

**INTERNATIONAL JOURNAL OF SCIENCE FOR GLOBAL SUSTAINABILITY****Anti-Nutritional and Nutritional Composition of *Zobo (Hibiscus Sabdariffa)* Enriched with Pineapple and Orange Juice**

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ABSTRACT

Zobo (Roselle), a popular traditional Nigerian beverage, is known for its rich taste and potential health benefits. Recently, there has been growing interest in enhancing the nutritional value of *Zobo* through the addition of fruit juices. This research aimed to assess the Anti-nutritional and nutritional composition of *Zobo* enriched with pineapple and orange juice. The results revealed that the incorporation of pineapple and orange juice significantly increased the moisture content as expected of a juice product. Crude fibre and carbohydrates were found to increase as pineapple and orange were added. All anti-nutrient contents were also found to be low in all samples. Notably, saponin concentrations in *Zobo* samples were found to be 5.70 ± 0.02 ; 4.81 ± 0.09 ; 4.09 ± 0.03 ; 4.38 ± 0.54 . The presence of Saponin in food is known to kill protozoa and mollusks, and also act as antifungal and antiviral agents. Furthermore, indicates that the panelists accepted the four samples in all of the attributes except sample D. These findings support the potential of *Zobo* enriched with pineapple and orange juice as a functional beverage with enhanced nutritional qualities.

Keywords: Nutritional Qualities; Phytochemical Compositions; Pineapple; Orange; *Zobo* Drinks**1.0 INTRODUCTION**

Zobo, a dark-red hibiscus-based beverage, is a popular traditional drink in Nigeria and other West African countries (Olawale-olakunle *et al.*, 2023). It is traditionally prepared by steeping dried calyces of *Hibiscus sabdariffa* in water, often sweetened with sugar and spiced with ginger, cloves, or other flavorings (Akujobi *et al.*, 2018). Natural flavorings such as orange, pineapple, and watermelon are sometimes added in addition to the other spices mentioned (Kehinde and Augustine, 2022). *Zobo* is well-known for its energizing flavor, vibrant color, and potential health benefits, which include antioxidant and anti-inflammatory properties. In light of these characteristics, it is suitable for the production of soft drinks (Salami and Afolayan, 2020).

As reported by (Salami and Afolayan, 2020), Several studies had been carried out on the nutritional and medicinal functions of the *Zobo* drink. 100 g of calyces contained 84.5% water, 1.99 mg protein, 0.1 g fat, 12.3 g carbohydrate, 2.3 g fiber, 1.2 g ash, 1.72 mg calcium, 57 mg phosphorus, 2.9 mg iron, 300 g vitamin A, and 14

mg vitamin C. Roselle calyces were also discovered to be high in vitamins (particularly vitamin C), carbohydrate, protein, antioxidants, and minerals (Etemadi Razlighi *et al.*, 2023). In addition, the extracts of roselle have been reported to contain phytochemicals, vitamins, and several minerals (Keshinro *et al.*, 2023). However, there has been a growing interest in fortifying *Zobo* with fruit juices to enhance its nutritional composition and potential health benefits (Idowu-Adebayo *et al.*, 2021, Idowu-Adebayo *et al.*, 2021). Pineapple (*Ananas comosus*) and orange (*Citrus sinensis*) juices are commonly consumed and rich in essential nutrients and bioactive compounds. Phytochemicals are bioactive compounds found in plants that have been associated with numerous health benefits. The incorporation of pineapple and orange juice into *Zobo* can significantly enhance its phytochemical composition. Pineapple is a rich source of bromelain, a proteolytic enzyme with anti-inflammatory properties, and vitamin C, a potent antioxidant (Nath *et al.*, 2023). Similarly, Orange juice is abundant in flavonoids, particularly hesperidin, and naringenin, which exhibit antioxidant and anti-inflammatory activities. It also

contains vitamins, particularly vitamin C and vitamin A, as well as minerals like calcium, potassium, and magnesium. (Hosawi, 2023, Uthman and Garba, 2023). The addition of these fruit juices to *Zobo* may not only improve its nutritional value but also impart unique flavors and increase consumer acceptance.

Despite these obvious advantages of the *Zobo* drink, pineapple and orange juices, more research is needed to determine how the pineapple and orange juices affected the nutritional value of the mixed juice and to determine the concentration of anti-nutrients in the mixed juice.

2.0 MATERIALS AND METHODS

Dried *Zobo* leaves, ginger, cloves, pineapple and orange was purchased at Lapai Market Niger State, Nigeria. This was prepared and used for the analysis. Dirt and other foreign materials were removed by handpicking.

2.1 Preparation of Zobo drinks

Dry *Zobo* leaves, ginger and cloves were sorted. The ginger and cloves were grounded to powder using a blender. The pineapple fruit was thoroughly washed under running tap water and peeled with a stainless steel knife. To extract the juice, it was sliced into small chunks, blended, and sieved. The orange fruit was washed under running water and dried with a clean towel. A manual juice extractor was used for obtaining the juice.

The *Zobo* drink was made according to the method described by Akujobi *et al.* (2018), with minor modifications. In a pot, water and *Zobo* leaves were combined and boiled for 5 minutes. The ginger and cloves were heated in boiling water for 1 minute. After removing the pot from the heat, the *Zobo* drink was allowed to cool before filtering with a muslin cloth. The pure *Zobo* drink plus sugar stood for sample A, then 70% pure *Zobo* drink and 30% pineapple juice were added to the mixture for sample B, then 70% pure *Zobo* drink and 30% orange juices were added to the mixture for sample C, then 70% pure *Zobo* drink and 20% pineapple juice plus 10% orange juice were added to the mixture for sample D, and the product was packaged and labeled in a clear bottle for refrigeration.

2.2 Nutritional analysis: Proximate composition was determined using standard methods (Carbohydrate, Moisture and crude protein content, ash content, and crude fibr) (AOAC, 2000).

2.3 Determination of Anti-nutrients

The concentrations of saponin and alkaloid content were evaluated as described by (Harborne and Harborne, 1973). The method of (Ola and Oboh, 2000) was adopted for the determination of phytate. Oxalate was determined using the method adopted by Ahmad *et al.*, (2022). For the determination of tannins, the method of Tiencheu *et al.*, (2021) was employed.

2.4 Sensory evaluation

The sensory evaluation was carried out by a panel of 20 Food Science department students who are familiar with the sensory attributes of taste, aroma, consistency, and color. Their preference was rated on a hedonic scale of nine (9) points. Where 9 denotes extremely liked, 8 denotes liked very much, 7 denotes liked moderately, 6 denotes liked much, 5 denotes neither like nor dislike, 4 denotes dislike, 3 denotes dislike moderately, 2 denotes dislike very much, and 1 denotes disliked extremely. The samples were served in transparent disposable cups at the same time. Bottle water was provided for mouth rinsing between samples.

2.5 Statistical analysis

Using the statistical package for the social sciences (SPSS) version 21.0, the collected data were subjected to analyses of variance (ANOVA) and Duncan's test to separate the means among the sample.

3.0 RESULT AND DISCUSSION

3.1 Nutritional analysis

The nutritional composition of the *Zobo* sweetened with Pineapple and Orange Juice is presented in Table 1. All samples exhibited a high moisture content as expected of a juice product. All moisture content result falls within the acceptable range for fruit juices (80-95 percent) as reported by (Ahmed and Sohail, 2020, and Kolo *et al.*, 2022). Crude fibre and carbohydrates were found to increase as pineapple and orange were added. This is similar to the result obtained by (Akujobi *et al.*, 2018,

Omenna *et al.*, 2023) where fruit portions were added to *Zobo* drinks. The fat content of all samples was found to be low. This makes the juice suitable

for people seeking to lose weight or for people managing diseases linked to high dietary fat intake as reported by (Akujobi *et al.*, 2018).

Table 1: Nutritional Analysis of *Zobo* Blend with Pineapple Juice and Orange Juice

Samples (%)	Moisture	Ash	Fat	Protein	Crude fibre	Carbohydrate
A	92.52±0.04 ^a	0.81±0.00 ^a	0.40±0.08 ^a	1.04±0.01 ^a	0.08±0.01 ^a	3.04±0.01 ^a
B	97.05±0.01 ^b	0.84±0.02 ^a	0.40±0.01 ^a	1.39±0.01 ^b	0.14±0.01 ^c	3.89±0.01 ^a
C	95.79±0.81 ^b	1.81±0.02 ^b	0.41±0.00 ^a	1.75±0.01 ^d	0.18±0.01 ^d	4.16±0.01 ^a
D	96.01±0.01 ^b	1.91±0.01 ^c	0.55±0.01 ^a	1.60±0.02 ^c	0.23±0.01 ^a	5.24±0.01 ^a

Values are mean ± standard error of the mean. Values followed by different superscripts along the same column are significantly different at $P < 0.05$ DMRT

Keys

Sample A= *Zobo* 100% + pineapple juice 0% + orange juice 0%

Sample B= *Zobo* 70% + pineapple juice 30% + orange juice 0%

Sample C= *Zobo* 70% + pineapple juice 0% + orange juice 30%

Sample D= *Zobo* 70% + pineapple juice 20% + orange juice 10%

3.2 Anti-nutritional Analysis

Table 2. presents the anti-nutritional components of *Zobo* sweetened with Pineapple and Orange Juice. Tannins are known to interfere with the absorption and digestibility of iron and protein (Akujobi *et al.*, 2018). Therefore the low content observed shows that *Zobo* sweetened with Pineapple and Orange Juice is safe for consumption. Alkaloid contents were also found to be low in all samples and in comparison with other authors, similar results were obtained in the Alkaloid content of *Zobo* drinks with the addition of various fruits. Alkaloid is reported to possess some medicinal and as well act as a stimulant

when consumed (Kehinde and Augustine, 2022). In this study, saponin concentrations in *Zobo* samples were found to be 5.70±0.02; 4.81±0.09; 4.09±0.03; 4.38±0.54. Presence of Saponins in food is known to kill protozoa and mollusks, and also act as antifungal and antiviral agents (Kehinde and Augustine, 2022). This could be the reason why *Zobo* drinks can last a few days at ambient temperature (Udensi *et al.*, 2020). The concentration of phytate in all samples was low. This is in favor of consumers as phytate is known to negatively affect digestion, lowers mineral bioavailability and inhibit growth (Satheesh and Workneh Fanta, 2020).

Table 2. Anti-Nutritional Analysis of *Zobo* Blend with Pineapple Juice and Orange Juice

Samples (%)	Tanin	Saponin	Phytate	Oxalate	Alkaloid
A	0.40±0.02 ^a	5.70±0.02 ^b	0.86±0.00 ^a	0.36±0.04 ^{ab}	0.42±0.01 ^c
B	0.80±0.12 ^b	4.81±0.09 ^{ab}	0.84±0.01 ^a	0.29±0.01 ^a	0.39±0.01 ^b
C	0.33±0.00 ^a	4.09±0.03 ^a	1.21±0.00 ^c	0.30±0.01 ^{ab}	0.33±0.00 ^a
D	0.54±0.02 ^a	4.38±0.54 ^a	0.99±0.01 ^b	0.36±0.00 ^b	0.34±0.01 ^a

Values are mean ± standard error of the mean. Values followed by different superscripts along the same column are significantly different at $P < 0.05$ DMRT

Keys

Sample A= *Zobo* 100% + pineapple juice 0% + orange juice 0%

Sample B= *Zobo* 70% + pineapple juice 30% + orange juice 0%

Sample C= *Zobo* 70% + pineapple juice 0% + orange juice 30%

Sample D= *Zobo* 70% + pineapple juice 20% + orange juice 10%

3.3 Sensory evaluation

Table 3. presents the values obtained from the sensory analysis on the analysis of blending *Zobo* with pineapple juice and orange juice. This result indicates that the four samples were accepted by the panelist in all the attributes tested except for sample

D with a score of $5.63^d \pm 0.04$ in color. The score represents “neither like nor dislike” according to the hedonic scale. However, sample B which contained *Zobo* (70%), pineapple juice (30%) and orange juice (0%) was most preferred by the panelist as it had the highest score of $8.04^a \pm 0.06$.

Table 3. Sensory Analysis of *Zobo* Blend with Pineapple Juice and Orange Juice

SAMPLE	AROMA	TASTE	COLOR	CONSISTENCY	OVERALL ACCEPTANCE
A	$7.82^a \pm 0.03$	$8.00^a \pm 0.06$	$7.87^a \pm 0.01$	$7.08^b \pm 0.01$	$7.88^b \pm 0.02$
B	$7.75^a \pm 0.06$	$7.47^b \pm 0.01$	$7.33^b \pm 0.01$	$7.28^a \pm 0.02$	$8.04^a \pm 0.06$
C	$7.47^c \pm 0.01$	$7.74^c \pm 0.02$	$6.94^c \pm 0.01$	$7.34^a \pm 0.01$	$7.94^b \pm 0.03$
D	$6.34^d \pm 0.01$	$7.45^b \pm 0.02$	$5.63^d \pm 0.04$	$6.15^c \pm 0.03$	$6.03^c \pm 0.04$

Values are mean \pm standard error of the mean. Values followed by different superscripts along the same column are significantly different at $P < 0.05$ DMRT

Keys

Sample A= *Zobo* 100% + pineapple juice 0% + orange juice 0%

Sample B= *Zobo* 70% + pineapple juice 30% + orange juice 0%

Sample C= *Zobo* 70% + pineapple juice 0% + orange juice 30%

Sample D= *Zobo* 70% + pineapple juice 20% + orange juice 10%

4.0 CONCLUSION

The enrichment of *Zobo* with pineapple and orange juice presents an opportunity to enhance its nutritional value. The incorporation of these fruit juices exhibits a balanced nutritional profile, with notable amounts of moisture, dietary fiber, and carbohydrates. Consuming *Zobo* enriched with pineapple and orange juice can contribute to a diversified diet, providing essential nutrients and potential health benefits. Further studies are warranted to explore the bioavailability of the phytochemicals and the impact of enriched *Zobo* on human health. The development of functional beverages like enriched *Zobo* may offer an innovative approach to improving the nutritional status and overall well-being of individuals.

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