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BIOCHEMICAL COMPOSITION OF COCONUT WATER: NIGERIA SPECIES

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Abstract

Coconut water is one of the world's most versatile natural product with increasing scientific evidence that support the role of coconut water in health and medicinal application. The aim of this work is to assess the biochemical properties of coconut water using standard and accepted methods; inorganic ions, total proteins, albumin, PH, specific gravity, volume, and weight. Thirty (30) coconut samples (24 ripe and 6 unripe) were used for the study. The result shows that Nigeria coconut nut water contains various electrolytes, devoid of bicarbonates and albumins. Also result shows that both ripe and unripe coconut water contain high mean K+ concentration (Meq/L, $\dot{x}\pm SE$) of 44.75±1.02 and 35.23±3.41 respectively with a PH of 5.4. The application of coconut water in clinical trial for the treatment of pathological conditions is advocated.

INTRODUCTION

The coconut palm, cocos nucifera is a member of the family *Arecacecae* (palm family). It is the only accepted species in the genus of cocos (Asian and Pacific coconut community (APCC). (1994). It is a large palm growing up to 30m (98ft) tall with pinnate leaves 4-6m (13-20ft).coconut water has been extensively studied since its introduction in the 1940s. In its natural form, it is a refreshing and nutritious beverage which is widely consumed due to its beneficial properties to health, some of which are based on cultural/traditional benefits. (Sandhya and Rajamohan (2008), Asian and Pacific coconut community (APCC). (1994); Seow and Gwee (1997); Campbell-flack et al (2000). It is believed that coconut water could be used as important alternative for oral rehydration and even so for intravenous hydration of patients in remote region due to its electrolyte content. (Pumer et al. 2001).

Some of the important significant and useful components in coconut water are cytokinins, which are class of cytochromes (Miller et al. 1955). The first cytokinins N^6-furfuryladenine (kinetin) was isolated from an autoclaved sample of herring sperm DNA in 1955 (Letham 1963). These cytokinins showed anti-ageing, anti-carcinogenic and anti-thrombotic effects. (Rattan and Clark (1994); Sheu et al. 2004). Beside anti-ageing and anti-cancer effects, kinetin has effective anti-platelet properties and may be potential therapeutic agent for treating arterial thrombosis. Kinetin inhibits platelet aggregation in human platelets when stimulated by an agonist (Barciszewski et al. 2007) and could therefore help to prevent blood clots (Heo et al. 2002).

Recent studies shows that trans-zeatin can be a potential drugs to treat neural diseases, some research found that Trans-zeatin actually possess an inhibitory effect on Acetyl cholinesterase and it can be used to treat Alzheimer diseases or related neural dysfunction such as dementia (Institute of medicine (IOM). 2000). Acetyl cholinesterase degrades the neural compounds that mediate neural transmission and thus by blocking its action synaptic transmission can be improved. Yet another study also found that trans-zeatin can prevent amyloid β-protein formation, which has causal role in the development and progress of Alzheimer disease.

Inorganic ions are required for normal cellular function and are critical for enzyme activation, bone formation, hemoglobin function, gene expression, and the metabolism of amino acids, lipids and carbohydrates (Institute of medicine (IOM). 2000). Coconut water contain a variety of inorganic ions (Miller et al. 1955) and these ions contribute to the therapeutic value inherent in coconut water. This basic ion composition of coconut can replenish the electrolyte of the human body excreted through sweat such as sodium, potassium, magnesium, and calcium. It can serve as rehydration drink (Campbell-flack et al; 2000). The concentration of these electrolyte in coconut water generate an osmotic pressure similar to that observed in the body (Kuberski et al. 1979) and it also does not affect homeostasis

TABLE 1: CHEMICAL COMPOSITION OF NIGERIA COCONUT WATER (n=30)

PARAMETERS	UNRIPE	RIPE	P-VALUE
Glucose(Meq/L)	42.06±1.51	4.23±2.12	P<0.01
Total protein(g/100ml)	0.14±0.01	0.27±0.14	P<0.0005
Na+(Meq/L)	25.54±0.84	28.30±5.21	P<0.005
K+(Meq/L)	44.75±1.02	35.23±3.41	P<0.05
Cl- (Meq/L)	21.70±0.68	23.23±0.88	NS
Ca^{2}+(Meq/L)	6.30±0.21	5.17±0.58	P<0.0025
Mg^{2}+(Meq/L)	6.12±0.40	20.72±7.51	P<0.0025
Po-4(Meq/L)	3.88±0.04		
Weight(kg)	0.91±0.01	2.64±0.19	P<0.0005
Volume(M/kg)	394.96±8.23	0.30±0.07	P<0.0025
PH	4.79±0.208	79.33±33.35	P<0.0025
S.G	1.027	5.00±0.00	

(plasma coagulation) . interestingly Anurag and Rajamohan showed that coconut water has cardio protective effect in experimental myocardial infarction induced in rats and this was probably attributed to the rich mineral in coconut water especially potassium (Pumer et al.(2001); Anurag and Rajamohan 2003). Coconut water also contains folate also known vitamin B9. It was identified in the late 1930s as the nutrient required in reducing anemia in pregnancy (Jackson et al. 2004) which also help to prevent mitochondrial toxicity induced by methanol metabolites.

The question now is what is the composition of Nigeria species coconut water? It interesting to know that the biochemical composition of coconut is affected by several factors which include maturity state, soil, and environmental conditions (Goh and Koren; 2008). A study conducted in Brazil demonstrated that physical properties of coconut water were affected by varying nitrogen and potassium application (Jean et al. 2009). Hence our motivation to study the inorganic ions, proteins, PH, Electrolytes and glucose content of Nigeria coconut.

MATERIAL AND METHODS

The study was carried out on coconut water and the laboratory work done in the department of chemical pathology. A total of 0f 30 coconut palms of different species were used comprising of 24 unripe and 6 ripe. The coconut water extracted under aseptic to avoid contamination. In situation where immediate analysis was not possible the sample were preserved at 4^{0}c. The samples were analyzed for the following constituents. Chloride, sodium and potassium, calcium, magnesium, phosphates, Protein, Glucose. The pH, Specific gravity, volume and weight were equally measured with state of art equipment. colorimetric method (570nm) using spectrophometer was used to measure Ca2+, glucose oxidase method using randox reagent to measure glucose. Na+, Cl_, K+, and HC03_, mg2+ and phosphate were assay using ion selective electrode. Total protein assayed using Biuret method and bromocrysol method for albumin.

RESULTS

Table 1 shows mean±S.D of Weight, Volume, Glucose, Total proteins, Albumin, and Inorganic ion concentration in unripe and ripe coconut palms examined. The water weighed 0.91±0.01 0f unripe and is significantly higher (p<0.0025) than ripe (0.30±0.07). There exists a significant difference between unripe coconut and ripe coconut palms studied in terms of inorganic ions glucose and proteins (Table 1). There was no difference in chloride ion between unripe and ripe. There exist a significant difference in glucose between unripe and ripe coconut and thus giving the the unripe coconut a good hypogycaemic fluid thou an hypoglycaemic fluid when compared with the body electrolytes.

Electrolytes are responsible for normal haemostasis of the human body. A comparison between coconut water electrolytes and body electrolytes (table 2) shows an increase in potassium, calcium, magnesium, and phosphate ions in coconut water than body plasma. Therefore from this study coconut water when used intravenously can be beneficial to the body. Interestingly bicarbonates and albumin level in both ripe and unripe was nil in coconut water compared to body plasma. Tanzania coconut water contain elevated inorganic ion compared to the Nigeria species studied. (table 3)

DISCUSSION

The composition of coconut water is acidic and is in

TABLE 2: COMPARISON BETWEEN NIGERIA COCONUT WATER ELECTROLTYES AND PLASMA ELECTROLYTE.

Parameters	Unripe coconut H^20	Ripe coconut H^20	Plasma electrolyte
Na+(Meq/l)	25.5	28.3	120-140
K+(Meq/l)	44.4	35.2	4.5-5.8
Cl-(Meq/l)	21.7	23.3	98-106
HCo3-(Meq/l)	0.0	0.0	15-35
PO4-(Meq/l)	3.4	2.6	2-4
Mg^2+(Meq/l)	6.1	20.7	1.8-2
Ca^2+(Meq/l)	5.2	6.3	5.0
Glucose(mmol/l)	0.76	0.08	10
Total protein(g/100ml)	0.14	0.27	6-8
Albumin(g/100ml)	0.0	0.0	2.5
PH	4.8	5.0	7.4
S.G	1.027		1.027

TABLE 3: COMPARATIVE STUDY BETWEEN NIGERIA COCONUT WATER AND TANZANIA SPECIE

PARAMETERS	NIGERIA	TANZANIA
Na+(Meq/l)	26.3	0.7
K+(Meq/l)	40.0	81.8
Cl-(Meq/l)	22.5	38.6
Ca^2+ (Meq/l)	5.8	7.2
Mg^2+ (Meq/l)	13.4	26.8
HCo3-(Meq/l)	0.0	3.4
PO4- (Meq/l)	3.0	6.4
Glucose (mmol/l)	0.4	0.3
Total protein (g/100ml)	0.2	0.005
Albumin (g/100ml)	0.0	0.0
PH	5.4	6.0
S.G	1.027	1.019

$P<0.05$

agreement with Jean et al; 2009. The potassium and magnesium ions are higher than that of the extracellular fluids (ECF) making it a good source of electrolytes for the body. Also the calcium content is slightly higher than the ECF and is in agreement with work of Msengi et al 1985 land this makes coconut water a major source of calcium to the body, in addition intake of coconut water by infants can help prevent nutritional rickets. It is important to note that in exclusive breast feeding after the forth calcium is gradually reduced from the colostrum and we are advising regular intake of coconut by nursing mother to meet up the calcium nutritional requirement of the baby. Jean et al 1990(21) has however shown that neuromuscular effect of potassium is neutralized by calcium and magnesium in the body which might be responsible for the reduction in ECF. Coconut water when given intravenously is electrolitically harmless to a patient in circumstances where it may be dangerous to give the same amount of potassium alone. The phosphates ion is nearly same as that of body fluid. However sodium and chloride ion were lower when compared with ECF several researchers obtained similar lower values (Jean et al. 2009). The glucose content is slightly lower than that of fasting blood sugar level for humans. With this coconut water could be the best drinks for diabetic's patient. Also glucose could be a source of energy in diarrhea patients and this can promote intestinal absorption of water and electrolyte. Coconut is deficient in bicarbonate in this study and agrees with that of kuberski et al 1976 and disagree with that of a Tanzanian research Msengi et al 1985. Comparing Nigeria coconut water to others, the difference in inorganic content is minimal.

CONCLUSION.

The chemical composition of coconut is dependent on environmental factors, soil and the state of maturity. Comparing Nigeria coconut and Tanzania coconut both countries in West Africa shows remarkably differences in chemical composition supporting the above statement. Also from the on-going Nigeria coconut water is prototype of a good electrolyte to the body. Since all important ECF ions of the human body are present in Nigeria coconut water, research grant should be devoted into clinical of coconut water in the management of certain pathological condition in Nigeria health sector and also cultivation of coconut in commercial quantity will not only increase the country GDP rather a major source of drink free from sugars during occasion and ceremonies.

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