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# Preparation, Physiochemical and Sensory Assessment of Pawpaw-red Ginger Food Drink

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**Abstract:** Superiority on the account of safety and health maintenance of food products of natural origin above counterparts of non-natural origin formed the basis of this study. Food drink blends prepared using vegetables of contrast nutraceutical values, namely pawpaw and red ginger were examined for physicochemical, some nutrient-health promotion and sensory qualities. Product blends were comparable to pawpaw whole juice in terms of phenolic content, reducing potential and protein content, with marginal difference in total titratable acidity. Sensory scores showed that some blends were superior to pawpaw whole juice. Such natural food blends drink may find usefulness in replacing much cherished fizzy drinks of non-natural origin.

**Key words:** Pawpaw · red-ginger · food drink · blending · quality assessment

## INTRODUCTION

The wide-view that bioactive components of foods may be a first-line defence strategy against life-style and degenerative diseases [1] may play a prime role in management of public health in developing or under developed countries.

The nutritive and refreshing attributes of fruit juices dated back to the days of yore, while recent research have avalanche of documentations on pharmacological potentials of vegetables (fruit, leafy, stem or rhizome). For example, consumption of diet rich in vegetables significantly reduce the incidence and mortality rates of cancer, cardiovascular disorders and other degenerative diseases caused by oxidative stress [2]. Added to this, eating vegetables reduces blood pressure, enhances the immune system, detoxifies contaminant and pollutant, as well as reduction of inflammation [3]. The therapeutic endowment of vegetables have been ascribed to the phenolic and their glycosidic constituents [4].

Pawpaw,a nutritious fruit vegetable is available throughout the year and very common, second to banana in the tropics. It is very rich in vitamins A and C [5]. Also, *Curcuma longa* (red ginger), a cheap rhizome vegetable has been used in the tropics in treatment of physiological disorders such as asthama, heart and liver problems, arthritis, gall bladder digestive disorder and dismennorrhoea [6].

In this study, we report our findings on preparation, physiochemical, some nutrient-health promotion and sensory assessment of drink blends using pawpaw and red-ginger.

## MATERIALS AND METHODS

Dominant raw materials namely, just ripe pawpaw and red-ginger were obtained from fruits packing shed and local market respectively, in Ado-Ekiti, Nigeria.

Red-ginger powder was prepared essentially by peeling the rhizome *Curcuma longa*. The peeled rhizome was sliced and dehydrated in air oven. Water soluble constituents of the dehydrates were extracted by boiling 40 g of dried red ginger in 3 litres of potable water for 15 minutes. The boiled mixture was filtered to obtained red ginger extract. Besides, matured but ripe pawpaw fruits were washed, peeled, sliced in order to remove the seeds. The sliced were then diced for easy pulping necessary for extraction of the juice. The process is simply presented schematically in Fig. 1. Products of red ginger extract and pawpaw juice were blended at proportional gradient (Table 1). The drinks were pasteurized at 60°C for 30mins, cooled and packaged in clean uniform plastic bottles for subsequent studies.

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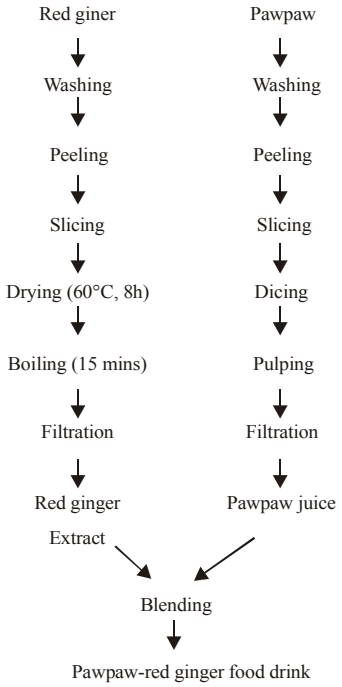


Fig. 1: Preparation of pawpaw-red ginger food drink

Table 1: Proportion of pawpaw Juice and red ginger in food drink blends

| Sample codes | Pawpaw juice (%) | Red-ginger extract (%) |
|---|---|---|
| A | 100 | 0 |
| B | 90 | 10 |
| C | 80 | 20 |
| D | 70 | 30 |
| E | 60 | 40 |
| F | 50 | 50 |

## Methods

**Determination of titratable acidity:** Blends of various proportional gradient were titrated with standard alkaline. Results were expressed as percentage of citric acid of food drink blends [7].

**Determination of total solid and moisture content:** Total solid and moisture content of drink samples were determined using weight reduction method according to the method of AOAC [7].

**Determination of soluble solids:** Soluble solids of samples were measured using hand refractometer at 28°C. Results were reported in degree brix.

**Measurement of pH:** The pH of samples were measured using omega H. $HP_x$ digital pH meter. Standardization of the meter was done using buffer solution of pH 4 and 9.

**Evaluation of ascorbic acid:** Total ascorbic acid was evaluated using indophenol method [8]. Ascorbic acid content of samples was extractd with 0.4% oxalic acid and the extract titrated with standardized sodium 2, 6 dichlorophenol indophenol.

**Evaluation of total phenolic content:** Total phenolic contents were evaluated according to the method described by Taga *et al.* [9]. Briefly: A 100µl of Folin-Ciocalteau reagent (2N wrt acid Fluka Chemic AG-Ch-9470 BUCHS) was added to each sample (20 µl) and well mixed after addition of 1.58ml of water. After 30 seconds, 300µl of 20% sodium carbonate solution was added and the sample tubes were left at room temperature for 2h. The Absorbance (A) of the developed blue colour was measured at 700nm using Unicam Helios and UV/VIS/Spectrophotometer. A plot of A700nm against corresponding concentration was used to calculate phenolic content (g/g ascorbic acid equivalent).

**Determination of reducing potentials:** Reducing potentials of each sample was determined in accordance with the method of Oyaizu [10].

**Determination of protein content:** Protein content was determined by modifying the Bradford [11] dye method using egg albumin as standard.

**Colourmetric measurement:** Colour of drink blends and whole drink samples was determined using, tristimulus value obtained from spectroscopic measurements of spectra transmission between wavelength of 380 and 770nm at 10nm intervals using the weighted ordinate method. To calculate the $L^*$, $a^*$, $b^*$,chroma and hue angle using the commission. Internationale de1'Eclaire 1967 $L^*a^*b$ (CIELAB 76) convention. $L^*$, a, $b^*$, values described a three-dimensional colour space. The vertical axis $L^*$ is a measure of Lightness, $a^*$ is a measure of redness (or- $a^*$ of greenness) and $b^*$ of yellowness (or- $b^*$ blueness) on the hue circle. The hue angle (°) expresses the colour nuance and is calculated from $h=\tan^{-1}(b^*/a^*)$. The chroma was obtained as $(a^*+b^*)^{½}$. All measurements were done in duplicate and the mean values reported.

Light source C was used for calculations. The selected psychometric colour functions were calculated for interpretation.

**Sensory evaluation:** Using multiple comparison test, sensory evaluation of the different pawpaw juice-red ginger extract food drink blends and whole pawpaw drink

was carried out by eight trained panelists comprised of students of the Dept. of Food Technology., Fed. Polytechnic, Ado-Ekiti,

In order to eliminate influence of flat taste, natural acidulant and sweetner were added to the drink prior to blending for uniformity of taste. Sensory attributes evaluated were: taste, mouth feel, colour, odour, brightness and overall acceptability using a score scale of 1 to 7 where 1 indicates extremely like and 7 indicates extremely dislike [12].

**Statistical analysis:** One way analysis of variance (ANOVA) using repeated measures was conducted. When significant ($P \leq 0.05$) difference were observed, means were separated using Tukey's test [13].

## RESULTS AND DISCUSSION

The results of physicochemical analysis conducted is shown in Table 2. Total titratable acidity of samples range between 0.00812-0.0348% citric acid equivalent of juice. Total titratable acidity value decreases as proportion of red-ginger extract added increased. Similar trend was also observed for soluble solid (5-11)% with corresponding decrease in pH (Table 2). Selected nutrient-health promotion factors evaluated are presented in Table 3. The ascorbic acid content (78mg/100g) of pawpaw whole juice obtained in this study is similar to earlier report published in Ihekoronye and Ngoddy [14] on ascorbic acid content (80 mg/100 g)of just ripe pawpaw pulp. The slight difference could be accounted for on the basis of the difference in nature of sample used for the different analysis. Ascorbic acid content of red ginger extract as determined in this study was 3mg/100g of extract. However, ascorbic acid content of samples (Table 3) decrease as amount of red ginger extract added increased. Correlation exists (0.92) between pH and ascorbic acid content of samples. Thus pH can be used to predict ascorbic status of blends during preparation of pawpaw juice- red ginger food drink. Among the factors, phenolics and reducing potentials are the most recently focused for their therapeutic roles in management of degeneration and age-related diseases. Phenolic as well as reductones of bioactives in plant foods are known for antioxidant activities [15,16]. The phenolic content (11mg-12mg/ml) expressed in ascorbic acid equivalent per ml of juice appeared to be similar, because the difference is marginal. Although, the observed phenolic content of the samples were similar. This does not decimate the superiority of pharmacological potentials of bioactive phenolic compounds in red ginger above that of pawpaw for the following reasons:

(a) Red-ginger (*Curcuma longa*) belong to the Zinginberace family that is used for medicinal activities in the tropics since ancient times [6,17].
(b) Activities of phenolic compounds does not only depend on the quantity but on the quality of the phenolic compounds/components [18].

Table 2: [a]Physicochemical properties of pawpaw-red ginger food drinks

| [b]Samples | [c]Titratable acidity (%) | [d]Water content (%) | Total solid | Soluble solid ([o]Brix) | pH |
|---|---|---|---|---|---|
| A | 0.0348 | 91.30 | 8.69 | 11 | 4.52 |
| B | 0.0325 | 90.91 | 9.09 | 10 | 5.00 |
| C | 0.0232 | 94.74 | 5.26 | 8 | 5.50 |
| D | 0.0139 | 95.24 | 4.76 | 6 | 5.65 |
| E | 0.0128 | 95.60 | 4.40 | 5 | 5.85 |
| F | 0.0081 | 96.55 | 3.45 | 5 | 6.00 |

[a] Average of three determinations

[b] See Table 1 for composition of samples

[c] Obtained prior to treatment for taste

[d] Obtained by subtraction of total solid from 100

Table 3: [a]Quantitative characteristics of some nutrient-health promotion factors of pawpaw-red ginger food drink

| [b]Samples | Ascorbic acid (mg/100ml) | Phenolic content (ascorbic acid equivalent mg/ml | Relative Reducing power | Protein content (mg/ml) |
|---|---|---|---|---|
| A | 78.00 | 12.70 | 1.32 | 29.60 |
| B | 62.10 | 12.30 | 1.12 | 28.70 |
| C | 52.65 | 11.75 | 1.20 | 29.10 |
| D | 49.85 | 11.50 | 1.20 | 28.00 |
| E | 45.90 | 13.00 | 1.38 | 29.10 |
| F | 42.30 | 11.10 | 1.07 | 26.20 |

[a]Average of three determinations

[b]See Table 1 for composition of samples

Table 4: ANOVA of sensory scores of pawpaw-red ginger drink blends: F-Value for judges and sample scores aspect

| | Judge | | sample | |
|---|---|---|---|---|
| Quantity attributes | F-cal | F-Tab | F-cal | F-Tab |
| Colour | 0.43 | 2.23 | *47.96 | 2.32 |
| Mouthfeel | 0.29 | 2.23 | 2.24 | 2.31 |
| Odour | 1.00 | 2.28 | 2.16 | 2.38 |
| Brightness/glossiness | 0.05 | 2.20 | *45.35 | 2.38 |
| Overall acceptability | 0.72 | 2.21 | *17.77 | 2.32 |

*Significantly different (P = 0.05)

(c) It is also possible that pharmacological activities of red ginger is due to inherent non-phenolic activity promoters which act in synergy with the phenolic compound and their glycosides to facilitate its enhanced medicinal value.

The relative reducing power, an index of antioxidant potentials of the blend appeared to be similar (11.2-13.8 mg/ml) in all samples. Exceptional, to the trend is sample F (10.7mg lml). Similar trend was observed for protein content. Protein contents (28.0-29.6 mg/ml) of samples A B C and D were similar, while the protein content (26.2 mg/ml of sample F was much less.

The fact that blending of red ginger with pawpaw juice at the ratio used in this study showed increase in pH but decrease in ascorbic acid, soluble solid contents but with marginal difference in nutrient health promotion factors notably phenolic content and relative reducing power suggests that the nutrient that would have been lost in pawpaw juice due to blending has been supplemented by red ginger. Moreover, the fact that red ginger is a medicinal herb suggest that it may possess superior health promotion bioactive components.

Comparative assessment of colorimetric scores of the samples showed that blending of pawpaw juice with red ginger extract improved lightness value ($^*$L) (Table 5) of blend samples when compared with 100% pawpaw juice. Similarly, there was an increase in a$^*$ which is Hue measure of redness of the samples as red ginger extract was blended with pawpaw juice. Conversely, Hue (b$^*$) value showed a decrease in measure of yellowness of the samples. Similarly, addition of red ginger extract improves chroma and hue angle indices of pawpaw juice when compared to whole pawpaw juice (Table 6). The results of the objective analysis, strengthens the validity of the sensory results (Table 5) obtained in this study, where some blend samples were preferred to 100% pawpaw juice. The consequence of the above result is that blending of pawpaw juice with red ginger extract till ratio 6:4 v/v of pawpaw to red ginger respectively make no much difference in the protein content. The blends can be useful as full liquid diet in therapeutic diets..

Samples evaluated subjectively were rated. Scores were subjected to ANOVA. Consistency of judges scores on samples were validated (Table 3). The low sensory scores for the samples implied higher preference for the samples.

Table 5: Sensory scores of pawpaw-red ginger food drink blends

| | $^*$Samples | | | | | |
|---|---|---|---|---|---|---|
| Quantity parameter | A | B | C | D | E | F |
| Colour | 1.88b | 1.13b | 1.50b | 2.25b | 4.63a | 6.00a |
| Mouthfeel | 4.50a | 2.50a | 2.25a | 2.75a | 3.00a | 3.75a |
| Odour | 3.14a | 2.57a | 1.71a | 3.00a | 4.29a | 3.29a |
| Brightness/glossiness | 1.29b | 1.29b | 1.57b | 1.71b | 4.74a | 5.71a |
| Overall acceptability | 2.63b | 1.50cd | 1.13d | 1.88c | 3.00b | 3.38a |

•See Table 1 for composition of samples

•Means within a now for each blend/drink followed by the same letter are not significantly different as 5% level of probability. Low values indicate higher preference for blend

Table 6: Colourimetric scores of pawpaw-red ginger food drink blends

| | Samples | | | | | |
|---|---|---|---|---|---|---|
| Chromatic parameters | A | B | C | D | E | F |
| L$^*$ | 73.74 | 74.83 | 76.17 | 79.50 | 80.80 | 82.34 |
| a$^*$ | 18.30 | 46.03 | 37.36 | 40.43 | 40.44 | 39.16 |
| b$^*$ | 23.55 | 20.39 | 4.62 | 8.79 | 1.00 | 9.40 |
| Chroma | 29.82 | 50.34 | 37.64 | 38.35 | 40.45 | 40.27 |
| Hue angle | 37.85° | 66.10° | 82.95° | 80.84° | 82.85° | 76.50° |

[a]Data of each measurement are the average of duplicate evaluation of samples

[b]See Table 1 for composition of samples

In terms of colour there was no significant difference in samples A,B,C and D. however there exist a significant difference in samples E and F as were rated lower than the formal samples. Besides, there was no significant difference detected in the samples with respect to odour and mouth feel. The non-detection of significant difference in mouthfeel can be ascribed to impact-taste-treatment effect on the products using sweeter and acidulant. Regarding, brightness/glossiness appeal, samples A B C and D were most preferred with no significant difference within the samples. These were followed by samples D and F. Overall acceptability assessment showed that sample D B and C had highest acceptance in the order of appearance of the samples. And while sample G E F were rated sub-superior to the former samples.

## CONCLUSION

Blending pawpaw juice and red ginger extract gave products with physicochemical and nutrient-health promotion properties comparable to pawpaw whole juice. Some blends were superior to pawpaw whole juice in some sensory terms. Products of blend of juice from pawpaw, a table fruit and red ginger, a herbal stem suggest that such blend may possess health benefits superior to pawpaw whole juice.

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