ISSN: 1597-5037

SELECTED FOOD ADDICTIVES COMPOSITION IN BEVERAGES COMMONLY CONSUMED IN NORTH-EASTERN NIGERIA.

*Usman Adam Abdullahi[1], Abubakar Adam[2] and Muhammad Adamu Kabanu[3]

*[1]School of Secondary Education (Sciences), Department of Chemistry, Umar Suleiman College of Education, Gashua, Yobe State, Nigeria.
[2]School of Art and Social Sciences Department of Geography, Yobe State University, Damaturu, Yobe State, Nigeria.
[3]School of Secondary Education (Sciences), Department of Chemistry, Umar Suleiman College of Education, Gashua, Yobe State, Nigeria.

***Corresponding Author Information:**
E-Mail : khalifadanborno@yahoo.com
Phone No.: 09169333116

ABSTRACT

A rapid and simple UV spectrophotometric procedure were applied for the determination of levels of the composition of some food additives (aspartame, saccharin, potassium sorbate and sodium benzoate) in twenty (20) different beverages commercially available in north eastern part of Nigeria. These analytical measurements were undertaken primarily to assess the compliance of composition levels of the investigative food additives with the world health organization (WHO) maximum permissible levels. The results obtained from this study indicated that the composition levels of most of the studied food additives are significantly lower(P<0.005) than the maximum permissible levels. The findings of this study suggest that moderate consumption of these beverages is less likely to pose health risk associated with consumption of these additives in consumers.

Keywords: UV Spectrophotometry, Food additives, Beverages

INTRODUCTION

Food additives are used to improve the look, textures and taste of every day foods especially beverages. Natural sweeteners are generally sweet tasting compounds with some nutritional values consisting of either monosaccharide or disaccharide [1-2]. Artificial sweeteners are compounds that improve taste of foods or drinks but have little or no nutritional values [3].

Artificial sweeteners are mostly employed in food, drinks, and pharmaceutical products being used to control calorie intake and in certain medical conditions such as diabetes and hyperclycaemia [4]. The most common artificial sweeteners are aspartame, sodium cyclamate, acesulfame-K and saccharin, which are marked in about 90 countries of the world [5]. Artificial sweeteners are also called low calories sweeteners, sugar substitutes or nonnutritive sweeteners

ISSN: 1597-5037

[5]. They can be used to sweeten food and drinks for less calories and carbohydrates when they replace sugar [6]. These sweeteners are used by food companies to make diet drinks, baked foods, frozen desserts, candy, light yoghurt, and chewing gum [7].

Preservatives are additives that inhibit the growth and activities of the microorganisms and help to increase shelf of beverages for a longer time without affecting its natural characteristics [8]' the benzoic acid, acetic acid and Sorbic acid together with propionate and Sulphur dioxide are acid preservatives mostly employed in large scale in foods and soft drinks preservation [9]. Sorbic acid and the sorbates are the preservatives mostly used in the soft drink industries [10]. In fruit beverages preservation, the sodium salt of the benzoic acid is frequently used, as it is more soluble than the free acid [4].

Preservatives can be used alone or together with other methods of food preservation [9]. Preservative may be antimicrobial preservative, which inhibit the growth of bacteria or fungi, including mold or they can be antioxidants such as oxygen absorbers, which inhibit the oxidation of food constituents [11]. Nonetheless, food additives have been the subject of interest among consumers, health professionals, commercial and industrial agencies like because they are widely consumed in the diet by most segments of the population and can exert adverse health effects, especially for children and pregnant women. In fact, such food additives are subjected to regulation, since excessive or inappropriate use may present food safety problems and can introduce a risk factor. For instance, a small group of people who have the hereditary disease phenylketonuria are sensitive to phenylalanine, one of the metabolites of aspartame artificial sweetener thus; all products containing aspartame must be labelled in many countries. In addition, it is well established that excessive intake and consumption of caffeine may cause many undesirable side effects. However, excessive use of some of these chemicals in food materials may cause toxicity in humans [12]. Some chemicals food preservatives have been found to provoke urticaria and angioedema and asthma [13]. In addition, these chemical preservatives have been linked with cancer both in animals and human studies [14].

They have been association with many symptoms in susceptible individuals, such as severe chest and facial pressure or overall burning sensation [15].

The amount of these additives to be used in food and beverages are often regulated by relevant bodies. Whether beverages and food industries adhere to the permissible limits is another issues. There is therefore need for information on the levels these additives in beverages commonly consumed as most industries tent to be profit driven rather than being concerned about the effects of excessive amount of these additives. This study determined concentration of additives in selected beverages commercially available for consumption southeast Nigeria with a view to ascertain the levels of compliance with WHO permissible limits.

MATERIALS AND METHODS

Sample Collection and Preparation and Analysis

The twenty (20) beverages samples investigated in this study were categorized as:

1. Soft Drinks
2. Yoghurt/Milk Drinks
3. Juice Drinks
4. Sachet Drinks

Commonly consumed in the North-Eastern part of Nigeria. The randomly purchased beverages samples were subjected to mild cleanup procedures such as filtration and degassing. Once sample bottles were open the drinks were degassed, homogenized and filtered. Quantitative analysis of these samples were done using standard spectrophotometric methods [1, 16].

DATA COLLECTION AND ANALYSIS

In order to conduct the necessary statistical evaluations, all quantitative measurements were repeated three times. The results were expressed as mean±standard deviation and difference between mean obtained by one-way analysis of variance ANOVA.

RESULTS AND DISCUSSION

Table 01: Results for mean values of food additives compositions in canned soft drinks samples

S/No.	Beverages	Concentration in Mg/L			
		Aspartame	P.Sorbate	Saccharin	S. Benzoate
1	COCA COLA	14.55±0.25	27.17±0.14	4.56±0.16	12.67±0.54
2	FANTA	26.97±0.24	25.72±0.08	0.89±0.07	11.33±0.54
3	LACASERA	6.26±0.14	21.61±0.21	9.06±0.34	14.78 ±0.42
4	FAYROUS	12.72±0.25	26.33±0.14	0.39±0.08	10.89±0.69
5	PEPSI	22.42±0.25	28.67±0.14	1.33±0.22	12.00±0.55

Result expressed as mean SD of triplicate determinations. ND is Not Detected

Table 02: Results for mean values of food additives compositions in Yoghurt/Milk drinks

S/No.	Beverages	Concentration in Mg/L			
		Aspartame	P.Sorbate	Saccharin	S. Benzoate
1	HOLLANDIA YOGHURT	147.81±0.28	24.78±0.16	3.00±0.36	12.78±0.69
2	VIJU MILK	219.49±0.62	25.83±0.27	1.11±0.78	17.78±0.42
3	BOBO	39.29±0.51	28.94±0.21	6.83±0.14	39.22±0.42
4	VITA MILK	ND	26.89±0.08	1.39±0.08	12.78±0.42
5	NUTRI MILK	36.26±0.29	24.00±0.27	2.78±0.08	45.44±0.42

Result expressed as mean SD of triplicate determinations. ND is Not Detected

Table 03: Results for mean values of food additives compositions in sachet drinks (Powdered form)

S/No.	Beverages	Concentration in Mg/L			
		Aspartame	P.Sorbate	Saccharin	S. Benzoate
1	AMILA	12.02 0.14	27.28 0.08	6.72 0.08	11.45 0.32
2	MANGO	10.20 0.38	24.00 0.27	17.25 0.24	10.78 0.32
3	BIG COLA	2.63 0.15	ND	3.45 3.46	12.78 0.32
4	SPRITE	33.3 0.25	25.5 0.08	17.37 0.08	12.11 0.57
5	NUTRI C	3.83 0.38	25.17 0.13	6.72 0.21	3.78 0.32

Result expressed as mean SD of triplicate determinations. ND is Not Detected

Table 04: Results for mean values of food additives compositions in Juice drinks in paper sachets

S/No.	Beverages	Concentration in Mg/L			
		Aspartame	P.Sorbate	Saccharin	S. Benzoate
1	FRUTTA	6.67±0.25	135.95±0.16	11.44±0.21	14.44±0.42
2	FUMMAN	ND	26.78±1.15	124.67±0.24	13.56±0.42
3	CHIVITA	7.27±0.25	27.68±0.12	8.67±0.14	11.78±0.42
4	HAPPY HOUR	10.1±0.14	23.95±0.48	11.5±0.14	12.56±0.42
5	CHI EXOTIC	4.04±0.14	4.72±0.34	1.29±0.08	11.89±1.29

Result expressed as mean SD of triplicate determinations. ND is Not Detected

Table 1,23 and 4 shows the result obtained for the mean values of food additives compositions in canned soft drinks, yoghurt/milk drinks, sachet drinks available in powdered formed juice drinks available in powdered formed juice drinks in paper bags samples respectively.

The use of additives in food industry has been increased with the advancement in the production technologies. However, excessive use of some of these chemicals in food materials may cause toxicity in humans [12].

The results in Table 01 shows aspartame to be highest in FABTA but lowest in LACASERA which has the highest concentration of saccharin whereas FANTA has the lowest concentration of potassium sorbate is generally higher than the concentration of sodium benzoate. PEPSI and LACASERA have the highest concentrations of potassium sorbate and sodium benzoate respectively whereas LACASERA and FAYROUZ have the lowest. Reaction of sorbates is rare, but have included reported of urticaria and contact dermitis [18]. The composition levels of potassium sorbate in several soft drinks ranging from 20.4 0.1 mg/l to 29.13 0.03mg/l was reported in Riyandh city [19]. The maximum level of potassium sorbate in soft drinks of 30.11 0.13mg/l has been reported [20]. The composition levels recorded here are in agreement with earlier reports of food additives in beverages [19,20]. The world Health Organization has set the

maximum permitted levels of potassium sorbate level in beverages to be 300mg/l. all the analyzed beverages samples are far below this recommended level by the World Health Organization.

According to twenty-two (22) samples collected, the compositions of aspartame in beverages were significantly higher than other food additives. High composition of aspartame in beverages is due to it wide application because of its ability to extend flavor making them seems sweeter and given them a fuller bodied taste [23].

The results for the mean values of additives compositions in yoghurt/milk drinks are shown in table 02. The concentration of aspartame appears to be significantly (P 0.05) high compared with the concentration of saccharin in the yoghurt/milk drink. HOLLANDIA YOGHURT and BOBO have the highest concentration of aspartame and saccharin respectively whereas vita milk and VIJU MILK have the lowest concentrations. However, aspartame was not detected in VITAMILK. For the representatives, the concentration of potassium sorbate appears to be generally higher than the concentration of sodium benzoate. BOBO and NUTRI MILK have the highest concentration of potassium sorbate and sodium benzoate respectively whereas NUTRI MILK has the lowest concentration of potassium sorbate; HOLLANDIA YOGHURT and VITAMILK have the lowest concentration of benzoate. Benzoates have been used mainly in marinated fish, fruit-base fillings, jam, salad, cream, soft drinks and beer; have been reported to provoke urticaria, angioedema and asthma [24].

Table 04, shows the mean values of food additives composition in sachet drinks available in powdered form are shown in Table 03. SPRITE has the highest concentration of both aspartame and saccharin whereas BIG COLA has the lowest concentration of both. AMILA and BIG COLA have the highest concentration of potassium sorbate and sodium benzoate respectively whereas BIG COLA and NUTRI C have the lowest.

The result for the mean values of food additives composition in juice drinks in paper bags are shown in Table 04. The concentration of saccharin is higher than the concentration of aspartame. HAPPY HOUR and FUMMAN have the highest concentration of aspartame and saccharin respectively whereas FUMMAN and CHIVITA have the lowest concentration. However, aspartame was not detected in FUMMAN. Its n agreement with reports elsewhere that the concentration of saccharin in various beverages ranged from 35.11 mg/l to 134.59 mg/l [25]. According to the United State (US) Food and Drug Administration (FDA), the maximum permissible level of saccharin in various beverages is 80 mg/l [25]. The concentration of saccharin in FUMMAN found to be higher than the WHO permissible levels. The concentration of potassium sorbate is generally higher than the concentration of sodium benzoate. FRUTTA has the highest concentration of both potassium sorbate and sodium benzoate whereas HAPPY HOUR and CHIVITA have the lowest concentration of both.

Most of the analysed beverages samples except FUMMAN juice showed significant ($P<0.005$) decreases when compared to the recommend levels by the World Health Organisation (WHO).

CONCLUSION

The use of preservatives in food industry has been increased with the advancement in the production technologies. However, excessive use of some of these chemicals in food materials may cause toxicity in humans. The findings of this study suggest that, the concentrations of these additives in the various beverages analysed are mostly within regulatory bodies' permissible levels and hence consumption of these beverages are not likely to poses health's risk associated with moderate consumption of these additives in consumers.

REFERENCE

1. Lau, O. W., Luke, S. F. and Chan, W. M. (1998). Spectrometric Determination of Aspartame in Soft Drinks with Ninhydrin as Reagent. Analyst 113: 765-768.
2. Tfouni, S. A. V. and Toledo, M. C. F. (2000). Determination of benzoic and Sorbic acids in Brazillian Food. Food Control. 13: 177-123.
3. Butchko, H., Stargel, W. W. and Comer, C. P. (2002). Aspartame: Review of Safety. Regulatory Toxicology and Pharmacology 32(2): 51-93.
4. Krebs, H. A., Wiggins, D. Stubbs, M., Sols, A. and Bedoya, F. (2000). Studies on the Mechanism of the Antifungal Action of Benzoate. BioChem. J. 214(3): 651-563.
5. David, J. A., David, P. P. Sott, A. H. and Alan, R. K. (2008). Commercial, Synthetic Non-Nutritive Sweeteners, Angewandte Chemie International Edition 2(2): 441-451.
6. Ranney, R. E., Opermanu, J. A., Muldoon, E. and Macmahon, F. G. (2007). Comparative Metabolism of Aspartame in Experimental Animals and Humans. J. Toxical Environ Health 2(2): 441-451.
7. Yagasaki, M. and Hshimoto, S. (2008). Synthesis and Application of Dipepties, Current Status and Perspectives. Applied Microbiology and Biotechnology. 81(1): 13-22.
8. Kubo, I. and Lee, (2008). Potential of Antifungal Activity of Sorbic Acid. J. Agric Food Chem. 46: 4052-4055.
9. Tulamait, A. Laghi, E. Mikrut, K., Carey, R. B. and Budinger, G. R. (2005). Potassium Sorbate Reduces Gastric Colonisation in Patients Receiving Mechanical Vitalisation. J. Crit Care 20(3): 281-287.
10. Polypiew, H. M. and Grether, M. T. (2000). Rapid High-Performance Liquid Chromatography Method for the Analysis of Sodium Benzoate and Potassium Sorbate in Foods. J. Chromatogr. 883(2): 1779-1787.
11. Wen, Y., Wang, Y. and Feng, Y. Q. (2007). A Simply and Rapid Method for Simultaneous Determination of Benzoic and Sorbic Acids in Food Using In-Tube Solid Phase Microexaction Coupled with High-Performance Liquid Chromatography. Anal Bioanal. Chem. 388(8): 17791787.
12. Wakabiyashi, K. (1990). Identification of food mutagens in: Mendeisohn ML. Albertini R. J. (Edu.), In Mutation and Environment. Part E: Environmental Geno toxicity, Risk and Modulation. Wiley-Lss, New York. PP 107-116.

13. Smith, J. M. (1990). Adverse Reaction to food and drug additives. EuropeanJournalClin. Nutri. 45 (20): 17-21.
14. Hoover, D. and Milich, R. (1994). Food Additives. JournalofAbnormalChildPsychology 22(15): 501-515.
15. Collins, W. C. (1996). Intolerance of food additives. Curr. AllergyAshmaRep. 51: 315-316.
16. Alghamdi, A. H., Alghamdi, A. F. and Alwarthan, A. A. (2005). Deteremination of Content Levels of Some Food Additives in Beverages Consumed in Riyadh City. J.King Saud.Univ. 18, Science (2), PP 99-109.
17. Kinderlerer, J. L. and Hatton, P. (1990). Fungal Metabolites of Sorbic Acid. Food Addit. Contam. 7(5): 657-669.
18. Ahmad, H. A., Alghamdi, A. F. and Abdulrahaman, A. A. (2005). Determination of Content Levels of Some Food Additives in Bevergaes Consumed in Riyadh City. Food Chem Control 13(2): 117-123.
19. Prodolliet, J. and Brulhart, M. (2003). Determination of Aspartame and its Major Decomposition Products in Foods. J. AOAC Int. 76(2): 275-282.
20. Daniel, M. (2008). Reactions to Food Additives and Preservatives. Food Australia, 45(8): 374-380.
21. Sabah, S. and Scriba, G. K. E. (2008). Determination of Aspartame and its Degradation by Capillary Electrophoresis J. Pharma. Biomed Anal. 16: 1089-1096.
22. Weihranch, M. F. and Diehl, V. (2004). Artificial Sweeteners-do they bear a carcinogenic risk? Annals of Oncology 15(10): 1460-1465.
23. Guastafsson, E. Edlund, M. and Hagberg, M. (2003). Effect of food additives. Health Beliefs 34(5): 565-570.
24. Maja, S. and Zorka, K. (2011). Determination of Artificial Sweeteners in Beverages and Special Nutritional Products Using High Performance Liquid Chromatography. Arch. High. RadaToksikol 62: 169-173.