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Preparation and Quality Analysis of Yacon (*Smallanthus sochifolius*) Wine

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ABSTRACT

Three musts containing 24 °Bx TSS, 3.8 ± 0.1 pH and 100 ppm SO_2 were prepared from yacon juice, yacon pulp and yacon syrup and were fermented for 20 days at 26 ± 2 °C temperature using wine yeast. The wines were analyzed for chemical (TSS, acidity, antioxidant activity, total phenolics, alcohol, esters, aldehydes, higher alcohol and methanol) and sensory (color, taste, smell, flavor, mouthfeel and overall) characteristics. No significant difference in TSS was found among the wines (7.60 – 8.33°Bx). Total and fixed acidities (0.86 and 0.72%, m/v as lactic acid), antioxidant activity (98.83%) and total phenolic (86.5 mg GAE/100 mL) were higher in yacon syrup wine, while alcohol (12.5% v/v) was higher in yacon juice wine. Total esters, aldehydes and higher alcohol contents of the three wines ranged from 51.0 to 68.8 mg ethyl acetate/L, 0.23 to 0.31 mg acetaldehyde/L and 170 to 220 mg/L respectively. No significant difference in methanol content was found among the wines (11.1 – 13.4 mg/L). Sensory evaluation showed that color and mouth-feel preference scores of wines were not significantly different ($p>0.05$) while the taste, smell, flavor and overall acceptability scores of yacon juice wine were higher than that of yacon syrup wine. Hence, considering antioxidant activity, methanol content and sensory properties, both yacon juice and syrup could be used as raw materials for the preparation of wine comparable in quality to those of fruit wines.

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1. INTRODUCTION

Wine has been an integral part of human culture for thousands of years. Today, wine is enjoyed worldwide, with a rich diversity of styles and flavors reflecting the regions where it is produced (Estreicher, 2023). The process of fermenting fruit is old but continues to draw attention by using unconventional raw material such as yacon tuber.

Yacon (*Smallanthus sonchifolius*) has been found to be one of the richest plant sources of fructooligosaccharides (FOS), which are claimed to have numerous health benefits (Caetano et al., 2016). Besides being prebiotics, FOS are non-cariogenic, impart moderate sweetness and provide negligible calories. FOS are recognized as a soluble fiber which causes several favorable effects during digestion (Manrique, 2005). Yacon concentrate is a sweet syrup derived from juice extracted from the roots of the yacon plant (Smallanthus sonchifolius) and has physical and sensorial characteristics similar to honey or sugar cane syrup (Genta et al., 2009; Wang & Li, 2013; Yan et al., 2019).

Yacon-based wines are known for their antioxidant, anti-inflammatory, and prebiotic properties, which can promote gut health and improve digestion. Its low glycemic index and prebiotic properties make it particularly valuable for diabetics and those seeking natural sweeteners (Caetano et al., 2016).The high fructooligosaccharide (FOS) content in yacon makes it an excellent candidate for fermentation, resulting in a wine that not only has a unique sweetness but also offers health benefits.

Previous studies on the preparation of yacon wine have been carried out using yacon juice only (Brandão et al., 2014; Shrestha, 2015; Pokhrel, 2018) but the works concerning the possibility of preparing wines from yacon pulp and yacon syrup are scarce. Despite the huge health benefits of yacon, its cultivation has declined over the last few years owing mainly to its marketing problem. As the juice yield of yacon is comparable to those of apples and pears, and the TSS like that of pear, the outcome of this study will help in developing yacon as a promising raw material for wine making. Commercial utilization of yacon for wine making will be beneficial not only for the wine industries in finding alternative raw material, but also to the grower for ensured marketing. This initiative aligns with the consumer trend towards alternative alcoholic beverage options, positioning yacon-based beverages as a promising addition to the global wine market.

2. MATERIALS AND METHODS

2.1 Raw Materials

Yacon root was obtained from local market of Dhankuta district. Yacon syrup containing 66 °Bx was obtained from Nepaley Industry, Kathmandu. Wine yeast (Lalvin dried wine yeast EC 1118, USA) was purchased from Kathmandu. All chemicals used were of AR grade.

2.2 Preparation of Yacon pulp and Yacon Juice

Yacon was washed thoroughly with water, peeled by using stainless steel knife and sliced. The slices were immediately dipped into water containing 100 ppm sulphur dioxide to inhibit enzymatic browning. The sliced yacon was pulped in a blender using 3 g citric acid and 87 mg potassium metabisulphite (KMS) per kg of slices to prevent browning during pulping. The pulp was divided into two lots. One lot of the pulp was used for pulp fermentation and the other was strained through a double-folded muslin cloth to obtain yacon juice.

2.3 Preparation of Musts for Fermentation

2.3.1 Yacon Juice Must

The weight of yacon juice (11.5°Bx TSS and 5.8 pH) was noted and its TSS was adjusted at 24 °Bx by adding cane sugar. The pH was adjusted in the range of 3.8 ± 0.1 using 20% citric acid solution. Potassium metabisulphite (KMS) was added to the ameliorated must to maintain sulphur dioxide content at 100 ppm. The amount of KMS added during pulping was taken into consideration while adjusting the must SO_2 content.

2.3.2 Yacon Pulp Must

The weight of pulp (10°Bx and 5.7 pH) was noted and its TSS, pH and SO_2 contents were adjusted as described for the preparation of yacon juice must.

2.3.3 Yacon Syrup Must

Yacon syrup (66 °Bx TSS and 4.3 pH) was diluted to 11°Bx with potable water and the TSS was adjusted at 24 °Bx using cane sugar. The pH and SO_2 were maintained at 3.8 ± 0.1 and 100 ppm respectively as described for yacon juice must.

2.4 Fermentation

The fermentation containers (5 L glass jar) were cleaned with detergent, rinsed with water containing 500 ppm SO_2 and finally rinsed with boiled water. The three musts (yacon juice, pulp and syrup) were filled into three separate glass jars up to their 70% volumetric capacity and cotton plugged. The wine yeast was pitched at the rate of 0.3 g/L of the must after 6 h of must sulphitation. The containers were cotton plugged and allowed for alcoholic fermentation at room temperature (26 ± 2 °C). The containers were shaken twice a day for two days of fermentation to facilitate must oxygenation and biomass development. After 14 to 16 days of active fermentation, the containers were air-locked, and passive fermentation was allowed till the fermentation was completely stopped as evidenced by the cessation of bubbling and constant TSS. To airlock the fermentation container, an airlock was inserted into the stopper with a hole and the stopper was inserted into the container's opening. The airlock was filled with acidified distilled water (pH 4) containing 100 ppm SO_2.

2.5 Racking, Pasteurization and Bottling of Wines

After the completion of fermentation, the wine was racked and batch pasteurized (70 °C/10 min). For pasteurization, the wine was put in a heating vessel and heated with continuous stirring. During heating and holding periods, the vessel was covered with a plate containing cold water in order to prevent the loss of alcohol due to evaporation. Then wine was cooled to room temperature (26 ± 2 °C) and filled in to pre-cleaned and 500 ppm KMS solution treated followed by hot water rinsed wine bottles. The wines were analyzed for their chemical and sensorial characteristics.

2.6 Analytical Procedures

2.6.1 Determination of total-, fixed- acidity and volatile acidity

The total- , fixed- and volatile acidities were determined as per (Sabino & de Castilhos, 2023). Total and fixed acidities were expressed in % (m/v) as lactic acid, while volatile acidity was expressed in % (m/v) as acetic acid.

2.6.2 Determination of TSS and pH

TSS was determined using hand refractometer (Hanna Instrument, Portugal) and the results were expressed as °Bx. The pH was measured by using digital pH meter (Hanna Instrument, Portugal).

2.6.3 Determination of alcohol content

One hundred milliliter of the wine was neutralized with 0.1N NaOH and distilled as described by Kirk et al. (1991). The alcohol content in the distillate was determined by spectrophotometric method as per Zoecklein et al. (2013) using UV-vis spectrophotometer (Labtronics Model LT – 291, India).

2.6.4 Determination of Total Esters

Total esters content was determined by titrimetric method as per Kirk et al. (1991). Briefly, 100 mL of the distillate was neutralized with 0.1 M NaOH and 10 mL of 0.1 M NaOH solution was added to it. It was refluxed for 1 h using glass beads, cooled and titrated with 0.05 M H_2SO_4 solution. Similarly, a blank was also run using 100 mL distilled water instead of the distillate. The difference between blank and sample titers was used for calculation and total esters content was expressed as mg ethyl acetate/L of wine.

2.6.5 Determination of Total Aldehydes

Total aldehydes content was determined by titrimetric method as per Kirk et al. (1991) and the results were expressed as mg acetaldehyde/L of wine.

2.6.6 Determination of Antioxidant Activity

The antioxidant activity of wine was determined by DPPH method as per Singh et al. (2008). Briefly, wine sample was filtered through Whatman No. 41 filter paper and 10-fold diluted with distilled water. One mL of the diluted wine was taken in a test tube and 4 mL of 0.004% methanolic solution of DPPH was added. Then the test tube was incubated at room temperature (28 ˚C) for 30 min in the dark and absorbance was measured at 517 nm using a UV-vis spectrophotometer. Similarly, blank was also run using methanol instead of the sample. The DPPH scavenging activity was calculated as follows:

$$\text{DPPH Scavenging Activity (\%)} = \frac{(\text{Blank absorbance-Sample absorbance})\times 100}{\text{Blank absorbance}}$$

2.6.7 Determination of Total Phenolic

Total phenolic content was determined as per López-Vélez et al. (2003). Briefly, 1 ml of the filtered wine was diluted to 10 ml with distilled water. One mL of the diluted wine was pipetted into a test tube and 2 mL of distilled water and 0.5 mL of Folin-Ciocalteau reagents were added. After 3 min, 2 mL of sodium carbonate solution (20%) was added, mixed thoroughly and incubated at room temperature for 1 h after which the absorbance was measured at 650 nm against a reagent blank. Total phenolic content in the wine was calculated from the standard curve prepared using different concentrations of gallic acid and the result was expressed as mg gallic acid equivalent (GAE)/100 mL wine.

2.6.8 Determination of Higher Alcohol

Higher alcohol was determined by spectrophotometric method as per Pilone (1985). Briefly, 1 g of the fusel oil standard (4 volumes isoamyl alcohol mixed with 1 volume of isobutyl alcohol) was diluted to 1 L with distilled water. Finally, working standard solutions were prepared by pipetting 0, 5 10, 25 and 35 mL of fusel oil standard solution into 100 mL volumetric flasks containing 7 mL of 95% neutral ethanol and diluting to volume with distilled water.

Distillate (1 mL) was pipetted in a test tube and diluted to 2 mL with distilled. 1 mL DMAB solution (1 g DMAB dissolved in a mixture of 5 mL H_2SO_4 and 90 mL distilled water and volume made up to 100 mL with distilled water) was added to the test tube, shaken and placed in ice bath for 3 min. With the tube still in ice bath, 10 mL of chilled H_2SO_4 was added into the tube, shaken and placed in ice bath for 3 min. Then the tube was placed in a boiling water bath for 20 min and placed in ice bath for 5 min. The tube was shaken and brought to room temperature. Similar procedure was followed for fusel oil working standard solutions. The transmittance (% T) of both the test sample and working standard solution were read at 540 nm against reagent blank as reference. The concentration of the fusel oil was found out from the fusel oil standard curve prepared by plotting gram fusel oil on linear scale as abscissa against %T as ordinate on log scale of semi log paper. The results were expressed as mg fusel oil/L wine.

2.6.9 Determination of Methanol Content

Methanol content was determined by chromotropic acid colorimetric method as per Delirrad et al. (2012). Briefly, 2 mL of $KMnO_4$ solution (3 g KMnO4 dissolved in a mixture of 15 mL H_3PO_3 and 85 mL distilled water) was pipetted into a 50 mL volumetric flask, chilled in ice bath. 1 mL of the distillate sample was added to the flask and stand for 30 min in ice bath. The excess of $KMnO_4$ solution was decolorized with 2% sodium sulphite solution and 1 ml of chromotropic acid solution (5% aqueous solution) was added. Then 15 mL of conc H_2SO_4 was slowly added with swirling and placed in hot water bath maintained at 70 ˚C for 15 min and cooled. The volume was made up to 50 mL, and the absorbance was read at 575 nm against a reagent blank containing 5.5% ethanol treated similarly. Standard methanol solution (0.025% by volume in 5.5% ethanol) was also treated simultaneously in the same manner, and the absorbance recorded. Methanol content in the wine was calculated as follows:

$$\text{Methanol content } \left(\%\frac{v}{v}\right) = \frac{\text{Sample absorbance}\times 0.025}{\text{Standard absorbance}}$$

2.7 Sensory Evaluation

Sensory evaluation of the wines was carried out by using a 5-point hedonic scale (1 = Poor, 2 = Fair, 3 = Satisfactory, 4 = Good, and 5 = Excellent) as per (Ranganna, 1986) with slight modification. Semi-trained panelists were asked to evaluate the samples in terms of color, taste, smell, flavor, mouthfeel and overall acceptability.

2.8 Data Analysis

Chemical and volatile constituents of wines made from yacon juice, pulp, and concentrate were analyzed, and their sensory qualities were compared.

3. RESULTS AND DISCUSSION

Chemical and volatile constituents of wines made from yacon juice, pulp, and concentrate were analyzed, and their sensory qualities were compared.

3.1 Chemical characteristics of yacon juice, yacon pulp, and yacon syrup wines

The chemical characteristics of wines made from yacon juice, pulp, and syrup were analyzed and the results are shown in Table 1.

Wine made from yacon syrup had the highest total acidity (0.86%, m/v as lactic acid), while that of yacon juice had the lowest total acidity (0.59% m/v). Fixed acidity (FA) contents (% m/v as lactic acid) between yacon juice (0.56%) and pulp (0.59%) were not statistically different ($p>0.05$), while wine made from yacon juice concentrate had significantly higher FA (0.72%) of all the wine samples. Analogous results of total acidity were also reported by Otegbayo et al. (2020) in carrot wine (0.71% as tartaric acid), Sudheer kumar et al. (2012) in mango wine (0.49 – 0.87 % as tartaric acid), Mahapati et al. (2010) in tomato wine (0.45%) and Nehra et al. (2023) in different blends of carrot-beetroot and carrot orange wines (0.42 – 0.63% as tartaric acid) but higher total acidity in pomegranate wine (1.65 – 1.7% as citric acid) was reported by Kokkinomagoulos et al. (2020).

Table 1

Chemical characteristics of wines made from yacon juice, pulp, and syrup

Characteristics	Wine samples*		
	Yacon juice	Yacon pulp	Yacon syrup
Total acidity as lactic acid (%, m/v)	0.59^{a} (0.02)	0.69^{b} (0.03)	0.86^{c} (0.03)
Fixed acidity as lactic acid (%, m/v)	0.56^{a} (0.01)	0.59^{a} (0.01)	0.72^{b} (0.02)
Volatile acidity as acetic acid (%, m/v)	0.022^{a} (0.004)	0.058^{b} (0.008)	0.063^{b} (0.004)
pH	3.67^{ab} (0.06)	3.73^{b} (0.06)	3.53^{a} (0.06)
TSS (°Bx)	7.60^{a} (0.53)	7.67^{a} (0.58	8.33^{a} (0.58)
Antioxidant activity (%) **	62.11^{a} (0.85)	42.88^{b} (4.34)	89.83^{c} (1.51)
Total phenolic (mg GAE/100 mL)	44.7^{a} (1.14)	40.9^{a} (1.16)	86.5^{b} (2.71)

*: values are the means of three determinations. Figures in the parentheses are standard deviations. Means having similar superscripts in a row are not significantly different (p>0.05).
**: 1 mL of wine was diluted to 10 mL with distilled water and used for the determination.

Volatile acidity content was similar in wines made from yacon pulp and yacon syrup, while it was significantly lower in yacon juice wine. Similar results of volatile acids in various wines were also reported by Egan et al. (1981) (0.03 – 0.2% m/v) and Kokkinomagoulos et al. (2020) in pomegranate wine (0.20 to 0.84 g acetic acid/L). But the values of volatile acidities found in this study were quite lower than those reported by Ancín et al. (1996) in white wine (0.27% m/v) and rose wine (0.3%, m/v) and Vilanova et al. (2007) in red wine (0.3%, m/v).

pH of yacon pulp wine (3.73) was significantly higher than that of yacon syrup wine (3.53), but it did not differ from that of yacon juice wine (3.67). Similar results were also reported by Chhetri et al. (2025) in carrot wine (3.35 – 3.48), Otegbayo et al. (2020) in beetroot wine (3.2) and Soibam et al. (2017) in sugarcane -beetroot juice wines (3.45 –3.8). However, higher pH values (4.10 – 4.20) were reported for honey-coconut wines (Balogu & Towobola, 2017). The pH values of yacon wines found in this study were slightly higher than those reported by Ancín et al. (1996) in rose wine (3.0) and white wine (3.33)

The TSS of wines was in the range of 7.60 – 8.33°Bx, however, the values were not statistically different. Similar result of TSS was reported by Joshi et al. (2012) in Jamun wine (8.6 – 10.0° Brix).

The antioxidant activity of wines differed significantly from each other, with the highest value being for yacon syrup wine (89.83% and lowest for yacon pulp wine (42.88%). Antioxidant activity of wines found in this study was higher than those reported by Jangra et al. (2019) in kinnow wines (8.75 – 16.01%), Sahu et al. (2012) in tendu wine (52%), and Nirmal Sharma et al. (2013) in jackfruit wine (36%). DPPH free radicals scavenging activity values of yacon wines were similar to that reported by Nehra et al. (2023)in different blends of carrot-beetroot and carrot orange wines (83 – 96%).

Total phenolic content (mg GAE/100 mL) was maximum in yacon syrup wine (86.5), but the values for yacon juice and yacon pulp wines were not significantly different (p>0.05). Analogous results of total phenolics were also reported by Vilanova et al. (2007) in three red wine samples (35.81 – 55.66 mg GAE/100 mL), Sudheer Kumar et al. (2012) in different mango wines (Alphonso: 537 mg/L, Banginapalli: 456 mg/L and Sindhoora: 490 mg/L) and Thakur et al. (2014) in pumpkin wines (370.7 – 899.1 mg/L). Higher values of total phenolics content have been reported by Panda et al. (2014) in bael wine (0.93 g/100 mL), Elez Garofulić et al. (2012) in elderberry fruit wines (5136.75 – 8307.69 mg GAE/L).

3.2 Volatile constituents of yacon juice, yacon pulp and yacon syrup wines.

The volatile contents viz., alcohol, total esters, total aldehydes, higher alcohols and methanol in yacon juice, pulp and syrup wines were determined and the results are shown in Table 2.

Table 2

Volatile constituents of yacon juice, pulp and syrup wines

Volatiles constituents	Wine samples*		
	Yacon juice	Yacon pulp	Yacon syrup
Alcohol (%, v/v)	12.5^{a} (0.24)	11.0^{b} (0.50)	10.67^{b} (0.76)
Total esters as ethyl acetate (mg/L wine)	68.8^{a} (3)	51^{b} (1.8)	58.2^{a} (2.3)
Total aldehydes as acetaldehyde mg/L wine)	0.31^{a} (0.02)	0.23^{b}(0.01)	0.31^{a} (0.01)
Higher alcohols (mg/ L wine)	170^{a} (7.8)	220^{b} (9.5)	193^{a} (6.6)
Methanol (mg/L wine)	11.1^{a} (2.0)	12.7^{a} (1.2)	13.4^{a} (1.2)

* Values are the means of three determinations. Figures in the parentheses are the standard deviation. Means having similar superscript in a row are not significantly different (p>0.05)

Alcohol content of yacon juice wine (12.5%, v/v) was significantly higher than those of yacon pulp and yacon syrup wines, but the values between yacon pulp and yacon syrup wines were not significantly different (p>0.05). The alcohol contents found in this study were similar to those reported by Egan et al. (1981) in different wines (7.5 – 14% m/v), Joshi et al. (2012) in Jamun wine (10.7%), Jeong et al. (2025) in different Korean grape wines (9.9 – 13.5%), Jakabová et al. (2021) in different white wines produced in Slovakia (11.5 – 13.8%), Nehra et al. (2023) in wines made from different blends of carrot-beetroot and carrot-orange (10 – 12.58%) and by Jangra et al. (2019) in kinnow wines with and without pulp (10 – 14%). The alcohol contents found in this study were higher than those reported in three red wines (9.86 – 9.46%, v/v) by Vilanova et al. (2007).

Total ester contents (mg ethyl acetate/L wine) between yacon juice wine (68.8) and yacon syrup wine (58.2) were similar, but it was significantly lower in yacon pulp wine (51). Total ester content in yacon wines found in this study was in the range reported by Clarke et al. (2004) (25 – 300 mg/L). Ethyl acetate contents in different wine samples were reported to vary from 43.70 to 194.95 mg/L of wine Arcari et al. (2013) which agrees with our result. Marcon et al. (2019) reported very low ethyl ester content in three Moscato wines (9.3 – 9.6 mg/L of wine). Ethyl ester concentrations higher than 150–200 mg/L of wine are considered to have a negative effect on the flavor of wines and are usually associated with contamination of the grape, must or wine by acetic bacteria, indicating the existence of flaws in the vinification and/or conservation process Gil et al. (2006). Wines made from yacon juice and yacon syrup had significantly higher total aldehydes content than that of yacon pulp wine. Total aldehydes content in yacon wines found in this study was lower than that reported by Briggs et al. (2004) (10 – 20 mg/L wine). The principal causes of high acetaldehyde concentrations in wine are the use of poor quality pitching yeast, excessive must oxygenation, unduly high fermentation temperature and excessive pitching rates (Briggs et al., 2004).

Higher alcohol content was maximum in yacon pulp wine (220 mg/L) compared to yacon juice and syrup wines. Similar result of higher alcohol contents in wines (188 to 222.8 mg/L of wine) was also reported by Marcon et al. (2019). Higher alcohol contents found in yacon wines were lower than those reported by Nemzer et al. (2021) in red wines (300 – 600 mg/L wine). According to Usansa (2003), the higher alcohols content in wine should be 80-540 mg/L and the concentration of higher alcohols below 300 mg/L contributes the desirable aroma of wine, whereas these components are seen as a negative factor in creating the aroma when their level exceeds 400 mg/L.

Methanol contents in different yacon wines were in the range of 11.1 – 13.4 mg/L, however, the values were not significantly different. Methanol contents found in this study were very lower than those reported by Jeong et al. (2025) in nine different Korean red wines (43.6 – 396 mg/L), Jackson (2020) in different wines (100 – 200 mg/L and by Reddy et al. (2011) in guava wines (126 – 150 mg/L).

3.3 Sensory quality of wines made from yacon juice, pulp and syrup.

The sensory quality of wines was evaluated in terms of their color, taste, smell, flavor, mouthfeel and overall acceptance using 5-points hedonic scale and the results are shown in Figure 1.

The mean color scores for yacon juice, pulp and syrup wines were 3.27, 3.45, and 3.73 respectively. Statistical analysis revealed that the scores were not significantly different (p>0.05). The average taste scores were 3.91, 3.09 and 3.0 for wine made from yacon juice, pulp and syrup respectively. Statistically, yacon juice wine had significantly the highest taste score compared to yacon pulp and yacon syrup wines, whereas the taste scores for the latter two wines were similar. In terms of the taste preference, yacon juice wine was rated as “good”, while yacon pulp and yacon syrup wines were rated as “satisfactory” by the sensory panelists.

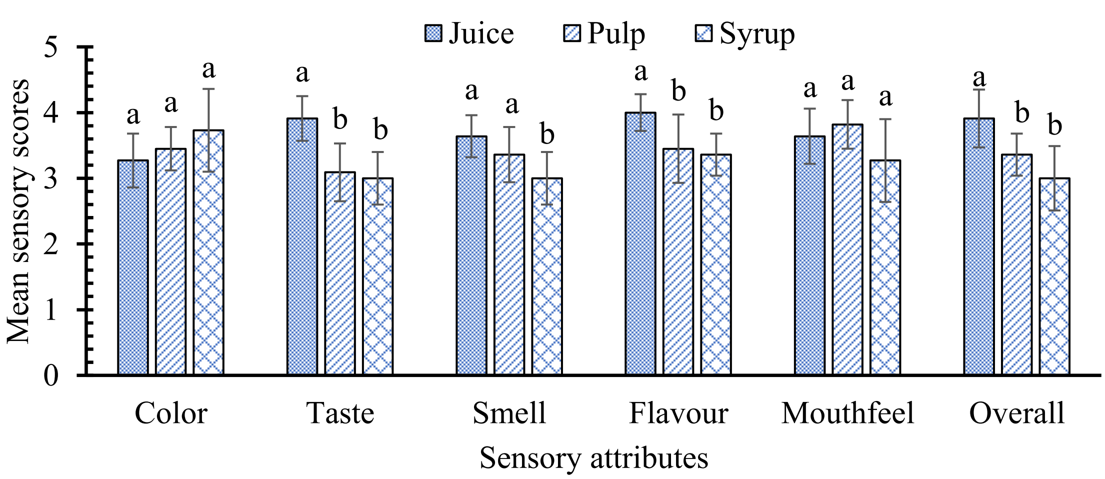

Figure1
Mean sensory scores for yacon juice, pulp and syrup wines
*: Values are the means of 10 panelists. Error bars indicate 95% CI. Similar letters for any quality attribute are not significantly different (p>0.05).

The mean smell preference scores for yacon juice, pulp and syrup wines were 3.64, 3.36 and 3.0 respectively. The scores between yacon juice and yacon pulp wines were not different, while that of yacon syrup wine was significantly lower than yacon juice and pulp wines. The mean flavor scores for yacon juice, pulp and syrup wines were 4.00, 3.45 and 3.36 respectively. Statistically, the flavor preference score of yacon juice wine was higher (panelists rated as "good") than those of yacon pulp and syrup wines (rated as "satisfactory")

The average mouthfeel scores were 3.64, 3.82 and 3.27 for yacon juice, pulp and syrup wines respectively, but the values were not significantly different. All wine samples were rated as "satisfactory" by the sensory panelists based on mouthfeel. Overall acceptability scores for yaon juice, pulp and syrup wines were 3.91, 3.36 and 3.00 respectively. Statistical analysis showed that yacon juice wine had the highest overall acceptability score (3.91 = rated as "good") of all the wine samples, while the wines made from yacon pulp and syrup had similar overall acceptability score (rated as "satisfactory").

Both the volatile and non-volatile constituents' analysis revealed that yacon syrup wine had the highest antioxidant activity and total phenolics contents, but it had significantly lower alcohol content. Moreover, total esters, total aldehydes and higher alcohol contents between yacon juice and yacon pulp wines were similar. Based on the sensory evaluation of wines, most of the sensory attributes were significantly higher for wine made from yacon juice compared to yacon pulp and syrup.

4. CONCLUSION

Color and mouth-feel preference scores of all wines were not different and were rated as "satisfactory". Taste, smell, flavor and overall acceptability scores of yacon juice wine were higher than that of yacon syrup wine. Based on the chemical and sensory quality of wines, it was concluded that both yacon juice and yacon syrup could be used as raw materials for the preparation of wine comparable in quality to those of other fruit wines.

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