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Original Article

Coconut (*Cocos nucifera)* Inflorescence Sap Nutritional Characteristics and Health Effects

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Abstract: Coconut is widely known as the tree of life. Every part of the tree is useful and therefore, coconut palm is an important economic crop of the local people. Neera is the exudate obtained from the unopened inflorescence of coconut palm (*Cocos nucifera*). It is healthy and therapeutic drink since it is rich in Vitamin C, has more food calories than milk, fights diabetes, cancer, electrolyte deficiency and even hair fall. Neera is rich in minerals and vitamins and it contains glucamic acid necessary for protein synthesis. It aids in digestion health. Neera contains vitamins (A and C), which have anti - oxidant properties thereby preventing damage or death of cells. *Neera* contains acids nicotinic acid and riboflavin and also can be consumed by people suffering from diabetes since it has a low glycemic index and a low glycemic load. In the study discuss about chemical composition including total sugar, reducing sugar, ethanol and vitamins.

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INTRODUCTION

Coconut palm is an important economic crop of the local places. Coconut inflorescence sap (Neera) is sweet, white and translucent and was reported to be highly nutritive and a good digestive agent. The chemical composition including total sugar, reducing sugar, ethanol and vitamin contents. Coconut inflorescence sap, obtained by tapping the unopened spadix of coconut palm, is sweet, oysterwhite and translucent (Gupta et al., 1980) and was reported to be highly nutritive and also function as a good digestive agent (Devdas et al., 1969). Neera is highly susceptible to spontaneous fermentation, initially alcoholic followed by acidic fermentation due to the presence of native microflora consisting of yeast and bacteria. *Neera* is a highly nutritive and a good digestive product. *Neera* is widely consumed in India, Sri Lanka, Africa, Malaysia, Indonesia, Thailand and Myanmar.

Coconut sugar as one of sweetener which has a lower glycemic index (GI) compared to cane sugar becoming popular nowadays in developed countries as reported by Solanki (2016). Trinindad *et al.* (2010) observed that coconut sap sugar has a GI in the range of 35±4 and 42±4. Furthermore, Solanki (2016) also noted that the demand for palm sugar in European countries within the last five years is very high. Fresh sap from palm trees including coconut (*Cocos nucifera*) tree is the raw material in producing palm or coconut sugars. *Neera* consumption prevents jaundice and also facilitates clear urination. It keeps the human system cool and improves digestion.

MATERIALS AND METHODS

Collection of Neera

Fresh saps were collected from the coconut plantation. Tapping is the process of artificially extracting sap from the unopened spadix. When the flow of sap commences, to collect the sap, a thin slice is cut-off in the spadix both in the morning and evening. The fresh samples were taken at random after afternoon tapping where one container without preservative and the other one were added limestone powder (approximately 10g/L fresh sap) as a preservative.

The collection time started from spatches the inflorescence until bringing down the collected fresh sap was about 12 hours before further processing to produce coconut sugar. As soon as the collected fresh sap was brought down approximately 100 ml were filled in a sterilized bottle transported in a coolbox to the laboratory and before analysis, the samples were stored in refrigerator at about 4ºC. While coconut sap syrup stored in PVC pouches in refrigerator at about 4ºC before laboratory analysis.

Biochemical and mineral composition

Biochemical constituents, mineral and vitamin composition were analysed based on the standard methods. Coconut sap is analysed Biochemical parameters such as sugars, minerals, proteins, phenolics, ascorbic acid, N, P, K, Mg, Zn, Fe and Cu.

Determination of total sugar and reducing sugar

Total sugar was transformed into invert sugar. To obtain invert sugar, 50 ml of clarified sap was heated and was boiled for 2 min, and then 15 ml of 5% hydrochloric acid was added. The resulting solution was then neutralized with sodium bicarbonate. Reducing
sugar was calculated as invert sugar too (Jackson *et al.*, 2004).

Determination of ethanol content

Ethanol in the sap was estimated using an ebulliometer. 50 ml distilled water was added to 50 ml sap. The fluid was distilled until the distillate was up to 50 ml. Then, ebulliometer was used to determine the ethanol content (Samarajeewa and Tissera, 1975).

RESULTS

Biochemical and mineral composition

Fresh sap is rich in sugars, minerals and proteins. It is also a rich source of phenolics and ascorbic acid and essential elements, viz. N, P, K, Mg and micronutrients Zn, Fe and Cu. Tables 1 and Figure 1 give the biochemical constituents, mineral and vitamin composition of coconut sap.

Table 1. Biochemical and mineral composition of coconut sap (Neera)

S.No	Biochemical parameters	Neera sample / 100 ml)
1	pH	7.16 ± 0.28
2	Total sugar (g)	14.16 ± 0.46
3	Reducing sugar (g)	0.56 ± 0.12
4	Protein (g)	0.15 ± 0.10
5	Phenolics (mg)	5.16 ± 0.83
6	Sodium (mg)	90.64 ± 1.32
7	Potassium (mg)	167.34 ± 2.74
8	Copper (mg)	0.031 ± 0.10
9	Manganese (mg)	0.016 ± 0.04
10	Phosphorus (mg)	3.8± 0. 63
11	Iron (mg)	0.056 ± 0.43
12	Zinc (mg)	0.020 ± 0.04

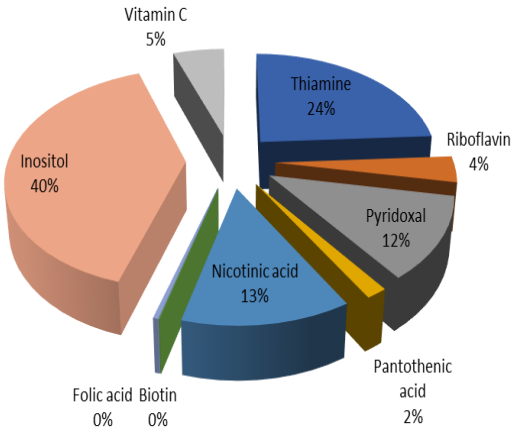

Figure 1. Vitamin content (mg/100 ml) in coconut sap (Neera)

Total sugar content

Total sugar contents are shown in Table 2. Minimum fermentative suger level noted on the seventh day and the maximum level noted on the first day. Inversion of sugars occurred during natural fermentation, total sugar dropped steadily. This is due to sucrose being converted into fructose and glucose during initial fermentation.

Reducing sugar content

Reducing sugar content are shown in Table 2. Minimum fermentative suger level noted on the first day and the maximum level noted on the fourth day. Reducing sugar content decreased significantly from day 5 to 7 of fermentation.This is due to sucrose being converted into fructose and glucose during initial fermentation, and the reducing sugar was consumed by microorganisms at the later stage.

Ethanol content of Neera

Minimum fermentative ethanol level noted on the first day and the maximum level noted on the seventh day. Ethanol content increased significantly from day 1 to 5 of fermentation its maximum seventh day. Ethanol content are shown in Table 2.

Table 2. Total sugar, reducing sugar and ethanol contents (mean ± SD) of coconut sap (Neera)

S.No	Day	Total sugar (g/1000g)	Reducing sugar (g/1000g)	Ethanol content (g/1000g)
1	1	142.12 ± 1.48	1.15 ± 0.10	1.16 ± 0.28
2	2	127.24 ± 2.34	6.56 ± 0.23	3.15 ± 0.16
3	3	117.34 ± 1.23	26.16 ± 0.36	9.64 ± 1.26
4	4	110.12 ± 3.45	34.16 ± 0.63	40.26 ± 1.48
5	5	83.56 ± 1.42	24.61 ± 0.46	85.53 ± 1.23
6	6	76.32 ± 2.41	8.52 ± 0.31	94.64 ± 1.62
7	7	63.34 ± 1.42	7.61 ± 0.27	97.42 ± 2.43

DISCUSSION

Coconut inflorescence sap is rapidly fermented by a heterogeneous population of microorganisms that originate from the environment of the coconut inflorescence. More than 50% of the microorganisms isolated from fermenting coconut inflorescence sap can produce ≥ 9% (v/v) ethanol in batch cultivation using coconut inflorescence sap containing 15–18% (w/v) sucrose (Wijesinghe and Samarajeewa, 1988).

Ta'lin (2013) also noted that traditional way of tapping the inflorescence is very risky as it needs to climb the tree for slicing and bringing down the previously collected coconut sap. The high risk of falling off the tree during tapping and collecting the coconut sap and climbing the coconut tree with more than 10m height is a physically hard job. Therefore, an improved technology for safely tapping coconut sap is urgently needed. Purnomo and Mufida (2004) reported that the afternoon tapping the inflorescence and collecting the fresh coconut sap next morning (about 12 hours) where 1 g sodium metabisulphite combined with 10 ml limestone solution for about 2L fresh sap contained 18.72% sucrose. This high sucrose content due to the preservative added which retarded the fermentation process as it affected the growth of microorganisms. The nighttime temperature is usually lower than daytime which also slightly retarded the fermentation process as well.

The maximum alcohol concentration of the coconut fermented sap. This accorded with Nzabuheraheza and Nyiramugwera (2014) who fermented must containing 18º Brix sugar that yielded a wine with 10% (v/v). The fermented neera had the highest overall acceptance and best flavor according to the trained sensory panel. Hebbar *et al*. (2015) observed that fresh coconut sap after harvesting (8-12 hours from tapping to collecting) contained 15% sugar and decreased to about 6% while at the same time the reducing sugar level increased up to 5%. While Misra (2016) reported that fresh coconut sap (neera) contained total sugars 14.4 g/ml and total reducing sugars 9.85 g/100 ml. Hence detailed studies on the stature of the coconut sap physiological and biochemical studies during tapping and collection. However, there are few reports comparing the sap production parameters from different cultivars and varieties. Therefore research on the quantity and quality of sap from different cultivars and varieties needs to be carried out. In addition, sap yield is influenced by the health and weath parameters.

REFERENCES

Devdas, R.P., Sundari, K., Susheela, A. (1969). Effects of supplementation of two school lunch programmes with neera on the nutritional status of children. J. Nutr. Diet. 6: 29-36.

Gupta, R.C, Jain, V.K., Shanker, G. (1980). Palm sap as a potential starting material for vinegar production. Res. Ind. 25: 5-7.

Hebbar, K.B., Arivalagan, M., Manikantan, M.R., Mathew, A.C., Thamban, C., Thomas, G.V. and Chowdappa, P. (2015). Coconut inflorescence sap and its value addition as sugar – collection techniques, yield, properties and market perspective. *Current Science*, 109(8), 1–7.

Jackson, J.C., Gordon, A., Wizzard, G., McCook, K., Rolle, R. **(**2004). Changes in chemical composition of coconut (*Cocos nucifera*) water during maturation of the fruit. J. Sci. Food Agr. 84: 1049-1052.

Nzabuheraheza, F.D., and Nyiramugwera, A.N. (2014). Golden wine produced from mixed juices of passion fruit (Passiflora edulis), mango (Mangifera indica) and pineapple (Ananas comosus). African Journal of Food Agriculture, Nutrition and Development. 14: 9104-9116.

Purnomo, H. and Mufida, L.H. (2004). Sugar components of fresh sap and sap syrup of coconut. *ASEAN Food Journal*, 13(3), 159-163.

Samarajeewa, U., Tissera, M.P. (1975). Use of ebulliometer for alcohol determination in coconut toddy. Ceylon Cocon. Q. 26: 86-88.

Ta'lin, T. (2013). Modification and Improvement of Inflorescence Cutter for Nira Tapping (Modifikasi dan perbaikan kinerja alat pengiris mayang kelapa untuk menyadap nira). *Agritech*, 33(4), 477–482.

Wijesinghe, D.G.N.G., and Samarajeewa, U. 1988. Screening yeasts from coconut inflorescence sap for continuous alcoholic fermentation. Food Microbiology. 5:119- 123.