Special Conference Edition, April, 2022
http://dx.doi.org/10.4314/bajopas.v13i1.70S

Bayero Journal of Pure and Applied Sciences, 13(1): 467 - 470
ISSN 2006 – 6996

EFFECT OF GINGER AND CLOVE EXTRACTS ON THE NUTRITIONAL QUALITY OF *Hibiscus sabdariffa* beverage (ZOBO)

[1]*Bagwai, M. A., [2] Bukar, A., [3]Bagwai, B. A., [4]Nata'alah, F. M., [5]Khaleel, Z. I.
[1]Department of Life Sciences, School of Technology, Kano State Polytechnic, Kano, Nigeria
[2]Department of Microbiology, Bayero University, Kano, Nigeria
[3]Department of Food Science and Technology, KUST Wudil, Kano, Nigeria
[4&5]Department of Science Laboratory Technology, School of Technology, Kano State Polytechnic
*Correspondence author: buharibagwai@gmail.com +234 7060793539

ABSTRACT
The study aimed to determine the physicochemical constituents of ginger and clove extracts in* the *Hibiscus sabdariffa beverage (Zobo). The methodology involved producing the beverage drink using roselle calyx of H. sabdariffa in the laboratory; a freshly prepared infusion of 100ml volume was dispensed each into four (4) sterile and labelled bottles. A 2ml of sodium benzoate was added into bottle A as a positive control; bottles B and C were supplemented with 10ml ginger and cloves each, while bottle D was a negative control. Physicochemical analysis was carried out to determine the total sugar, soluble solid, ascorbic acids, pH and titratable acidity. The results of the physicochemical study ginger recorded the highest ascorbic acids (35.20mg/100g); this showed a significant increase of ascorbic acids from the positive control (22.20mg/100g). In addition, both ginger and cloves had recorded the least pH of 5.00 and 5.20, respectively. However, the titratable acidity results showed that cloves recorded higher titratable acidity of 37.90%. A significant difference at p<0.05 among samples were recorded. The study showed that ginger and clove extracts effectively improve the physicochemical and nutritional properties, whereas using synthetic materials has lowered some physicochemical properties of the beverage. Therefore, plant-based materials effectively improve the physicochemical properties and enhance flavour, taste and a pleasant aroma in the drinks; therefore, plant-based materials should be encouraged.
Keywords: Nutritional, Physicochemical, Ginger, Clove, Ascorbic acids

INTRODUCTION

Zobo is a non-alcoholic beverage produced from Roselle calyx leaves of *Hibiscus sabdariffa,* commonly consumed in tropical and subtropical regions, especially in West Africa, India and Mexico (Fasoyiro *et al*., 2005). The two varieties found in Nigeria, includes red/brown and green (Ilondu and Iloh, 2007; Adanlawo and Ajibade, 2006). The green type is found in Southern Guinea savanna, while the brown type is prevalent in the Northern Guinea and Sudan savanna (Ilondu and Iloh, 2007).

The beverage is known as zobo or zoborodo in Nigeria, karcade in Sudan, bissap in Egypt and Senegal (Salami and Afolayan, 2020). The increased beverage consumption rate is because of its nutrient, medicinal values, cost-effectiveness, readily available, and ease of preparation. In addition, its good taste, aroma, and colour are the other reasons (Ogiehor and Nwafor, 2004). The plant has been used in folk medicines, as a colouring agent, and for beverage or tea preparation (Salami and Afolayan, 2020).

Almost all parts of the plants are used for food preparation, many parts of roselle, such as leaves, seeds, flowers, and roots, are widely consumed, but the red calyces are the most useful (Yadong *et al*., 2005) whereas the green variety is used to prepare soup, stew, sauces, jam, and sauces (Salami and Afolayan, 2020; Adanlawo and Ajibade, 2006).

Foods and beverages that originated from *H. sabdariffa* have been reported to be free from saturated fats, sugars, and salts.

They, therefore, prevent the build-up of some chronic disease conditions (Pires *et al.*, 2019). Extracts of the leaves or calyces are traditionally used for their diuretic and hypotensive effects, decreasing blood viscosity and stimulating intestinal peristalsis (McClintock and Tahir, 2004; Delgado and Lopez 2002).

Numerous researches have been carried out to analyse the shelf life of the beverages using different plant-based materials, but little information is available on the impact of these additives on the physicochemical properties of the drinks. This study thus, provides an opportunity for scientific information to validate the effects of ginger and clove on the physicochemical properties.

MATERIALS AND METHODS

Sample collection and Preparation of *H. sabdariffa* beverage

The dry rossel calyx of *H. sabdariffa* was purchased from Wudil Market, Kano State, Nigeria, and authenticated by the vendor and a Botanist at Biology Department of Kano University of Science and Technology, Wudil, Kano, Nigeria. The beverage was prepared according to the method of Umaru *et al.* (2014) by hurling the 500 kg dried calyces into the distilled water for 60 minutes and then sieve after cooling, 250g of sugar was added to the filtrate then consumed (Ezeigbo *et al.*, 2015).

Addition of additives

About 100 ml of freshly prepared beverage was dispensed into four sterilized labelled bottles, then 2ml of sodium benzoate (synthetic preservatives) was added and labelled as a positive control, bottles B and C were supplemented with 10ml extract each of ginger and clove, respectively. At the same time, sample D was left untreated as a negative control. All the samples were pasteurized in a water bath at 75℃ for 5 minutes after corking the bottles and stored at ambient temperature of 25-30ºC (Bukar *et al.,* 2010; Wuru and Uzodinma, 2010).

Physicochemical analysis

Titratable acidity

Titratable acidity determination was carried out according to the methods of Onwuka, (2018), where a volume of 10ml of the samples were pipetted into a conical flask and 1ml of Phenolphthalein indicator was added. It was then titrated to endpoint (pink colour) using 0.1N NaOH. The titration was carried out in triplicates, and the average titre value was recorded.

% Acidity = Titer value ×0.0090081volume of the sample×100

pH determination

The pH was determined using a hand-held pH meter which was calibrated using buffers 4 and 7. A 30 ml of the samples were placed in a sterilized beaker, pH electrode was dipped into the solution, and the pH value was recorded when the displayed value was stable. Readings were carried out in triplicates (Onwuka, 2018).

Determination of Total Sugars

Determination of total sugars was carried out according to the method of Lane and Eynon, (2010). Liquor of the filtrate obtained in reducing sugar was taken and inverted with hydrochloric acid in a water bath at 60 ºC by keeping for 10 minutes. The solution was cooled immediately and neutralized with sodium hydroxide and finally with sodium carbonate. The solution was made up to volume, and reducing sugar was determined using the relation.

$$\text{Sucrose \%} = \frac{\text{Total reducing sugar}}{\text{Invert sugar \% - reducing sugar}} \times 0.95$$

Determination of Ascorbic acid (Vitamin C) content

Determination of ascorbic acid content as described by Onwuka (2008), a volume 10ml of the extract was pipetted into a 250ml conical flask, 10ml of 1% oxalic acid was added to it as a stabilizing agent and 2ml of acetone was added to the mixture. This was titrated with standardized indophenol solution to a faint pink color that persisted for about 15 seconds. The volume of the standard dye used was recorded, result of ascorbic acid was recorded in triplicates and expressed in mg per 100ml.

Determination Soluble Solid (°Brix)

The soluble solids of the samples were measured with the aid of a hand refractometer, a sample drop was placed on the screen of the refractometer prism, and the readings were observed and recorded in triplicates (AOAC, 2005).

RESULTS AND DISCUSSIONS

The results of physicochemical analysis are given in Table 1. There is increase in the total sugar sample supplemented with ginger recorded the highest value of 3.25% followed by sample supplemented with clove 3.10%. The samples supplemented with sodium benzoate recorded a value of 2.55% which does not differ significantly with negative control. This indicated that sodium benzoate do not contribute to the total sugar content of the samples. The ascorbic acid contents of beverages supplemented with ginger and cloves are 35.20mg/100g and 33.10 mg/100g, respectively, higher than the negative control (25.00mg/100g), there were a significant difference ($p<0.05$) among samples were recorded.

This showed that ascorbic acid of the drink could be enhanced by supplementing with these plant materials, whereas sample supplemented with sodium-benzoate recorded ascorbic acid of 22.00 mg/100g, which is lower than the negative control, this shows that sodium-benzoate have adverse effects on the physiochemical composition of the drink mainly due to the loss of ascorbic acids.

The study demonstrated that the pH of samples supplemented with ginger and cloves had recorded a pH of 5.00 and 5.20, respectively, whereas negative control recorded a pH value of 5.40. Significance difference exists in the titratable acidity of sample supplemented with sodium benzoate, cloves and negative control as the values range from 33.30% in sodium benzoate, 37.90% in ginger and 35.10% in negative control. The increase in acidity of in clove sample was due to acidic nature of the additives (Babalola *et al*., 2001).

The result agrees with the findings of Afolayan, (2020) who reported a significant amount of ascorbic acid in beverage. Ogiehor and Nwafor (2004) have reported ascorbic acid (14 mg), iron (57 mg), and β-carotene (300 µg) from *H. sabdariffa* extracts. Wong *et al*. (2002) found *H. sabdariffa* beverage to contain high vitamins, especially ascorbic acid, antioxidants, carbohydrates, proteins, and minerals. Moreover, Babalola *et al.,* (2001) reported some vitamins from 100 g fresh calyces: ascorbic acid 1.7 mg, riboflavin 0.277 mg, niacin 3.765 mg, thiamine 0.117 mg. Many reports confirmed that the calyx had a high content of calcium, niacin, riboflavin, iron, and ascorbic acid, much higher than citrus orange (Amin *et al*., 2008). Roselle calyces also have 4% citric acid, amino acid organic acids, and minerals because of their high vitamin C content; it is used to treat scurvy, cold, or flu (McClintock and Tahir, 2004).

Table 1: Physicochemical analysis of *H. sabdariffa* beverage

	Sodium Benzoate	Ginger	Clove	Control (-ve)
Ascorbic acid (mg/100g)	22.20 ± 0.25	35.20 ± 0.25	33.10 ± 0.10	25.00 ± 0.00
Total sugar (%)	2.55 ± 0.05	3.25 ± 0.05	3.10 ± 0.10	2.50 ± 0.00
pH	5.30 ± 0.15	5.20 ± 0.50	5.00 ± 0.50	5.40 ± 0.00
Titratable acidity (%)	33.40 ± 0.20	34.50 ± 0.50	37.90 ± 0.10	35.10 ± 0.00
Soluble solid (°Brix)	9.90 ± 0.20	8.80 ± 0.05	8.70 ± 0.20	9.70 ± 0.50

All values are Mean SD of replicate measurements $p<0.05$

CONCLUSION

This study showed that the use of plant-based materials effectively improves the physicochemical properties, whereas the used synthetic materials have lowered some physiochemical properties of the beverage. Therefore the use of plant-based materials should be encouraged to enhance the physicochemical composition of the drink.

REFERENCES

A.O.A.C. (2005). *Official methods of Analysis (*17th Ed*.).* Association of Official Analytical Chemist. Will Behington D.C.

Adanlawo, I.G., and Ajibade, V.A. (2006). Nutritive Value of the Two Varieties of Roselle (Hibiscus sabdariffa) Calyces Soaked with Wood Ash. *Pakistan Journal of Nutrition, 5 (6)*, 555-557.

Amin, I. , Hainda, E. K., I. and Halimatul, S. M. N. (2008). Roselle (Hibiscus sabdariffa L.) seeds nutritional composition, protein quality and health benefits. *Foods, vol. 2, no. 1*, 1–16.

Babalola, S. O., A. O., Babalola, and O. C. Aworh. (2001). Compositional attributes of the calyces of Roselle (Hibiscus sabdariffa L),. *African Journal of Food Technology, vol. 6, no. 4*, 133-134.

Delgado-Vargas, F. and Paredes-Lopez, O. (2002). *Natural colorants for food and nutraceutical uses.* FL, USA,: CRC Press. LLC, Boca Raton,.

Ezeigbo, O., Ekaiko, M. N., Agomo, K. O., and Nnadozie, A. (2015). Antimicrobial effect of lime juice treatment on the shelf-life of Zobo drink. *British Microbiology Research Journal, vol. 6, no. 3*, 147–153.

Farombi E. O., Ige, O. O. (2007). Hypolipidemic and antioxidant effects of ethanolic extract from dried calyx of Hibiscus sabdariffa in alloxan-induced diabetic rats. *Fundamentals of Clinical Pharmacology 21(6)*, 601-609.

Fasoyiro, S.B., Ashaye, O.A., Adeola, A. and Samuel F. O. (2005). Chemical and Storability of Fruit-Flavoured (Hibiscus sabdariffa) Drinks. *World Journal of Agricultural Sciences, 1 (2)*, 165-168.

Hertog, M. G. L., Feskens, E. J. M., Kromhout, D. (1993). Dietary antioxidant flavonoids and risk of coronary heart disease: the

Zutphen elderly study. *The Lancet, vol. 342, no. 8878,*, 1007–1011.

Ilondu, E. M. and Iloh, A. C. (2007). Inhibition of Three Fungal Isolates from Sorrel Drink (Zobo) Using Hurdle Technique. *World Journal of Agricultural Sciences, 3 (3):*, 339-343.

Izah, S.C., Orutugu, L.A. and Kigigha, L. T. (2015). A review of the quality assessment of Zobo drink consumed in Nigeria. *ASIO Journal of Microbiology Food Science and Biotechnology Innovations, 1(1)*, 34-43.

Lane, J. H. and Eynon, L. (2010). Methods for Determination of Reducing sugars and Non-Reducing Sugars. *Journal of Sciences, 42,*, 32-37.

McClintock, N. C. and Tahir, I. M. E. (2004). *Hibiscus sabdariffa L," in Vegetables/Legumes, G. J. H. Grubben and O. A. Denton, Eds.* Netherlands: PROTA, Wageningen.

Ogiehor, I. S. and Nwafor, O. E. (2004). Associated microbiological, biochemical and chemical quality changes in zobo beverage produced from Hibiscus sabdariffa Linn,". *Nigerian Annals of Natural Sciences, vol. 5*, 1–10.

Onwuka, G. I. (2018). *Food analysis an Instrumentation (Theory and Practice)-2nd edition.* Nigeria: Naphtali printers.

Pires, T.C., Barros, K., Santos-Buelga, C. and Ferreira, I. C. F . (2019). Edible flowers: emerging components in the diet. *Trends in Food Science & Technology, vol. 93,*, 244-258.

Salami, S.O and Afolayan, A. J. (2020). Suitability of Roselle-Hibiscus sabdariffa L. as Raw Material for Soft Drink Production. *Journal of Food Quality*.

Shruthi, V. H. and Ramachandra, C. T. (2019). Roselle (Hibiscus sabdariffa L.) calyces: a potential source of natural color and its health benefits. *Food Bioactives: Functionality and Applications in Human Health*, 169–190.

Umaru, G.A., Tukur, I.S., Akensire, U.A., Adamu, Z., Bello, O.A., Shawulu, A.H.B. and Audu, M. (2014). Microflora of Kunun-Zaki and Sobodrinks in relation to public health in Jalingo Metropolis, North-Eastern Nigeria. *International Journal of Food Research*.

Wong, P., Salmah, Y. H., Ghazali, M., and Che Man, Y. B. (2002). Physico-chemical characteristics of roselle (Hibiscus sabdariffa L.). *Nutrition and Food Science, vol. 32, no. 20,*, 68–73.

Wuru, M.U, Uzodinma C.C . (2010). Preservative effect of spices and their flavour acceptability in Zobo drink. . *Nigerian Food Journal 28(2):*, 265-274.

Yadong, Q. Chin, K. F. and Gajer, J. (2005). Biological characteristics, nutritional and medicinal value of roselle, Hibiscus sabdariffa. *Urban Forestry Natural Resources and Environment Circular,* no. 604*,* 2.