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NUTRITIONAL PROFILE AND FUNCTIONAL PROPERTIES OF COCONUT WATER CONSUMED IN WEST AFRICA

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Introduction



monocotyledon palm from the Palmaceae family, is a perennial plant that produces fruit 12–13 times a year for up to 60–70 years, providing between 30 and 75 fruits per year.

Coconut (*Cocos nucifera* L.)

The plant is available in two main varieties:

Tall tree such as the Sri Lankan or West African tall, can reach a height of 25–30 m,

Dwarf tree, such as the Malayan dwarf, seldom exceeds 4–8m.

and also hybrid varieties, each of which has unique characteristics that make it desirable in various situations (Gordon et al., 2017).



Introduction

Thus, coconut is one of the most useful trees in world because many products such as coconut oil, coconut milk, coconut meat and coconut water or juice are extracted from it (Peart and al., 2016).

Coconut water is a sweet refreshing drink made from the endosperm of green coconuts (Lima et al., 2015).



This beverage is popular and consumed for refreshing and medicinal purposes. For example, in India, Allevne et al. (2005) reported that significant reductions in mean systolic blood pressure were observed in 71%, 40%, and 43% of the hypertensive subjects receiving coconut water, mauby, and the mixture.

However, the biochemical, nutritional and microbiological properties of coconut water could be influenced by the coconut variety. To date, and to our knowledge, no study has been done to compare coconut water from tall dwarf and mixed (street) trees.



Introduction

Main objective

To provide social data and analyze the physicochemical, biochemical and functional properties of coconut water samples from different varieties of coconut trees sold on the streets of Abidjan.

OS
1

To determine the knowledge level of coconut water and the reasons for consumption;

OS
2

To analyze physicochemical, biochemical and functional properties of coconut water samples from different varieties of coconut trees.



Materials and methods

➤ Biological material

90 samples of coconut water

30



Tall coconut

30



Dwart coconut

30 coconuts mixed
(from street)

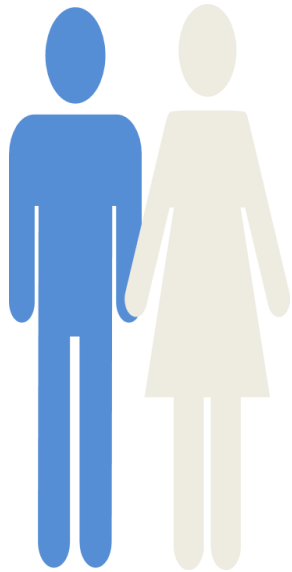


Coconut water



Materials and methods

➤ Survey



- 300 participants were interviewed in District of Abidjan
- The final survey was organized around two (2) primary points: knowledge level of coconut water and the reasons for consumption.



Materials and methods

➤ Physicochemical and biochemical analyses

The physicochemical characteristics

pH
Titrable acidity
Fat
Protein
Fiber
Ash and mineral
Dry matter and humidity rate

were determined
in accordance
with AOAC. Horwitz et
al., 2010

The carbohydrate contents and energy values were calculated from other physicochemical parameters and biochemical compounds contents. For all parameters, three independent measurements were made on each sample.



Materials and methods

➤ Phytochemical compounds contents

- **Total phenols**



The Folin-Ciocalteu colorimetric technique was used to determine total phenol content (Singleton et al., 1999).

- **Total flavonoid contents**



Total flavonoid contents were determined using the $AlCl_3$ colorimetric method.

- **Condensed tannins contents**



The determination of condensed tannins in the coconut water samples was carried out according to the method described by Heim et al. (2002).



Materials and methods

➤ Antioxidant activity

The 2,2-diphenyl-1-picryl-hydrazyl (DPPH) assay method, which is one of the most widely used methods for determining the antioxidant capacity of natural products, was chosen because of its simplicity and accuracy (Alves et al., 2010).

➤ Microbiological analysis

- **Mesophilic Aerobic Germs (MAG)**

Were counted on Plate Count Agar (PCA) (Oxoid LTD, Basingstore, Hampshire, England) according to AFNOR Standard NF V08-051,1999.

- **Fecal coliforms**

count was performed using VRBL agar) according to AFNOR Standard, NF ISO 4832 July 1991.

- **Yeasts colonies**

were enumerated on medium Sabouraud with chloramphenicol.



Results and discussions

Table 1: Eventual felt benefit effects of coconut water consumption

Parameters	Number of respondents	Percentages (%)
Coconut juice consumption have benefits effects ? (n = 300)		
Yes	300	100
Benefits effects (n=300)		
Refreshing	85	28.34
Digest	88	29.33
Strengthening	100	33.33
Aphrodisiac	27	9.0

A small group of consumers (9%) claimed an aphrodisiac effect was felt when coconut water is consumed before sexual relation

The results revealed that effects must water this energy (33.33%) was the respondents (100%) and followed by digestion was aften (29.33%) attributed by consumers.

On over hand, 28.34% consumed coconut water as refreshing beverage.



Results and discussions

These strengthening and digestive properties were reported respectively by Yong et al. (2009) and Rethinam et al. (2001)

Also, the use of coconut water as refreshing drink has been reported by Chaubey et al. (2017). These authors claimed that coconut water may be used as oral rehydration aid to replace fluid loss.



Results and discussions

Table 2: Macronutrient and micronutrients contents of coconut water samples

Parameters	CWD	CWT	CWS
pH	4.98±0.18 ^b	5.590±0.14 ^a	5.06±0.07 ^b
Titratable Acidity (TA) (%)	0.20±0.01 ^a	0.14±0.00 ^b	0.144±0.00 ^b
Total Soluble Solids (°Brix)	4.43±0.05 ^b	5.06±0.11 ^a	4.4 ± 0.17 ^b
Dry matter (%)	5.07±0.50 ^a	5.04±0.02 ^a	5.09±0.43 ^a
Moisture (%)	94.93±0.18 ^a	94.96±0.2 ^a	94.91±0.8 ^a
Protein (%)	0.291±0.00 ^a	0.269± 0.00 ^a	0.116±0.00 ^b
Fat (%)	0.335±0.02 ^b	0.172±0.20 ^a	0.190±0.04 ^a
Carbohydrate (%)	4.01±0.25 ^b	4.12±0.16 ^b	4.38±0.02 ^a
Fiber (%)	0.018±0.00 ^b	0.0210±0.004 ^b	0.035±0.002 ^a
Ash (%)	0.42±0.00 ^b	0.47±0.01 ^a	0.39±0.00 ^b
Energy value (Kcal/100 mL)	20.21±0.10 ^a	19.10±0.03 ^a	19.69±0.20 ^a
Calcium (Ca) (mg/L)	0 ± 0 ^a	1.14±00 ^b	0.88±00 ^c
Phosphorus (P) (mg/L)	0.05±00 ^a	0.02±00 ^b	0.05±00 ^a
Ca:P	0 ± 0 ^a	57±0.6 ^b	17.6 ± 0.8 ^c

The samples of coconut water from dwarf (CWD) and street (CWS) were characterized by low pH values (4.98 and 5.06) globally these parameters of coconut tree tall were depended (CWT) samples (5.59) which correlated tree to variety and maturity stage.

Values are expressed as means ± standard deviation for three independent measurements. Means values with same letter in a line are not significantly different (P > 0.05).



Results and discussions

Table 3: Phytochemical compounds content and antioxidant activity of coconut water samples.

	TOTAL PHENOLS (MG/ML GAE)	TOTAL FLAVONOID S (MG/ML QE)	CONDENSED TANNINS (MG/ML CE)	DPPH (%)
CWD	0.177±0.001 ^a	0.381±0.010 ^a	0.217±0.030 ^{ab}	40.150±3.180 ^a
CWT	0.166±0.001 ^b	0.197±0.010 ^b	0.144±0.020 ^b	15.840±1.760 ^b
CWS	0.069±0 ^c	0.130±0.009 ^c	0.260±0.050 ^a	65.140±0 ^c

Values are expressed as means ± standard deviation for three independent measurements. Means values with different letter in a column are significantly different (P < 0.05).

Probably the virtues attributed to coconut water could be due to the phenolic compounds and antioxidant activity. Several authors have reported a synergistic effect between phenolic compounds and antioxidant activity (Rahmanian et al., 2015).



Results and discussions

Table 4: Microbial loads (UFC/mL) of coconut water samples

	AMG	TOTAL COLIFORMS	COLIFORMS FECAL	YEASTS
CWD	(1 ± 0.6)10 ³ a	(8.8 ± 1.2)10 ² a	Abs	<10
CWT	(1 ± 0.4)10 ⁴ b	(5.5 ± 2.1)10 ² a	Abs	<10
CWS	(4.7 ± 1.2)10 ⁹ c	(1.4 ± 0.4)10 ⁸ b	<10	<10

AMG: aerobic mesophilic germs; AAB: acid acetic bacteria; LAB: lactic acid bacteria ; Abs : Absence.

Values are expressed as means ± standard deviation for three independent measurements.

Means values with different letter in a column are significantly different (P < 0.05).

None of the coconut water samples in this study satisfies the global microbiological criteria or standards.

These high loads of microbes could be due to contamination caused by poor hygiene in the sale area, frequent unsanitary handling and cross-contamination.



Conclusions and recommendations

Coconut water was mostly consumed due to its strengthening, digestive and refreshing properties in according the interviewed.

Overall, the physicochemical and biochemical characteristics seemed depend of the variety of the coconut tree.

Although coconut water is an excellent drink, it could be dangerous for the consumer as it can contains high loads of microorganisms. It is therefore important to take health precautions when consuming it to avoid food intoxication.

It is recommended that vendors should be made aware about good hygienic practices.



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Thank you for your attention!

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