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Coparative Studies on the Winning Potentials of Black Tamarind, Local Grape Fruit and Exotic Apple

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Abstract: The comparative winning potentials of black velvet tamarind, local grape and exotic apple were evaluated. The fruits musts were extracted, standardized and fermented under the same condition for three weeks using baker's yeast (*Saccharomyces cerevisae*). Important wine quality indices such as pH, titratable acidity, reducing sugars, specific gravity and alcoholic content were determined. The wine quality determinations indicated that each of the wine samples met at least the minimum standards expected of wines. The alcohol contents were 5, 7 and 9% by volume for local grape, exotic apple and black velvet tamarind, respectively. On the basis of sensory evaluation, the black velvet tamarind based wine was most preferred, followed by the apple wine and then the grape wine in terms of colour, flavour, taste and general acceptability.

key words: Wine, fruits, potentials, quality

INTRODUCTION

The need for meeting the beverage requirement of Nigeria's growing population and accelerating winery development cannot be overemphasized. Production of wine from most temperate fruits or the reliance on imported wines are inimical to conserving our foreign exchange, stimulating research and establishment of local orchard for wine production. In modern day Nigeria wine has become a very essential commodity that must be present during ceremonies. The result is that very large quantities of wines are purchased and consumed on daily basis. Therefore there is an urgent need to investigate other cheaper local raw material for wine production, which will in the long run reduce the cost of production as well as price of wine in Nigeria.

One very promising source of local raw material for wine production in Nigeria is *Dialium guinense* (black velvet Tamarind). This is a woody plant occurring in the forest, Savannah belts and belongs to the family ceasalpniaceal. There are three species of *Dialium guinense* in Nigeria and they are *Dialium dinklagei*, *Dialium pachyphyllum* and the plant. *Dialium guinense* is the commonest and most widely spread in Nigeria. The small black velvet fruits are very conspicuous and distinctive. In northern Nigeria it is found in Niger, Plateau and Benue states ; in the west it is found in Oyo, Ogun, Lagos and Ondo states. In the East it is found in Imo,Anambra and Enugu Sates[1]. In general therefore *Dialium guinense* is widely distributed and highly productive. It is a tree of about 60ft high but often shrubby with a densely leafy crown, bole without buttress. The back is smooth and grey; the slash is reddish, yielding a little gum; the sapwood is white and with distinct ripple marks. Each fruit has a stalk of 0.25 m long with little collar near the apex. It has a brittle shell enclosing the fruits. The seed is embedded in a dry brownish sweetly sour and edible pulp (Lewis *et al.*, 1978). *Dialium guinense* can be processed into various food products ranging from jelly to jam and more recently into non-alcoholic beverage. The seed pulp contains a high proportion of vitamin C, sugars and other nutritive components[2].

The problem tamarind has is that it is a seasonal fruit lasting for just 3-4 months. At the peak harvest period so much of it ripen and waste as there is presently no industrial product it is put into. Also because much of it is not demanded, farmers are not keen in domesticating and raising orchards of the plant. If however the wine-making potential of the fruit could be tested and proven to be good enough, large-scale wine production projects could be embarked upon. This will not only eliminate the post-harvest loses of the fruits but also encourage farmers to expand the production of tamarind crops. More so, the local cost of wine could be reduced as cheaper local source of raw materials are employed.

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Local grape fruit commonly employed in Nigeria for the local production of wine and exotic apple also used in wine production form good basis for testing the wine-making potential of the tamarind fruits. Therefore the main objective of this research is to compare the quality of wines made from tamarind fruit with those of local grape and exotic apple.

MATERIALS AND METHODS

In the study three fruits were employed in the production of must for subsequent wine production.The fruits were black velvet tamarind, grape fruit and exotic apple. They were all purchased from Umuahia market, Abia state, Nigeria at matured and ripened stage; and temporarily kept in a refrigerator and taken and used as required for the wine production.

Production 0f fruit juice: the different fruits were first used to produce must, then inoculated and fermented into wine. For the exotic apple, the light green fruits weighing 4.30 kg was washed, sliced and crushed using Kenwood blender. 1.3L of distilled water was added while blending, after which the must was strained using muslin cloth. The muslin cloth was actually placed in hot water at 70°C for 15 min when the extraction was carried out.The extracted juice was kept in a stainless bowl and stored in a refrigerator for further processing into wine. The yield of the juice was 3.0L from 5.4L of the blended mixture. In the case of the grape fruit, the light yellow fruit weighing 5.82 kg was sorted, washed, cut into halves and squeezed to extract the juice using Kenwood juice extractor, after which the must was strained using muslin cloth as described above. The resultant juice was stored in a refrigerator. The yield of the juice was 1.60L from 2.10L of the extracted mixture. For the velvet tamarind, the small black encapsulated fruits were dehusked, soaked, macerated and filtered to extract the liquid using cheese cloth. The yield of the juice was 2.8L from 6.20L of the macerated mixture after adding 4.10L of distilled water.

Development of starter culture: 250 mL of each of the three fruit juices in 400 mL conical flasks were carefully covered with aluminum foil and autoclaved at 135°C for 15 mim to sterilize the medium. They were separately cooled, after which 5.0 g of baker's yeast (*Saccharomyces cereviseae*) was inoculated into each of the autoclaved juice in the conical flasks. They were all incubated at 25°C for 24 h for subsequent inoculation into already prepared main juice for primary fermentation.

Fermentation of the fruit juice: Three separate 5L plastic jars were thoroughly washed with distilled water and dried. The fruit juice samples for fermentation were prepared by adjusting to uniform standards using wine ingredients. These ingredients included 18.75, 12.00 and 22.05 g of Ammonium Sulphate added to 2.50, 1.60 and 3.00L of Tamarind juice, grape juice and apple juice, respectively as nitrogen source to the yeast. In the same way, 0.49, 0.03 and 0.56 g of sodium metabisulphite were added to tamarind juice, grape juice and apple juice, respectively as anti microbial agents[3]. Also, 625, 400 and 700 g of sucrose were equally added to tamarind juice, grape fruit juice and apple juice, respectively as source of carbon[4]. The juices and their ingredients were then separately autoclaved and allowed to cool to 25°C before 105.9, 67.8 and 127.0 mL of yeast were inoculated to the individual juice of tamarind, grape fruit and apple, respectively for primary fermentation[5]. The mouth of the fermentation jars were stoppered with cotton wool soaked in sodium metabisulphite solution as antimicrobial agent. At the same center holes, provisions were made for thermometer insertion. The thermometer that monitored temperature changes were lagged with the cotton wool. The aerobic fermenting temperatures (28-30°C) were maintained by adjusting the incubator to the temperature range. The primary fermentation lasted for four days. While it was in progress the fermenting media were shaken intermittently to aid complete fermentation, until when yeast activity appeared to slow down by less vigorous, random, effervescent bubbling of carbon dioxide.

Secondary fermentation: The secondary fermentation was carried out under anaerobic condition as the holes in the fermenting plastic jars were sealed completely with cotton wool. This fermentation lasted for 3 weeks.

Chemical and physical analyses: Some important chemical and physical tests were carried out on the fruit juices samples, fermenting liquor and the finished wines. The proximate composition and vitamin C were determined according to the methods of Pearson[6]. Titratable acidity was evaluated using the method described by Joslyn[7] and Mitchell[8]. Reducing sugar was determined as enunciated by Plumber[10]. $_{P}$H was checked using pH meter. Pearson[6] method was used to analyze the alcoholic content using Billingham and Stanley refractometer.

Sensory evaluation: In the sensory evaluation, a 20-man panel of judges was used to evaluate some quality attributes of the three wine samples. The attributes evaluated were colour, taste, flavour and general acceptability. A 9-Point hedonic scale was used to evaluate the intensity of each parameter with 1-representing extremely disliked and 9-representing

Table 1: The chemical composition of the fruits used for the wine production

Fruit	Moisture Content (%)	Fibre (%)	Crude Protein (%)	Crude Fat (%)	Carbohydrate (%)	Ash (%)	Vit. C (mg 100 mL^{-1})
Velvet tamarind	18.2^{c}	5.9^{a}	3.4^{a}	1.3^{a}	69.3^{a}	2.3^{a}	24.6^{a}
Local grape	88.1^{a}	2.3^{b}	1.0^{b}	0.4^{b}	13.5^{c}	0.8^{b}	15.7^{c}
Exotic apple	83.3^{b}	1.5^{b}	0.7^{b}	0.6^{b}	21.1^{b}	0.8^{b}	17.0^{b}

*abc.. values with different superscript (s) along the same column are significantly different (p<0.05). All values were the mean of two determinations

Table 2: Winning qualities of black tamarind, local grape and exotic apple

Fruit juice	PH	Titratable acidity (%)	Reducing sugar mg 100^{-1}	Specific Gravity	Degree brix (B)
Velvet tamarind	3.93^{a}	0.33^{a}	8.30^{a}	1.070^{a}	24.64^{a}
Local grape	4.08^{a}	0.19^{a}	6.67^{b}	1.062^{a}	15.67^{b}
Exotic apple	4.12^{a}	0.17^{a}	7.10^{b}	1.069^{a}	17.02^{b}

*abc.. values with different superscript (s) along the same column are significantly different (p<0.05). All values were the mean of three determinations

extremely liked. The data was analyzed using the analysis of variance(ANOVA) and differences between means determined using the Least Significant Difference (LSD) as described by Gomez and Gomez[9].

RESULTS AND DISCUSSION

The chemical composition of the black velvet tamarind, local grape fruit and exotic apple is shown in Table 1. It can be noted from this table that black velvet tamarind was significantly (p<0.05) lower in moisture content, but higher in fibre, protein, total carbohydrate, ash and vitamin c than either the local grape fruit or exotic apple. Amongst the local grape fruit and exotic apple, the exotic was found to be significant (p<0.05) higher in vitamin c, total carbohydrate and fat whereas the local apple was higher in moisture content and protein. This trend of result is expected as the black velvet tamarind is a dry seed and well protected in shell and therefore should maintain a higher concentration of these chemical substances. The dryer nature also conveys a higher shelf-stability in storage. Interesting again is the very high content of vitamin C (24.6 mg 100 mL^{-1}) and protein (3.4%), which makes it a very nutritious wine ingredient.

The wine-making qualities of the fruits are shown in Table 2. As can be easily seen in this table, the black velvet tamarind absolutely distinguished itself as a better wine making fruit than the rest. It was significantly higher in reducing sugar and degree brix 8.30 mg 100 mL^{-1} and 24.64^{0}, respectively when compared with the local grape 6.67 mg 100 m^{-1} and 15.67^{0} as well as exotic apple, 7.10 mg 100 mL^{-1} and 17.02, respectively, indicative of better winning capacity. Even though a significant difference (p>0.05) could not be detected amongst the fruits in terms of pH, titratable acidity and specific gravity, the black velvet tamarind maintained a clear lead in score. These are the qualities that influence, the taste, flavour and alcoholic content in wine making[11-13].

The result of other critical quality indices of the wine produced are shown in Fig. 1 and 2. It could be seen in

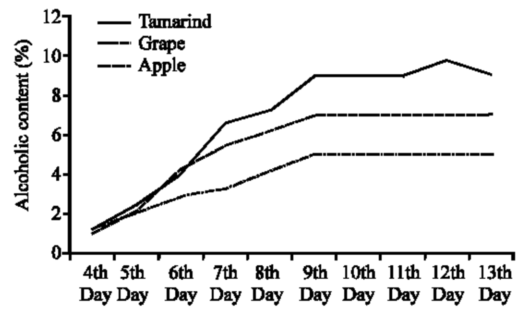

Fig. 1: Influence of fermenation time on the alcoholic content of different fruits

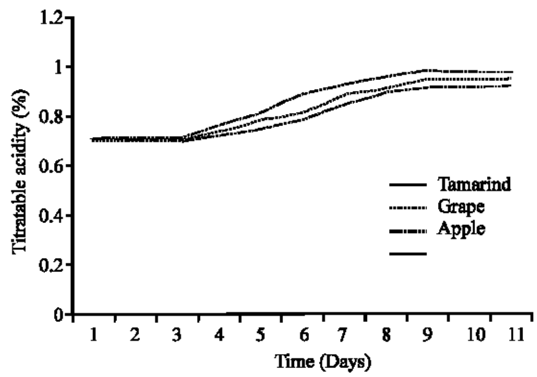

Fig. 2: Influence of fermenation time on the titratable acidity of different fruits

Fig. 1 that black velvet tamarind maintained initial lead in the content of reducing sugar as the fermentation progressed. This was closely followed by that of the exotic apple and lastly the local grape. However by the 9th day of fermentation the reducing sugars began to reduce sharply indicating high rate of fermentative activity of the yeast using up the reducing sugars. It becomes obvious that the black velvet tamarind will sustain higher alcoholic yield as indicated by the higher rate of activity of yeast on the reducing sugar.

On the other hand, the black velvet tamarind maintained higher titratratable acidity (0.98% by 11th day)

Table 3 : Sensory evaluation of the wine produced

	Wine colour	Taste	Flavour	General acceptability
Exotic Apple	6.50^{b}	7.02^{ab}	7.45^{b}	6.90^{b}
VelvetTamarind	8.10^{a}	6.30^{bc}	8.65^{a}	7.45^{a}
LocalGrape	6.05^{b}	5.84^{c}	6.55^{c}	6.30^{b}

*abc.. values with different superscript (s) along the same column are significantly different (p<0.05). All values were the mean of three determinations

through out the fermentation period, followed by exotic apple (0.95%) and lastly local grape (0.92%) as shown in Fig. 2. Higher titratable acidity improves the activity of the fermenting yeast while hindering the activity of other interfering organisms[11]. As expected from the result of the reducing sugar and titratable acidity, the black velvet tamarind generated the highest level of alcohol (9.0% by 13th day) throughout the fermentation period followed by that of exotic apple (7.0%) and lastly local grape apple (5.0%). This result goes a long way to prove that black velvet tamarind is a far more potent ingredient for wine making in Nigeria than most other fruits employed.

The result of the sensory evaluation of the wine produced is given in Table 3. It is indicative from this table that wine produced from black velvet tamarind was most acceptable being significantly ($p<0.05$) more acceptable than the other wines, followed by that of exotic apple and lastly the local grape wine. In terms of colour and flavour of wine, the black velvet tamarind also significantly scored better than the other fruits whereas the exotic apple followed next. The least score in terms of colour and flavour of wine was shown by local grape wine. In taste, exotic apple (7.02) maintained a better score and then followed by the black velvet tamarind (6.30), the least again was the local grape wine (5.84).

CONCLUSION

It is apparent from the results generated in this experiment that the black velvet tamarind is a far better wine ingredient than either exotic apple or local grape. This is buttressed by better nutritional quality indicated in Tables 1, 2 and 3. Black velvet tamarind was also found to have a better winning potential than the other fruits in terms of the fermentable sugar, titratable acidity and alcoholic content. Finally the black velvet tamarind based wine proved to be more acceptable by the sensory panel than the exotic and the local grape.

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