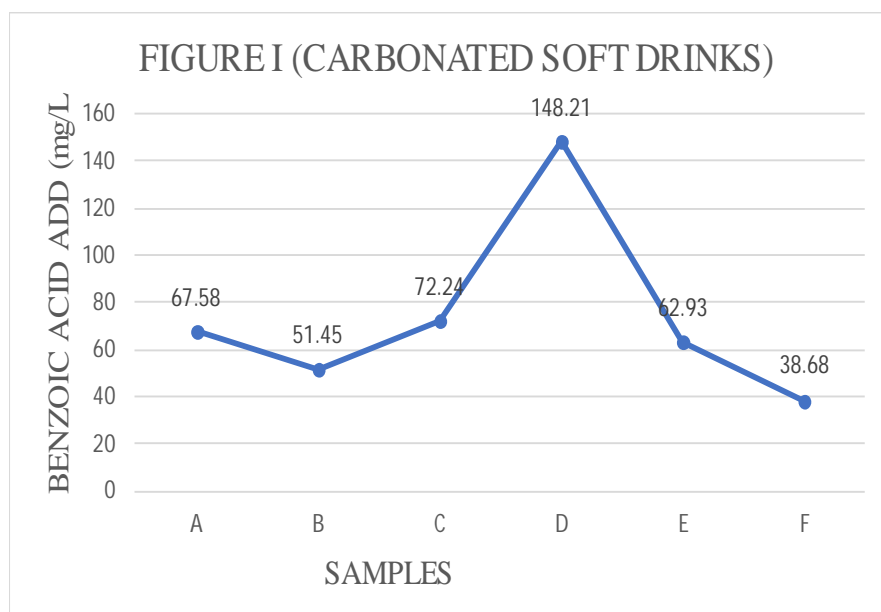
BENZOIC ACID WORKING STANDARD

Benzoic acid standard of 5,10,15,20,25,30 and 35 ppm were prepared from the stock solution as follows, 0.5ml of stock solution was pipetted into 50ml volumetric flask and diluted with distilled water to the 50ml mark. 1ml stock solution were pipetted into 50ml volumetric flask and diluted with distilled water.

EXTRACTION AND QUANTIFICATION OF BENZOIC ACID

150ml of sample were poured into a conical flask and acidified with 2 drops of dilute hydrochloric acid. 50ml of 80% (v/v) methylene chloride was added and the flask swirled gently for at least 5 minutes. The mixture was transferred into 250ml separating funnel and allowed to settle for about 5 – 10 minutes. The organic layer was drained into a beaker and allowed to evaporate on a water bath, leaving a residue of benzoic acid. The residue was diluted with methylene chloride and the absorbance of solution was measured at 228nm using UV visible spectrophotometer.

RESULTS



DISCUSSION, CONCLUSION AND RECOMMENDATIONS

DISCUSSION

From the results obtained benzoic acid and some common soft drinks were titrated using titrimetric method with sodium hydroxide (NaOH) as the base and benzoic acid as the standard. The common soft drinks analyzed are six carbonated and six non-carbonated. Sample A, B, C, D, E and F are carbonated soft drinks, where A₁, B₁, C₁, D₁, E₁ and F₁ are non-carbonated soft drinks. Figure I and II shows the benzoic acid level of some common soft drinks sold in Damaturu. From the result obtained in the figure, sample D has the highest benzoic acid level with 148.21 (mean value), sample F has the lowest value of 38.68 (mean value) for carbonated soft drinks. However, for the non-carbonated soft drinks, sample C₁ has the highest benzoic acid level with 86.88 (mean value) and sample E₁ has the lowest benzoic acid level of 55.26 (mean value);

CONCLUSION

This work is based on a simple, selective and rather fast titrimetric method for the determination of the levels of benzoic acid in soft drinks, sold in Damaturu. The levels of benzoic acid in both carbonated and non-carbonated drinks sold in Damaturu are within the acceptable limit of 150 mg/L as provided by regulatory bodies, WHO and NAFDAC. The results suggest that producers comply in general with the established limits in using benzoic acid as a preservative in the studied soft drinks products.

RECOMMENDATIONS

- The use of benzoic acid should be regulated at concentrations not exceeding the actual need. For products soft drinks
- The manufacturer should also consult or employ the chemist to help them at the production stage.
- The government should have a routine check-up on the various soft drinks, fruit juices, herbal products and other consumable products on the market to check the level of the preservative whether their levels are within the stipulated limits.

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