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Research Article

Production and Evaluation of Fruit Juice Blends from Velvet Tamarind (*Dilium Guineese*) and Noni Fruit Juice (*Morinda Citrifolia*)

Kabuo, N.O [1], Chukwu, M. N[2]*, Okezie P.F[1] and Chukwujekwu, U. D[1]

[1]Department of Food Science and Technology, Federal University of Technology, Owerri, Nigeria.

[2]Department of Food Technology, Abia State Polytechnic, Aba, Abia State, Nigeria.

***Corresponding Author:** Chukwu MN, Department of Food Technology, Abia State Polytechnic, Aba, Abia State, Nigeria.

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Abstract

This study was aimed to explore the production and evaluation of fruit juice blends from velvet tamarind and noni juices. Velvet tamarind fruit was processed to obtain 100% juice (VT sample) while that of noni fruit was also processed to obtain 100% pure juice (N sample). The respective fruit juice blends (N and VT) were formulated: VTN_1, VTN_2, VTN_3, VTN_4 at different ratios (20:80%, 40:60%, 60:40%, 80:20%) while N and VT were used as the control. Microbial analysis using pour plate method and sensory evaluation using 9-point hedonic scale were carried out. The blending of these fruit juices gave better sensory quality product with therapeutic effects. The controls VT (100%) was found to be best in all organoleptic attributes (approximately 7.00 = like moderately) and with microbial count of ($6.5x10^3$ cfu/g) while control (100%) samples rated worse sensorily. Sample VTN_4 rated best followed by VTN_3, VTN_2, VTN_1 respectively. Blending Velvet tamarind (VT) and Noni (N) juices at different proportions result reduce bland taste, unpleasant aroma of noni which improves the organoleptic acceptability of the blends. Noni mellowed down the tartness of velvet tamarind juice thus, obtaining refreshing, therapeutic, vitamin C., … antioxidant, and acceptable organoleptic characteristics of fruit juice blends.

Key words: noni; velvet tamarind; juice; blends; sensory attributes; microbial count

Introduction

Fruit juices have become an essential part of human diet and are preferred by all ages, classes, groups, and areas because of their exceptional nutritional, functional and therapeutic qualities (Bhardwaj and Pandey, 2011). Fruit juices can be easily obtained by extracting the pulp of fruits and are generally consumed as a beverage or may be used for flavouring in foods. As juices are consumed fresh (Landon,2007; Bhardwaj, 2012), they are liquid and an excellent way to retain and balance hydration levels in the body (Marwat and Khan, 2009). Fruit juices are readily digestible; they have no toxic effects on the body and exert a cleansing effect on the blood and digestive tract; they facilitate absorption of certain nutrients (Nandal and Meena, 2012) in the body.

Fruit juices in the daily diet have been strongly associated with reduced risk of some forms of cancer, cardiovascular disease (Grassi et al., 2009; Chong et al., 2010), positive effect on bone health (Shukla et al., 2008; Hadipour and Mozaffari, 2010) and skin related problems (Bae et al., 2009), allergies, gastrointestinal problems, hyperlipidemia, insulin resistance, oxidative stress, inflammation (Wilson et al., 2008), dental health (Davis et al., 2007), brain health, cognition and ageing (Varejao et al., 2009; Harrison et al., 2009), and other chronic diseases.

Dialium guineense,wild with English name black velvet or velvet tamarind tree, is a woody plant that grows well in the rain forest region of West Africa (Okuda et al., 2017). Dailium guineense commonly known as African black velvet tamarind, is a large tree found in many parts of Africa, such as West Africa, Central African Republic and the Chad. Dailium guineense belongs to the Leguminosae [Fabaceae-caesalpinioidaea] family and has small typically grape sized edible fruits with brown hard edible shells (Okudu et al., 2017). It grows up to the height of 30m with dark blue glossy leaves each measuring 5cm to8cm long and 2.5cm wide (Mbaeyi-Nwaoha and Onwe, 2019). It is a hard wood that is economically valuable for furniture and creative works. Its existence is threatened by human activities especially deforestation, logging and building constructions (Ogungbenle, 2015). It produces fruit seasonally, normally between January and May but the peak of harvest is March and April. The pulp is called Icheku by Igbos in South-Eastern part of Nigeria and Awin by Yorubas in South-Western part of Nigeria (Obasi et al., 2013).

African black velvet tamarind is a multipurpose tropical fruit tree with each part of it used for one of either nutritional or medicinal purpose (Akande et al., 2019). Nguyen (2015) reported to find various applications as a major component of beverage production. It is also utilized in the food industry for the production of candy (Obasi et al., 2013). The pulp has been used in many traditional medicines as a laxative, digestive, and as a remedy for biliousness and bile disorders. It can be used as a spicy condiment and as an emulsifying agent in syrups, decoctions and different pharmaceutical products. The juice made of tamarind pulp combined with dates, sugar, honey, cardamom, cloves, and coriander seeds produced a refreshing drink marketed in different parts of the world. Its pulp is also employed in confectionaries as a solidifying agent (Mbaeyi-Nwaoha and Onwe, 2019).

Velvet tamarind fruit is most valued for its high content of vitamin C, minerals and sugar (Abiodun et al., 2017). Ogungbenle and Ebadan (2013) reported that velvet tamarind is a rich source of vitamin C, fibre, sugars, acids, polysaccharides, small amounts of protein, lipid and possess some antioxidant properties yet underutilized and limiting in other nutrients. Black velvet tamarind is obviously among the abandoned fruit in Africa since none of the African countries produces it at commercial scale (Akande et al., 2019). The problem of limiting nutrients and astringent taste of African velvet tamarind pulp makes supplementation with noni a necessity. The blends are assumed to have improved organoleptic and nutritional properties. Morinda citrifolia is the scientific name of the commercially known plant Noni. The name Morindacitrifolia is also the botanical name which is originally derived from the two Latin words ‘‘morus’’ imputing to mulberry, and ‘‘indicus’’ imputing to Indian, and it belongs to the Rubiaceae family. In Hawaii, M. citrifolia called Noni, whereas in India it is called Indian mulberry and nuna, or ach. Malaysians call it mengkudu and in Southeast Asia it is called nhaut, while in the Caribbean, it is called the painkiller bush or cheese fruit (Assi et al., 2018). The Noni plant is a small evergreen tree found growing in open coastal regions at sea level and in forest areas up to about 1300 feet above sea level. The plant is often found growing along lava flows. It’s identifiable by its straight trunk, large, bright green and elliptical leaves, white tubular flowers, and its distinctive, ovoid, “grenade-like” yellow fruit. The fruit can grow in size up to 12 cm or more and has a lumpy surface covered by polygonal-shaped sections. The seeds which are triangular shaped and reddish brown, have an air sac attached at one end, which makes the seeds buoyant (Anitha et al., 2019).Morinda citrifolia Linn has a broad range of therapeutic effects, including antibacterial, antiviral, anti-fungal, anti-tumour, anthelmintic, analgesic, hypotensive, anti-inflammatory and immune enhancing effect (Ali et al., 2016). The unripe fruit is dark green in colour and the ripe fruit has a foul taste and odour. The pulp has a light dull yellowish white colour. The ripped fruit is juicy and bitter and Noni juice is prepared from ripe Noni fruit. It has been reported to have broad spectrum of therapeutic remedies for diseases such as diabetes, arthritis, cancer, hypertension, cough, cold, pain, blood pressure, tuberculosis, malaria, intestinal worms, etc (Thirukkumar et al., 2018). Many value added products such as Noni juice, capsule, powder, Noni concentrates, tea, etc. are available in the market made out of different parts of M. citrifolia. Noni juice is most popular for its nutraceuticals and high therapeutic values around the world. Noni juice has been recently established in European Union as a novel food. The noni fruit is a multiple fruit that has a pungent odour when ripening. Despite its strong smell and bitter taste, the fruit is nevertheless eaten as a famine food (Goveas and Abraham, 2014). It is due to the presence of high concentration of major volatile compounds octanoic, hexanoic acid and 3-methyl-3-buten-1-ol (Ankit et al., 2011). Hence, it is a challenging task to produce noni juice with sensory acceptability. Due to these reasons, blending of African velvet tamarind juice with the noni juice is thought to be a convenient alternative for its utilization in order to have value added fruit juice blends which are of high quality in respect of both sensory and nutritional aspects (Thirukkumar et al., 2018).The main objective of this study is production and evaluation of fruit juice blends from velvet tamarind and noni juices. This could be achieved by the following specific objectives by producing juices from velvet tamarind and noni fruit juices; making blends of juices from various ratios of velvet tamarind and noni juices; determining the microbial accounts of the juice blends; evaluating the sensory properties and acceptability of the juice blens.

Materials and Methods

Collection of Materials Velvet tamarind fruits were purchased from a local market in Owerri, Nigeria (Figure 1A, 1B and 1C). Noni fruits were obtained from the surrounding Department of Food Science and Technology, School of Engineering and Engineering Technology, Federal University of Technology, Owerri, Nigeria (Figure 2, 3 and 4). Equipment used in the study such as juice extractor, analytical balance, capping machine, plastic funnel, plastic buckets, knives, thermometer, spoons, stainless steel sauce pan, and strainers used for fruit juice production were obtained from processing laboratory of the Department of Food Science and Technology, Federal University of Technology Owerri, where the work was carried out.

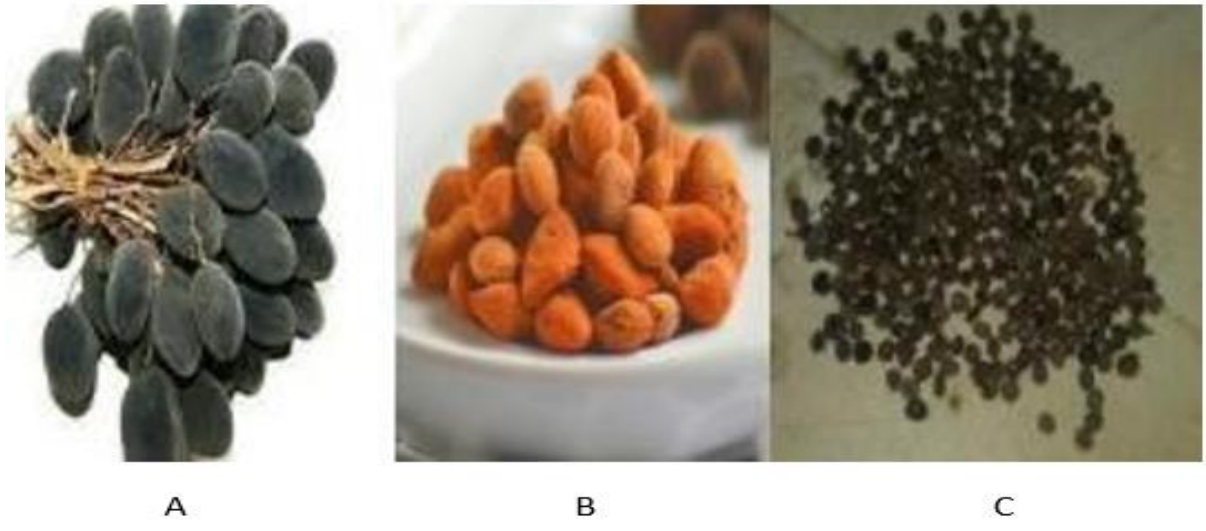

Figure 1: *(a) Unshelled (b) Shelled (c) Kernel of Dialium guineense fruit*

Figure: 2: *Morinda citrifolia var. citrifolia (Noni)*

Methods

Preparation of Raw Materials

Selection of matured and undamaged fruits of African velvet tamarind and Noni was carefully separated. Moldy and under-ripped fruits of noni were sorted and removed. The fruits of sorted noni were further washed with clean water that contains 1 tablespoon of hypochlorite to 5 litres of water (to lethal pathogenic microbes presents in the water) and allowed to dry, and thus kept in ambient temperature for up to 48hrs in order to obtain well ripen and soft fruit of noni which will ease the extraction of the juice. Also, the ripened velvet tamarind was carefully and properly dehulled in order the obtained the fruit flesh/pulp with the seed inside (Figure 5 and 6).

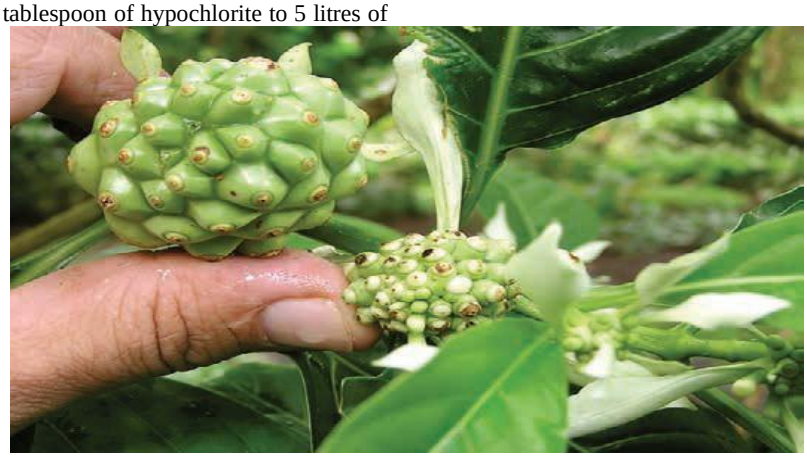

Figure: 3: *Morinda citrifolia var. bracteata*

Figure 4: *Morinda citrifolia cv. 'Potteri*

Production process of velvet tamarind juice.

A well-dehulled, sorted and prepared 500 g of ripened and dehulled fresh velvet tamarind was measured out using analytical balance. A clean water was carefully boiled and about 300 ml were collected and introduced into the weighed dehulled fresh velvet tamarind to separate the pulp of the fresh velvet from its seed (FAO, 2004). After which it was filtered to remove the fruit seed and equally make a clearer juice; with the aid of a muslin cloth. Followed by subsequent collection of juice. The juice was subjected to a heat treatment via pasteurization at about 75-90o C for 10-15 seconds prior to hot-filling into bottles by pasteurizing the 35 centiliters bottled juice at 80 oC for 20 minutes to prolong its shelf-life (Figure 5).

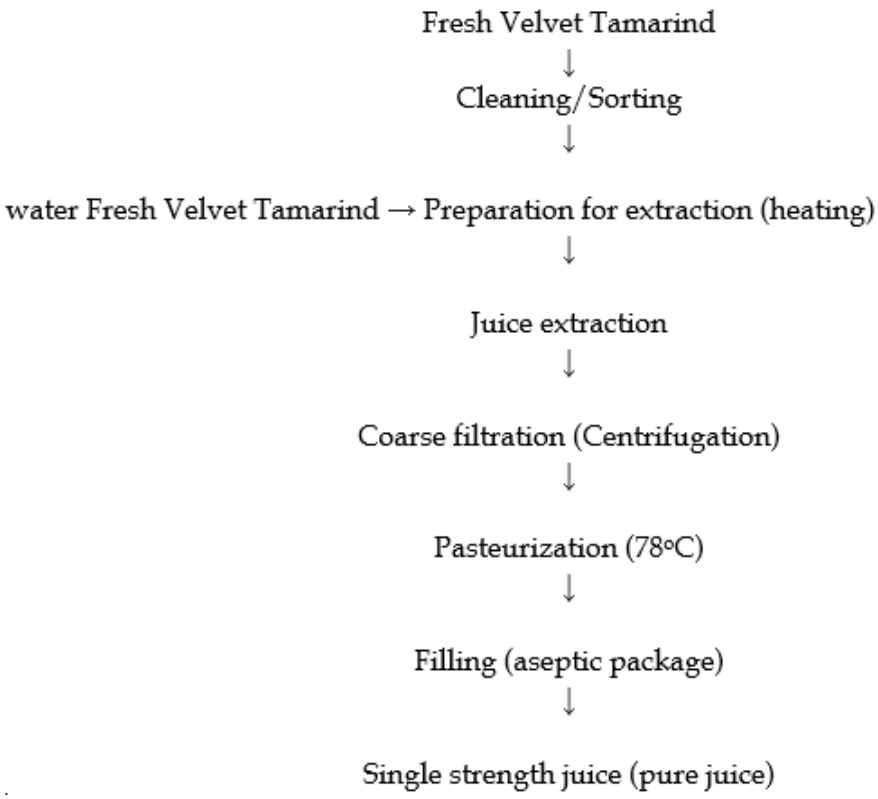

Figure 5: *Flow Chart for Velvet Tamarind Juice Production.*

Noni juice extraction processes.

The sliced pieces of noni fruit were wrapped with a muslin cloth in a hydraulic press by increasing the maximum pressure until there was no flow of the juice. The obtained and collected noni juice was pasteurized at a temperature of about 78 ^{o}C for 15 seconds. It was further hot filled in a 35 centiliters bottles and was capped with the aid of a capping machine. A second pasteurization with the juice inside the bottle at 80 ^{o}C for 20 minutes was done to inactivate pathogenic/deteriorative microorganism and subsequently extending the noni juice shelf-life (Figure 6). After which the juice was stored at a temperature of about 7^{o} C and was labeled appropriately (Anitha *et al*., 2019).

Ripened Noni Fruit Washing
↓
Sorting /cutting / skinning (with removal of seeds)
↓
Pressing in fruit press (to obtain point juice)
Extraction of juice
↓
Pasteurization (78^{0}C)
↓
Cooling and filling in bottles
Sealing and labelling
Storage
↓
Clear Noni Juice

Figure 6: *Flow chart for Noni juice extraction.*

Production of juice blends from velvet tamarind and noni juices

The velvet tamarind and noni juices were formulated using the ratios 20:80; 40:60; 60:40; and 80:20. Each sample was mixed homogenously respectively. The juice blends were filled in bottles, capped, pasteurized, labeled (Table 1) and stored in the refrigerator (Figure 7).

SAMPLE	VELVET	NONI (ml)
Table 1CODES	TAMARIND (ml)	
VT	500	0
N	0	500
VTN_1	100	400
VTN_2	200	300
VTN_3	300	200
VTN_4	400	100

Table 1: *Formulation of Samples in Different Ratios*

Key:
VT = velvet tamarind (500:0)
N = noni (500:0)
VTN_1 = velvet tamarind & noni sample 1 (100:400)
VTN_2 = velvet tamarind & noni sample 2 (200:300)
VTN_3 = velvet tamarind & noni sample 3(300:200)
VTN_4 = velvet tamarind & noni sample 4 (400:100)

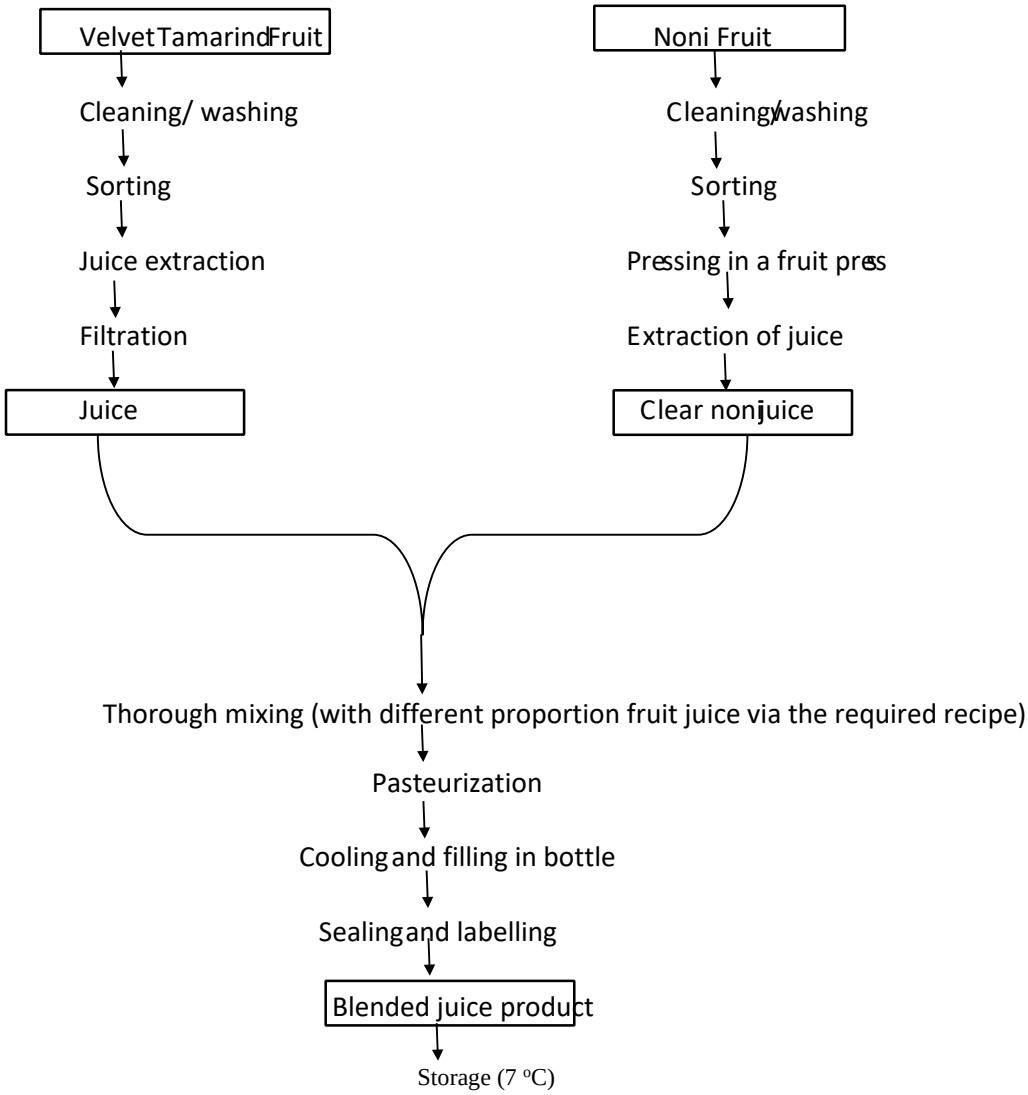

Figure 7: *Flow chart for velvet tamarind and noni juices production and their blends.*

Microbial Analysis

The glass wares to be used were sterilized in the oven at a temperature of 160 ^{o}C for 2 hours. Thirty-nine grams (39 g) of Potato Dextrose agar was dissolved in 1L of distilled water according to the manufacturer's specification. The mixture was poured into a conical flask and stirred. Peptone water was prepared as diluent by dissolving 15 g of peptone water powder in 1L of distilled water according to the manufacturer's specification. The mixture was poured into conical flask and stirred. Then 9ml of the diluent was transferred into each of the several sterile McCartney bottles and the bottles were tightly corked. The prepared medium and diluent were sterilized in an autoclave at a temperature of 121 ^{o}C for 15 minutes and at a pressure of 15 psi. One millilitre (1ml) of the prepared sample at different concentration of VTN_1, VTN_2, VTN_3 and VTN_4 were pipetted into the McCartney bottles containing 9ml of the sterile peptone water, and then serially diluted and labelled as appropriate (10^{-2}, 10^{-4}, 10^{-5}, 10^{-6} …, 10^{-9}). 1ml of the inoculants were pipetted into the petri dishes. Each experiment was carried out in duplicates to get a mean standard value of the colony forming units (cfu/ml) on the plates. The prepared media was inoculated into the petri dishes and shaken to distribute the mixture round the dish by spread plate method. The mixture was allowed to solidify and the dish was turned upside down to prevent droplets back into the dish due to condensation. The inoculated Nutrient agar was incubated at 35 ^{o}C for 24 hours to 48 hours for bacteria colonies and 25 ^{o}C for 78 hours to 120 hours for fungi colonies. After the period of incubation, the colonies on the plates were counted and recorded as colony forming unit per millilitre (cfu/ml) (Oboh and Elusiyan, 2004; Anitha *et al*., 2019; Agim-Ezenwaka *et al*., 2020). The cfu/ml was calculated using the formula below:

$$\text{Microbial Count} = \frac{No\ of\ Colonies \times Dilution\ factor}{Volume\ of\ culture\ plate}$$

Equation 1

Sensory evaluation of the fruit juice samples

Twenty members of panel assessors with different VTN samples were used. The panelist was semi-trained and each panelist was separated from the others to avoid any bias in their judgement. The organoleptic attributes assessed are: appearance, taste, after taste, aroma, mouth-feel, and overall acceptability using a 9-point hedonic scale in which 1=dislike extremely, 2= dislike very much, 3= dislike moderately, 4= dislike slightly, 5= neither like nor disliked, 6= like slightly, 7= like moderately, 8= like very much and 9= like extremely (Dimple *et al*., 2014; Rune *et al*., 2015; Anitha *et al*., 2019; David-Chukwu *et al*., 2021).

2.5 Statistical analysis.

The data obtained from the study were analyzed using Analysis of Variance (ANOVA) and the means separated using Fisher's Least Significant Difference (LSD). The data was processed using Microsoft Excel (Landau and Everitt, 2004).

Results and Discussion

Microbiological count of the fruit juice samples

The juice sample VT (velvet tamarind) gave lowest in bacterial population (6.5 x 10^3cfu/ml) as recorded at the end jof incubation period (3day) while sample N was lowest (1.0 x 10^2cfu/ml) on total fungal count and was recorded at the end of incubation period (5days).

Table 2 shows that microbiological counts of the six samples, VT, N, VTN_1, VTN_2, VTN_3 and VTN_4. The total viable count of the samples ranged from 6.5 x 10^3cfu/ml (VT) to 7.1 x 10^5cfu/ml (VTN_3). Also, the total fungal count ranged from 1.2 x 10^2 cfu/ml (VTN_4) to 1.2 x 10^3cfu/ml (VTN_1) . From the results, it could be deduced that the product sample (VT) tended to be the best quality and safe juice sample, while from the blends formulations that is VTN_1, VTN_2, VTN_3, VTN_4; it could be deduced that the VTN_4 sample had the lowest total viable count and even the lowest total fungi count as it contained considerably high amount of VT thus, giving the best quality juice blend product compare to other blends. This is because, Juice of 100% velvet tamarind (VT) had a pH ranging from 3.43 – 3.47 which due to the presence of tartaric acid (Abiodun *et al*., 2017). This low pH has been linked to inhibition of microbial growth. Therefore, low pH of the juice blends could prevent microbial growth and improve storage stability.Also, N sample which was found to be considerably high in total viable and fungal count when compared to the VT may be attributed to the moisture content and soluble solids as reported by (Chan-Blanco, 2005; Abiodun *et al*., 2017).

Sample	Total viable count (cfu/ml)	Total fungal count (cfu/ml)	Total count (cfu/ml)	sTotal coliform count (cfu/ml)
VT	6.5 x 10^3	1.3 x 10^2	-	-
N	6.0 x 10^4	1.0 x 10^3	-	-
VTN1	5.6 x 10^4	1.2 x 10^3	-	-
VTN2	6.8 x 10^4	9.4 x 10^2	-	-
VTN3	7.1 x 10^5	2.4 x 10^2	-	-
VTN4	4.3 x 10^4	1.2 x 10^2	-	-

Table 2: *The Total Microbial Counts Result of the Juice Blends.*

Organoleptic Characteristics of the Fruit Juice Blends

Table 3 shows the mean sensory characteristics of the juice samples. The control (VT) sample was more preferred in all sensory characteristics than the other juice blends according to the panelist. This could be due to the fact that the judges were very familiar with the taste of velvet tamarind and also because it has a sweet taste. There were significant differences ($p<0.05$) as observed in taste, aroma, mouth feel, colour, after-taste and overall acceptability (Table 3).

Sample	Taste	Aroma	Mouth feel	Colour	After taste	Overall acceptability
VT	8.06+0.007^{a}	6.05+0.07^{a}	7.12+0.01^{a}	7.5+0.01^{a}	7.74+0.01^{a}	7.23+0.01^{a}
N	2.21+0.01^{f}	3.21+0.01^{d}	3.15+0.01^{F}	6.021+0.01^{c}	2.71+0.01^{F}	3.56+0.1^{e}
VTN1	7.22+0.01^{b}	3.21+0.01^{c}	6.31+0.014^{b}	6.1+0.014^{d}	6.05+0.01^{b}	6.18+0.01^{b}
VTN2	6.11+0.01^{c}	5.04+0.01^{b}	5.13+0.01^{c}	5.61+0.014^{e}	5.56+0.01^{c}	5.48+0.01^{c}
VTN3	4.21+0.01^{d}	3.03+0.01^{c}	3.31+0.014^{e}	3.71+0.021^{f}	3.82+0.01^{d}	4.22+0.57^{d}
VTN4	2.45+0.01^{e}	3.29+0.07^{cd}	3.71+0.17^{d}	7.05+0.01^{b}	2.84+0.02^{e}	3.87+0.07^{de}
LSD	0.019	0.084	0.019 0.026	0.021 0.45		

Means with different superscript within the same column are significantly different ($p<0.05$) Key: VT = velvet tamarind N = noni

VTN_1 = velvet tamarind & noni juice sample 1
VTN_2 = velvet tamarind & noni juice sample 2
VTN_3 = velvet tamarind & noni juice sample 3
VTN_4 = velvet tamarind & noni juice sample 4

Table 3: *The sensory properties of the Juice blends of noni juice and velvet tamarind.*

Appearance

The appearance score ranged from 3.71 to 7.5. Sample VT recorded the highest mean score (approximately 8.0, i.e., like very much) and there was significant ($p<0.05$) difference in all the samples. The appearance of foods is usually determined by its colour. The higher the appearances score the greater the consumers' acceptability rate on a mark of quality. The high appearance value for sample VT could be attributed to its pale yellow colour which suggested the presence of carotenoid in it, is a precursor for vitamin A. There were significant ($p<0.05$) difference in the colour of all the samples.

Aroma

The aroma score ranged from 3.03 to 6.05. Sample VT was found to have the highest aroma score (approximately 6.0 i.e. like slightly). These could be attributed to the presence of aromatic compounds or esters present in the velvet tamarind. However, there was a significant ($p<0.05$) difference in the aroma score of VT, N, VTN_2, VTN_3 except VTN_1 and VTN_4 velvet has no significant difference ($p>0.05$) in aroma. The samples with higher volume of noni was rated lowest in aroma. This could be due to the objectionable aroma of noni juice (Wang *et al*., 2021).

Taste

The taste score range was from 2.21 to 8.0. Sample VT was found to have the highest taste score (approximately 8.0 i.e. like very much). These could be attributed to the sweet nature of velvet tamarind. However, because of the high content of vitamin in velvet tamarind, it is highly needed by both adult and children who suffers vitamin C deficiency. Also, that of N sample has the lowest taste score of 2.21 i.e. dislike very much. This could be as a result of natural bitter taste of noni.

Mouth-feel

The mouth-feel score ranged from 5.15 to 7.12. Sample VT had the highest mouthfeel 7.12 (i.e. like moderately). There was significant ($p<0.05$) difference for the rest of the samples. Noni due to its bitter taste, people normally reject it as fruit or drink except those that know the medicinal value. Samples that have higher noni ratios, received low rating by the panelists.

After taste

The after-taste score was in the range of 2.84 to 7.74. Sample VT had the aftertaste score (approximately 8.0, i.e. like very much). The lower the percentage of noni, the better the taste of the samples. Hence by blending VT with N at different proportion, it stabilizes and enhances the aftertaste effect as attested by VTN_1 (6.0 i.e. like slightly) However there was significant ($p<0.05$) difference in the rest samples.

Overall acceptability

The overall acceptability score ranged from 3.56 to 7.23. Sample VT had the highest acceptability score which shows that it was generally acceptable when compared to other samples. Sample VTN_1, and VTN_2 shows a second degree of acceptance when compared to samples N, VTN_3 and VTN_4. However, there was significant ($p<0.05$) difference in samples VT, VTN_1 and VTN_2 while no significant ($p>0.05$) difference occurred in sample N, VTN_4 and VTN_3. The higher the percentage of noni in the blend the lower the acceptability of the drink samples.

Conclusion and Recommendation

Conclusion

The production, evaluation and comparative research of this study had provided scientific information on the microbial quality and sensory attributes of drinks produced from velvet tamarind (*Dilalium guineense*) and noni (*Monrinda citrifolia*) juice blends (VTN which includes; VTN_1, VTN_2, VTN_3, VTN_4) in different ratios (20-80%, 40-60%, 60-40%, 80:20%). On the basis of the results revealed above, it can be concluded that the blending of these juices gives a better sensory quality product with therapeutic effects. The control VT (100%) was found to be the best in taste and preferences which was like very much (score: 8.0) in all sensory properties and N (100%) samples received the worse sensory acceptance. The juice blend VTN_4 (80-20%) sample was the best quality product to satisfy consumers taste and preferences followed by VTN_3 (60-40%), VTN_2 (40-60%), VTN_1 (20-80%) in this order. This blend of Velvet tamarind (VT) and Noni (N) juices at different proportions result in velvet tamarind to reduce the bitterness/objectionable odour and improves the taste composition of noni and also noni supplement the acidic taste of velvet tamarind thus,

obtaining therapeutic, vitamin C. antioxidant, nutrient and a better organoleptic compositions of fruit drinks.

Recommendation

The blended fruit juices are innovative products for new product development and commercialization as it's appropriate to carry out other work on evaluation of proximate, physiochemical and functional properties to determine the nutritional properties of the product as it contributes to human diet. It's also important that pharmaceutical industries and health related bodies (Federal Ministry of Health etc.) carries out intensive research as literature reviews high therapeutic effect in composition of this drink as it may provide solutions to some health challenging problems. The blended juice product can be consumed as a refreshing and after meal drink as its not intended to only satisfy thirst and to provide necessary nutrients for human but also to prevent nutrition-related disease and improve physical and mental well-being as consumers in Nigeria and other developing countries are more proactive in taking an initiative to find a food or drink for preventing an illness rather than waiting for cure.

Contribution to Knowledge

There had been a good number of works on different blends of fruit juices but none have been carried out using blends of noni and velvet tamarind juices. The contribution of the work to knowledge is that new product has been developed which have good quality sensory characteristic and have been able to improve significantly both the underutilization challenges on velvet tamarind and noni. Velvet tamarind have been recorded from literature to suffered post-harvest losses especially at its peak of harvest due to the fact that consumers find it stressful to consume it as fresh fruit due the stress of decorticating the seed. Also, noni has too many seeds in it and an objectionable flavor hence poor sensory acceptance. The blended juice is more acceptable to the panelists which will improve the usefulness of velvet tamarind as well as have a good sensory attribute to noni.

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