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Storage study on colour retention in zobo concentrates by increasing concentration of ginger (*Zingiber officinale*)

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The effects of three concentration of ginger (*Zingiber officinale)* on some storage characteristics of zobo concentrate were investigated. Zobo drink was prepared using the traditional methods. The drinks were then concentrated by dehydration to 67%. Increasing concentration of ginger, 10, 5 and 0% were added to produce sample A, B and C, respectively and stored in opaque packaging materials for 28 days. The results showed that retained colour of sample A (0.84±0.05) was significantly higher than that of the sample C (0.74±0.02) at the end of the duration of storage analysis. pH (2.87±0.03) for sample A was significantly higher than that of the sample C (2.20±0.02). The results of total soluble solids (TSS) and total titratable acidity (TTA) were not significantly different for all the samples. The results for sensory evaluation at p<0.05 showed that for flavor, sample A (7.0±0.6) was significantly different from sample C (5.8±0.2), for taste (7.0±0.6), it was significantly different from sample C (5.8±0.4), for colour (7.8±0.6) it was significantly different from sample C (7.1±0.1), for mouth-feel (7.2±0.7) it was not significantly different for all the samples. Generally, sample A (7.9± 1.3) was the most acceptable, while sample C (6.3±0.3) was the least acceptable and there was significant difference among the samples.

Key words: Zobo concentrate, ginger, retained colour, storage characteristic.

INTRODUCTION

Zobo drink is a local, cheaper soft drink made from *Hibiscus sabdariffa* calyx which is an herbaceous medicinal plant grown in the tropics (Adesokan et al., 2013). The demand for zobo drinks is due to its low prices, nutritional and medicinal properties (Oboh and Elusiyan, 2004; Osueke and Ehirim, 2004). It is served indoors or at special occasion to people of various tribes and tradition, in Nigeria. In fact, the drink has gained a wide and general acceptance in Nigeria (Bamishaiye et al., 2011). However, the shelf life of the drink is normally 24 to 48 h after which it begins to deteriorate. The process of preparing the zobo drink is laborious and tedious. Moreover, the risks of contamination during production are even higher especially when homemade or locally produced. Thus, the need to store in the form of a concentrate.

The zobo concentrated is a dehydrated water extract of the dried petals of the Rosselle plant (*H. sabdariffa*). It is

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red in colour and is a rich source of vitamins and minerals such as calcium and iron. It is prepared by first boiling the leaves of the rosselle (that is the dried leaves), spiced up with ginger and cloves, sweetened with sugar to produce the sorrel red drink. This is then dehydrated to concentration (67%). This reddish liquid extract can be reconstituted as a drink. Zobo drink is relished for its colour and flavor and is increasingly becoming a substitute for the more expensively produced soft drinks and juices (Oliver, 1980). Studies have shown that the colour of the drink influence consumer preference for the drink and the variety used for the production of zobo drink (Olayemi et al., 2011). Ginger (*Zingiber officinale)* one of the ingredients used in zobo production contain antioxidative substances that can reduce oxidation process of colour in foods (Folasade et al., 2012). The shelf life of the drink is normally 24 to 48 hs after which it begins to deteriorate. Moreover, the risks of contamination during production are even higher when homemade or locally produced. Thus, the need to store in the form of a concentrate. Furthermore, zobo drink if well prepared and packaged as a concentrate can compete favorably with most of the imported non-alcoholic beverages available in the country, considering the increasing acceptance, socio-economic potentials and vitamin C and other minerals content (Bamishaiye et al., 2011). There is need to evaluate the effect of ginger on the storage characteristic of the zobo concentrate.

MATERIALS AND METHODS

Sample collection

Dried ripped calyces of Roselle, ginger, cloves and sweetener were purchased from a local market.

Production of zobo concentrate

100 g of the calyces, 1 g of cloves were used to produce three different zobo concentrates samples, each sample contain varying quantities of ginger [sample A contain (10 g), sample B (5 g) and sample C (0 g)], respectively**.** The samples each were washed lightly and boiled over a Bunsen flame with 400 ml of water for 30 min and then filtered using a muslin cloth. 30 g of gum Arabic was dissolved in 20 ml of warm water to form a gel. The gel was then incorporated into the samples. The three different filtrates were then collected in pre-sterilized wide mouth glass bottles and then concentrated to about 67% total solid and packaged for the storage test in opaque containers (Figure 1).

Physical analysis

The following physical analysis was carried out on the three different samples as follows:

Colour determination

The modified method of Truonga et al., (2012) was used to evaluate the degradation of the colour during the storage study. 5 ml of the sample was dissolved in 10 ml of water. An aliquot of the zobo solution was placed in a cuvette and distilled water was placed in another cuvette as blank and then placed inside a colorimeter and measured at 530 nm. For visual colour analysis, twenty observers were asked to evaluate the overall colour quality and redness preference of the sample as a fruit drink and to rate it using a 9-hedonic scale from like extremely to dislike extremely.

pH determination

10 ml of the different samples were diluted with 10 ml of distilled water and a pH meter was used in taking the reading according to the method of AOAC (1980).

Total titratable acidity

10 ml of the samples were diluted with 20 ml of distilled water and titrated against 0.1 N sodium hydroxide. Phenolphthalein was used as an indicator (Pearson, 1975).

Total soluble solid

The refractor-meter was decked with distilled water and the cross wire was adjusted to lie on the border line between the dark and the clear field layers of the instrument so that the corresponding scale is at 0 mark. Few drops of the samples were then each placed on the prism and the cross wire readjusted to lie between the dark and the clear portions of the instrument. The corresponding scale reading was taken as the total soluble solid (°brix) of the concentrate.

Sensory evaluation

The sensory evaluation was determined using the method of Larmond (1977). The samples were presented to twenty untrained panelist to determine the most preferred sample. The scores were based on the intensity of the organoleptic quality attributes of taste, colour, texture and overall acceptability using a 9-point hedonic scale, 9 for like extremely and 1 for dislike extremely.

Statistical analysis

A one-way analysis of variance (ANOVA) was used for the determination of significant difference among mean. Statistically significant differences ($p<0.05$) were separated using the least significant difference (LSD) method.

RESULT AND DISCUSSION

The colour retention of the different zobo concentrates after a 28 day storage study showed that the colour of the samples decreased in all the samples with increasing time of storage (Table 1). Sample A had the largest value in terms of retained colour at the end of the duration of storage. Nafiseh et al. (2013) and Wong et al. (2002) observed that ginger contains components such as Shogaol and zingerone which contains anti-oxidative properties. These components were reported to

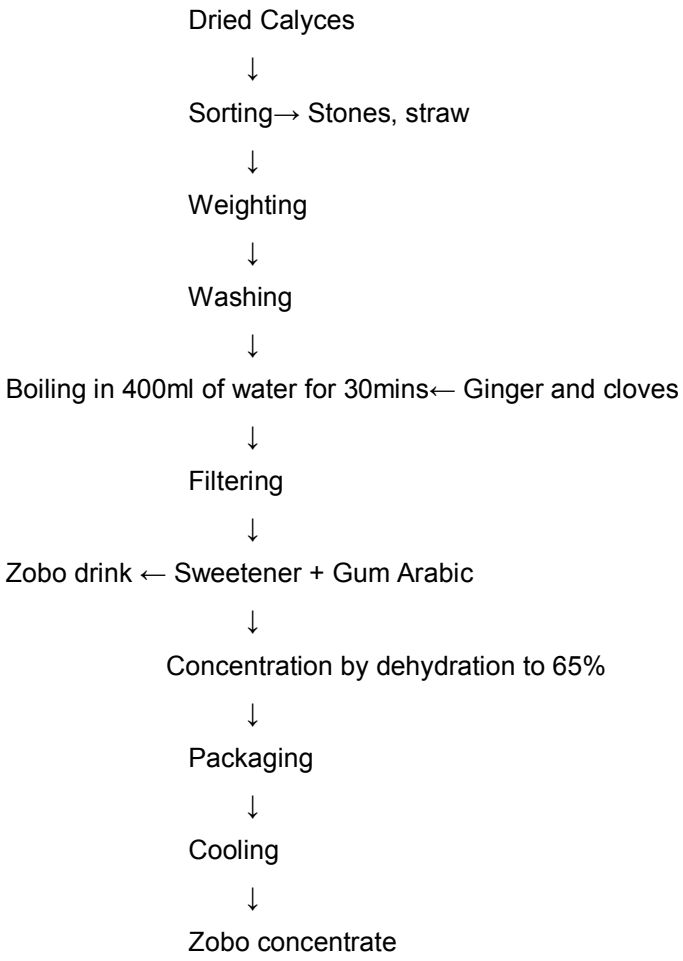

Figure 1. Flow diagram for the production of the zobo concentrate.

Table 1. Changes in colour during a 28 day storage of the three different zobo concentrates.

Sample	0	7	14	21	28
Sample A	1.57±0.03	1.53±0.02	1.01±0.02	0.87±0.01	0.84±0.05[a]
Sample B	1.56±0.01	1.48±0.02	0.96±0.01	0.82±0.02	0.78±0.04[b]
Sample C	1.54±0.02	1.26±0.02	0.91±0.04	0.78±0.03	0.74±0.02[c]

Values are mean values of duplicates samples. Values with same subscripts in the same column are not significantly ($p<0.05$) different.

scavenge free radicals generated during the process of oxidation. Furthermore, zingerone scavenges O^{2-} and OH^{-} and thus suppresses lipid peroxidation (Kabuto et al., 2005). Alongside other measures taken to prevent oxidative effect on colour of the concentrate was the use of opaque packaging materials. The sample C had the least value. This shows that increasing the quantity of ginger can influence colour retention of zobo concentrate.

Table 2 shows changes in pH of the samples during the storage studies. The pH of samples were very low with sample A having the highest value of 2.87 while sample C had the least value of 2.2. It shows that increasing percentage concentration of ginger influences the pH of the concentrates. This agrees with the observation of Olayemi et al. (2011) that the pH of the zobo drinks was on the low side indicating and confirming the high acidity usually noticed in zobo drink. It is found to be a naturally acidic fruit rich in organic acids: Oxalic,

Table 2. Physical analyses (pH, total soluble solids (TSS) and total titratable acidity (TTA)) of the three different concentrate after 28 day storage period.

Concentrates	Parameters		
	pH	TSS	TTA
Sample A	2.87±0.03[a]	47[0]	0.20
Sample B	2.48±0.04[b]	46[0]	0.20
Sample C	2.20±0.02[c]	46[0]	0.19

Values are mean values of duplicates samples. Values with same subscripts in the same column are not significantly ($p<0.05$) different.

Table 3. The mean sensory scores of the three different zobo concentrates.

Samples	Flavour	Taste	Colour	Mouth-feel	General acceptability
A	7.0±0.9[a]	7.0±0.6[a]	7.8±0.6[a]	7.2±0.7[a]	7.9±1.3[a]
B	6.1±0.3[b]	6.4±1.4[a]	7.2±0.2[b]	6.4±0.6[a]	6.6±0.6[b]
C	5.8±0.2[c]	5.8±0.4[b]	7.1±0.1[b]	6.2±0.8[a]	6.3±0.3[b]

Values are mean values of duplicates samples. Values with same subscripts in the same column are not significantly ($p<0.05$) different.

tartaric, malic and succinic. The high acid level will also inhibit the growth of some microorganisms that are not tolerant to it according to Jay (1996). The excellent keeping quality of fruits and soft drinks are due to their low pH. This is because low pH tends to inhibit bacterial growth.

Table 3 shows the mean sensory evaluation of the three different samples. There was no significant difference between sample A and B but were different from sample C in terms of flavor, taste, colour, mouthfeel and general acceptability. The agrees with the observations made by Shukla and Singh (2007) and Jolad et al. (2004) that ginger contains volatiles compounds such as sesquiterpene and monoterpenoid hydrocarbons that provides its distinct aroma and taste. Furthermore, Mounigan and Badrie (2006) observed that commercially, colour and taste are known to play a principal role in the nutritional and sensory acceptability of zobo beverage by the consumers.

Conclusion

The three concentrated sample analyzed in this study are good for consumption. However, the concentrate (sample A) with (10 g) percentage proportion of ginger was the most preferred in terms of colour retention and taste. With the present increase in the demand for zobo drinks due to its low price, nutritional and medicinal properties (Oboh and Elusiyan, 2004; Osueke and Ehirim, 2004), the concentration of the drinks into a ready-to-be-reconstituted product will come in handy. Considering the problem consumers experience in the rather tedious process of the production of the zobo drink, zobo concentrates if well prepared and packaged will compete favorably with most of the imported non-alcoholic beverages available in the country, considering its increasing acceptance and socio-economic potentials.

Conflict of Interests

The author(s) have not declared any conflict of interests.

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