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Production and quality evaluation of herbal tea from the blends of pawpaw leaf (*Carica papaya*), bitter leaf (*Vernonia amygdalina*), scent leaf (*Occimum gratissimum*) and other materials

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ABSTRACT

Herbal teas and beverages contain bioactive compounds or phytochemicals which have been reported to have beneficial effects in the prevention of metabolic disease such as diabetes, glucose intolerance and obesity. The leaves used were washed thoroughly, cut into bits and then dried in a cabinet dryer (made by Alu frames) at specific temperatures. Production and quality evaluation of herbal tea from the blends of Carica papaya (pawpaw), Vernonia amygdalina (bitter leaf), Occimum gratisimum (scent leaf), Zingiber officinale (ginger) and Citrus (lime) was carried out. Three samples (OMN, AKH and THR) of different blend ratio packaged in a tea bag was analyzed for the following parameters, the proximate composition, anti-nutritional composition, anti-oxidant composition, minerals and sensory evaluation. The result of the quality evaluation analysis with significant difference ($p<0.05$) revealed that the moisture content ranged between 15.38-29.09%, fat content between 1.02 - 1.48%, ash content (3.65-3.93%), carbohydrate (34.44 – 41.52%), crude protein (23.61-29.12%), crude fibre (8.20-9.03%), The samples subjected to sensory evaluation revealed that there was significant difference ($p<0.05$) with respect to color, taste, appearance but there was no significant difference for general acceptability. It can be concluded that the three herbal tea samples (labeled as AKH, OMN and THR) are valuable and has high nutritional value and therefore can thrive commercially in the tea market.

Keywords: *Herbal Tea, Carica papaya, sensory evaluation, moisture content*

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INTRODUCTION

Herbal Tea comes under the list of beverages with aroma, taste, and healing properties. Herbal tea is cooked by adding different plants in water, which can be served hot and cold, depending upon the user's preference (Firdous, 2020). Herbal medicine has shown promise in preventing, treating and managing of malaria, typhoid and cancers without adverse side effects. Top on the list of such medicinal plant include; Pawpaw (*Carica papaya*), Bitter leaf (*Vernonia amygdalina*), Scent leaf (Ocimum gratissimum), Sausage plant (Kigeliaafricana/pinnata), etc. (Elvan, 2019). Carica papaya Linn belongs to the Caricaceae family and is commonly known as pawpaw. They grow in the tropical regions and is one of the most loved fruits. This yellowish-orange fruit is full of nutrients, which is great for our health. It has antibacterial properties and almost every part of the papaya plant can be used. Apart from the fruit, the most consumed part of the papaya plant is papaya leaf. Papaya leaf juice is the most desired remedy used for increasing the platelet count. It has gained immense popularity in the lastfew years due to its various health benefits. It is rich in enzymes like papain and chymopapain, which aids digestion, prevents bloating and other digestive disorders. The alkaloid compound in it, works effectively against fighting dandruff and balding. The leaves contain a high amount of vitamin A, C, E, K and B. Papaya leaf preparations, such as teas, extracts, juices and tablets are often used to treat illness and promote health (Cezara and Andreea, 2019). *Vernonia amygdalina* belongs to the family Asteraceae, its common name is bitter leaf. It is a perennial shrub of 2–5 m in height that grows throughout tropical

Africa. The leaf and stem are acclaimed to be one of the most used medicinal plants in traditional practice (Onalapo, 2019). The leaf of *Carica papaya* in combination with *Vernonia amygdalina* is used traditionally to treat infection. In traditional medicine, herbal practitioners use *V. amygdalina* and *C. papaya* in Nigeria as anthelmintic, antimalarial, digestive tonic, appetizer, anti-hemolytic, antifungal, and anti-jaundice agents. The leaf infusion is used in treatment of urinary disorders and gonorrhea. The fresh leaves are used in dressing of wounds or as anti-dysentery agent and against chronic diarrhea or as sedative and as cure for pile and wounds of the urinary tracts and several other ailments. The plant extracts have been scientifically proven to function as antibacterial, antifungal, anticancer/tumor, and anti-plasmodial agents (Sakata-Kato *et al.,* 2019).

The added herbal mixture to this combination includes scent leaf (*occimum gratisimum*), ginger and lime. They are added to enhance the flavor, aroma and taste of the herbal tea and also has good health benefits to our body system consumption. Honey is recommended as a sweetener to subdue the bitterness of the herbal tea which is optional (based on consumer's preference) (Ugo et al., 2019). The aim of this study is to produce and evaluate the quality of herbal tea made from the blends of Carica papaya (pawpaw), Vernonia amygdalina (bitter leaf), Occimum gratisimum (scent leaf), and other materials and also to determine the proximate composition, phytochemical composition, minerals and physiochemical composition on the tea so as to ensure that it is safe for consumption.

MATERIALS AND METHODS

Source of materials

Pawpaw leaf (*Carica papaya*), bitter leaf (*Vernonia amygdalina*) and scent leaf (*Occimum gratisimum*) were obtained from a farm in Sango Ota town, Ogun state. Ginger (*Zingiber officinale*) and lime (*Citrus*) were purchased from Mile 12 market, Lagos state.

Methods

Pawpaw leaves were pre-washed in deionized water and dried and then cut into smaller pieces. It was blanched in hot water (96°C-98°C) for 90 seconds. The blanched leaves were arranged in aluminum trays which were placed in a cabinet dryer (made by Alu Frames) at 70°C for 6 hours, until its moisture content reached 10%. The dried leaves were packed in a waterproof bag and stored in a cool dark place until it was used. Fresh bitter leaves were picked off the stalk, cleaned to remove contaminants and blanched for 1 minute at 90^{0}C and was spread out to wilt in a shaded place for a day. The leaves were then spread thinly on a tray and placed in a cabinet dryer (made by Alu Frames) at 70^{0}C for 6 hours. The dried bitter leaves were packed in a waterproof bag and stored in a cool dark place until it was used. Scent leaves were washed in potable water, drained and then cut into pieces not more than 2 inches long. Blanching of the leaves took place for 3 minutes in steam. The wet mass was dried and the dried mass were screened through an appropriate sieve to remove as much stem as possible and to make a more uniform product, it was further dried in a cabinet dryer (made by Alu Frames) at 70^{0}C for 6 hours. The dried leaves were then packed in a waterproof bag and stored in a cool dark place until it was used. Fresh rhizomes were scraped to remove sand clumps, rotten and fibrous sections. The ginger was washed several times with a copious amount of potable water; it was then cut into smaller sizes of about 2 mm length with a kitchen knife. The wet mass of the pieces of rhizome were dried in a cabinet dryer (made by Alu Frames) for about 8 hours at 70^{0}C and screened through an appropriate sieve. The dried slices of ginger were packed in a waterproof bag and stored in a cool dry place until it was used. The limes were properly washed in potable water and dried. The *citrus* was cut into 1/4″ slices, the juice sac was removed so as to attain the albedo and exocarp which was arranged in a single layer on a cooling rack on top of a sheet pan. The oven was preheated to 20^0 F. Afterwards; the single layer was placed in a cabinet dryer (made by Alu Frames) for about 8 hours at 70^{0}C. The dried slices of *citrus* were stored in an airtight container until it was used. The dried herbal materials were then milled and blended together into 3 proportion of tea to form different samples with the percentage; Sample AKH: 50%, 5%, 20%, 15%, 10%. Sample THR: 40%, 10%, 25%, 20%, 5% and Sample OMN: 30%, 5%, 30%, 15%, and 20% of Carica papaya, Vernonia amygdalina, Occimum gratisimum, Zingiber officinale and Citrus respectively (Figure 1).

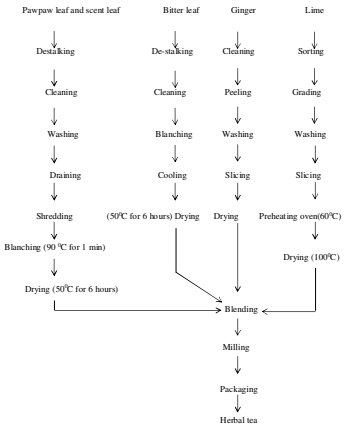

Figure 1: Flow diagram of unit operations involved in the production of herbal tea.

RESULTS AND DISCUSSION

The result obtained from the herbal tea sample AKH, OMN and THR was compared with different branded tea such as; black tea, anti-malaria tea and slimming tea to evaluate its quality (Table 1).

Table 1: Proximate composition of the blends herbal tea (g/100g).

SAMPLE	MOISTURE (%)	FAT (%)	ASH (%)	C FIBRE (%)	Protein (%)	CHO (%)
AKH	29.09±0.05a	1.02±0.03c	3.65±0.04c	8.20±0.02c	23.61±0.04c	34.44±0.06c
THR	15.74±0.19b	1.21±0.15b	3.93±0.06a	8.70±0.19b	28.90±0.13b	41.52±0.25a
OMN	15.38±0.05c	1.48±0.03a	3.82±0.04b	9.03±0.03a	29.12±0.04a	41.16±0.11b

SOURCE: SPSS VERSION 20.0 AND EXCEL 2010.
AKH, THR, OMN stands for code names for the samples.
Note: α = Level of significance (0.05 or 5%).
Values represent the Mean ± SD, n=3. The values with the different letters in a column are significantly different from one another @ p-value < 0.05.

The moisture content of the herbal tea samples ranges from (15.38-29.09%) with sample AKH having the highest moisture content (29.09%), sample OMN had the least moisture content (15.38%) compared to sample THR (15.74%), the values obtained from the sample when compared with black tea (5.62%), anti-malaria tea (5.39%) and slimming tea (4.85%) reveals that the samples (AKH, OMN and THR) are higher than that of the branded teas in terms of moisture content. The fat content of the herbal tea samples ranges from 1.02 - 1.48%. Sample AKH has (1.02%), THR (1.21%), OMN has the highest value (1.48%). As reported by Onyeneke, 2021, which has values ranging from 2.02-3.18%, black tea has the value of 3.18%, slimming tea 2.57% and anti-malaria tea 2.02%. Herbal tea has a saturated fat up to 0.005g which is nearly 0%. It has monosaturated fat and polysaturated fat up to 0.012g and 0.002g. The cholesterol in herbal tea is 0mg which is 0% (Firdous, 2020). Therefore, fat contents of AKH, OMN and THR are considered appropriate. Moringa tea has the value of 1.82% which is in accordance with the range of the herbal tea in this study. Therefore, the fat content in the herbal tea samples has the difference of 1% compared to the report by Firdous, 2020. The disparity between the fat content of the processed samples could be due to drying which concentrated nutrients, steaming or withering processes that contributed to loss of moisture (Jabeen et al., 2015). The Ash content of the herbal tea samples ranges from 3.65-3.93%. THR has the highest value of 3.93%; OMN, 3.82% while AKH has the least value of 3.65%. As reported by Onyeneke, 2021, slimming tea has the value of 6.02%; anti-malaria tea, 4.85% and black tea, 5.93% which is higher than the values reported in this work. Ash content of Tea is an important quality parameter. The Ash content of the herbal tea sample in this study is low as a result of the increase in moisture content. As recommended by ISO 1575, the total ash content of the herbal tea should not exceed 8.0%. Therefore, the ash content of the herbal tea samples in this study is suitable.

The result of the Carbohydrate content revealed a significant difference of ($p<0.05$) among the different herbal tea samples in this study, ranging from (34.44 – 41.52%) with the least being AKH (34.44%), THR has (41.52%), and OMN (41.16%). Onyeneke, 2021, reported a much higher value of carbohydrate content in his work with values ranging from 84.89-87.49%, According to Melodie, 2018, tea is naturally low in calories and provides very few carbohydrates, either in iced or hot state. Therefore, the range (34.44 – 41.52) obtained from the herbal tea sample in this study is suitable for herbal tea.

The Crude protein content of the herbal tea samples ranges from 23.61-29.12% with a significant difference of ($p<0.05$). AKH has the least value of 23.61%; THR, 28.90% while OMN has the highest value of while sample THR, has 28.90%, As reported by Yao-Kouamé et al., 2017, the tea samples have protein contents ranging from (6% - 9%) which is lower compared to the herbal tea samples in this study.

The reason for the higher protein content obtained in this study is attributed to the high protein content of the leaves used in the production of the herbal tea (*Carica papaya*: 26.14%, *Vernonia amygdalina*: 33.3%, *Occimum gratisimum*: 10.6%) which were in different blend ratio. Interestingly, tea protein has recently been found to be effective in decreasing blood lipid of hyperlipidemia and eliminating peroxide free radicals, as reported by Wang *et al*., 2014.

The crude fiber of the herbal tea samples ranges from (8.20-9.03%), with significant difference ($p<0.05$). AKH (8.20%), THR (8.70%), while OMN (9.03%) has the highest value. The value of crude fibre of the herbal tea samples in this study is lesser as compared with the report by Okolie and Ochem, 2011, which has a range of 9.52 – 17.27% in a herbal tea blend. Color which is the first sense of appeal to consumers has no significant difference between sample AKH and THR but for sample OMN there is significant difference. Sample AKH and THR have the same value of 7.10 while sample OMN has the least value of 5.90.

For taste, there is significant difference between sample AKH and OMN but sample THR is in-between the significant value of AKH and OMN, this may be either due to their similar composition from both samples. The most preferred choice, sample AKH has the highest value, of 7.05, THR has the value of 6.30, while sample OMN has 6.00. Sample AKH was preferred in terms of taste due to its high content of pawpaw leaf which gave its unique flavor while OMN was the least because its low content of pawpaw leaf which shared the same percentage with scent leaf which could have caused the reduction of pawpaw flavor in the herbal

Table 2: Results for the sensory evaluation on the herbal tea blends

	Sample		
Parameter	**AKH**	**THR**	**OMN**
Taste	7.05±1.00a	6.30±1.53ab	6.00±1.75b
Colour	7.10±1.17a	7.10±1.25a	5.90±1.68b
Appearance	7.45±1.15a	7.15±1.31a	5.95±1.96b
G Acceptability	7.30±1.08a	6.90±1.25a	6.32±2.00a

Source: SPSS 20 Outputs
Value represented in mean+SD, n = 3. The values (samples) with different letters in a row are significantly different from one another (p-value < 0.05).
The mean **taste** of sample AKH is significantly different from sample OMN (p-value < 0.05) but not different from THR (p-value > 0.05).

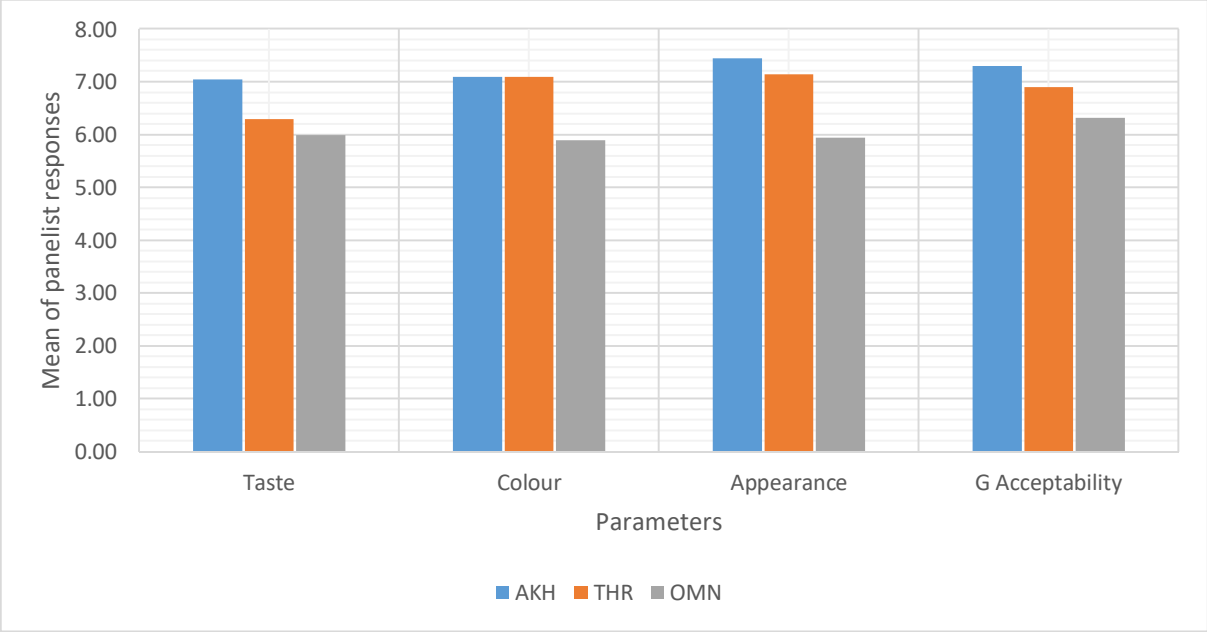

Figure 2: Bar chart represents mean of sensory analysis

tea sample (OMN), sample THR was an intermediary between both samples (AKH and OMN) in terms of pawpaw flavor (Table 2). For appearance, there was no significant difference between sample AKH and THR which has the value of 7.45 and 7.15 respectively. Sample OMN has the least value of 5.95. The appearance of sample OMN was affected due to an error during the sensory evaluation which was as a result of improper closure of the tea bag which led to an escape of the herbal material in the tea.

There was no significant difference between the samples (AKH, THR and OMN) in terms of general acceptability. Sample AKH has the highest mean value of 7.30, this may be associated with the enriched pawpaw flavor of the herbal tea, followed by sample THR which has the value of 6.90 while sample OMN has the least mean value of 6.32 (Figure 2). However, all the samples were generally acceptable but sample AKH had the highest preference.

The Infusion rate for the herbal tea samples in this study had the time range of 7-10 minutes. Sample AKH was infused for 10 minutes, sample OMN infused for 8 minutes while sample THR was infused for 7 minutes. The infusions must be prepared and consumed at the moment as they are preparations that do not keep well over time, this extraction is optimal for all parts of delicate plants. The infusion rate of the herbal tea in this study falls in the infusion range as reported by Albrigi, 2015 (5-30 minutes).

conclusion

At the end of this research, it was concluded that the three herbal tea samples labeled as AKH, OMN and THR produced and evaluated in this study are valuable, and the natural extract of the materials (Pawpaw leaves, Scent leaves, Bitter leaves, Ginger and Lime) contains such essential nutrients as Carbohydrate, Crude protein, Fat, Crude fibre and minerals such as; Magnesium, Potassium, Sodium, Calcium and Manganese which helps boost the

immune system and acts as an antioxidant that protects the body. The content of these herbal tea samples is also safe. In terms of sensory evaluation, the general acceptability of the three herbal tea samples in this study showed no significant difference. Therefore, all samples were accepted. The result showed that sample AKH performed best (7.30) than other samples; THR (6.90) and OMN (6.32). The consumption of the herbal tea in this study also provides the body with carbohydrate and less protein and fat. It is recommended that further studies be done on the reduction of the bitterness (if need be) and moisture content of the herbal tea samples produced in order to extend the shelf life and increase its market potential in the market.

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