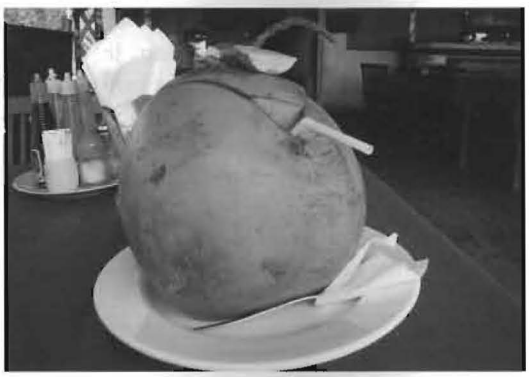
Research findings on tender coconut water

Biochemical Studies

Biochemical studies of tender coconut water of different maturity belonging to different cultivars and varieties have been conducted in different research institutes in the country. A brief write up on various studies are summarized below.



In a study conducted by the CPCRI, water of seven month old coconut of 12 cultivars were evaluated biochemically. It was found that COD had the maximum amount of total sugars (7.0g/100ml) and reducing sugars (4.7g/100ml followed by MOD (6.7g/100ml total sugars and 4.1g/ 100ml reducing sugars) and MYD (6.2 g/100ml total sugars and 3.8 g/ 100ml reducing sugars). Free amino acids were the highest in Andaman Ordinary (2.1 mg/ 100 ml) and volume of water was maximum in Philippines Ordinary (451 ml). Subsequently some more cultivars were screened for tender nut water.

In another study conducted by CPCRI involving Tall, DxT and TxD varieties, it was found that maximum quantity of nut water was observed in the sixth month old nuts of D x T (460 ml). The sugar content of the nut water and kernel were maximum in eight month old nuts of T X D and D X T varieties respectively (5.8% and 9.2%). A very thin deposition of kernel was observed in the sixth month in all the nuts. Nitrogen, P, K Ca and Mg increased up to the eighth month and then decreased (Kamaladevi and Velayuthan, 1978).

A study conducted by Regional Research Laboratory, Trivandrum involving WCT nuts of varied maturity revealed that the volume of water, reducing sugars and potassium were the highest in 6 month old nuts. Total sugars was highest in the seven month old nuts. The pH increased from 4.80 in the 6th month reaching 5.09 in the 8th month and then dropped to 4.50 in the 9th month. Interesting findings have been reported regarding the fatty acid composition of coconut water.While saturated fats up to 14:0 increased, higher unsaturated fats decreased during maturation. Linolic acid (omega 3) was the highest in the 6th month stage. Linolenic acid (omega 6) was also comparatively higher during the early stages. Presence of 15.0, 17.0, 14:1 and 16:1 fatty acids in the early stages and their total absence in the later stages were noteworthy.

In a study conducted by GKVK, UAS, Bangalore in Arsikere tall variety it was found that between the seventh and eighth month of maturation the nuts had the maximum amount of water in them (363-316 ml). In addition, the water then contained abundant amounts of sugars and minerals recording a high TSS (Chikkasubbana et. al, 1990).

In a study conducted at BCKV, West Bengal involving ten coconut cultivars, it was found that among the cultivars Philippines Ordinary had the maximum volume of water throughout the period of development (470 ml in 5th month, 500 ml in 6th month and 450 ml in 7th month). In the 7th month maximum reducing, sugars were found in WCT (4.9%) followed by MYD X WCT (4.8%) while in the 8th month Philippines Ordinary had the highest amount of reducing sugars (5%). Total sugars were found in the 8th month being 5.9% in AO, 5.8% both in LO and WCT, 4.9% in local tall and 5% in Philippines Ordinary. In most of the cultivars maximum free amino acid was found in the 7th month old nut.

Based on the analytical data it is confirmed that the water from nuts at the Kurumba stage (6th month) is best suited for drinking as a beverage since the glucose content is the highest in that stage besides containing the maximum volume of water.

Studies in other countries

A study on the sweetness of tender coconut water conducted in Malaysia revealed the following ranking: Malayan Green Dwarf> (Pandan)>, Malayan Red Dwarf> Malayan Yellow Dwarf> Malayan Tall> MAWA hybrid.

In a study conducted by Nigerian Institute for Oil Palm Research using 12 months old nuts of African Tall and Dwarf (somewhat similar to the Indian Nyiur Grading variety) it was found that dwarf coconut water has the highest total sugar concentration than tall nut water but sugar content per nut was higher in the latter because of its greater mean volume. The soluble protein content of the tall variety coconut water was higher than that of dwarf variety although neither could be ever remotely considered as a source of proteins.

The higher total solid content of dwarf coconut water is therefore reasonably attributable to its sugar concentration rather than any other factor.

Syrups derived from 12 month old nut water of the tall and dwarf varieties were fractionated by solvent crystallization procedure. High performance liquid chromatographic (APCC) analysis of sugar composition of the coconut water syrup fractions revealed that major difference between the tall and dwarf varieties was in the abundance of specific sugars. Fructose was the major sugar in the nut-water syrup of tall coconut while sucrose was the most abundant in the case of the dwarf. Dwarf coconut water syrup fractions showed traces of an unidentified 'trisaccharide' co-eluted with raffinose while the tall coconut water syrup fractions contained traces of a "tetrasaccharide" co-eluted with stachiose. Tall coconut water syrup and its fractions, contained 20-30% fructose which though not as sweet as the 45-90% high fructose corn syrup (HFCS) enzymatically manufactured from corn starch, should be suitable for use in richly flavored products of moderate sweetness, such as cocoa based sweets and similar products.

Pharmaceutical Studies

Eventhough ayurvedic literatures have referred to the medicinal values of tender coconut water, only one pharmaceutical study has been reported from India. The study was conducted by the Biochemistry Department of Trivandrum Medical College, Kerala in 1968 to asses the efficacy of tender coconut water when administered intravenously in gastroenteritis patients in comparison to glucose saline. Tender coconut water was injected to 16 patients in the Medical College Hospital while 20 patients were injected with glucose saline. The study found that the amount of potassium was higher in patients injected with tender coconut water on examination after 24 hours. Results of various studies conducted in other countries are given below.

Dr. Eufenio V Mecolalag, Jr., a Urologist in Philippines has proved that the utilization of tender coconut water orally or intravenously, is effective in treating urethral disorders and **in** reducing or dissolving all kinds of kidney stones. The treatment is termed "Bukolysis" which is done either directly through the unhusked coconut or through sterilized, dextrose type bottle (in which water of 7-9 months old nut is transferred aseptically). Dr. Mecolalag treated 204 patients with kidney stones using coconut water and only 16 patients underwent surgical removal of the stone.

Studies made by researchers from the National Institute of Science and Technology, Philippines showed that coconut water (modified) is a cheap indigenous source of fluid for oral dehydration. Success in treating dehydration in 43 out of 58 patients at the UP-PGH Medical Centre (University of the Philippines - Philippines General Hospital) with modified coconut water was confirmed by clinical improvements on their dehydration and weight increases. Eight -nine month old coconuts were used because they have high volume, electrolyte and glucose content. Pure coconut water is very low in sodium but very high in potassium. The modification process is done by first filtering the coconut water in clean cloth to remove the dirt. The clear fluid was then analysed, then diluted with equal amounts of distilled water (1-1 ratio). This reduces potassium concentration by one-half.

Studies using mice, rats, rabbits, dogs and monkeys indicated that coconut water is non toxic and intrevenous infusion did not cause significant changes in electrolyte composition, osmolarity and pH of the blood in the experimental animals. Coconut water (500-750 ml) infused intravenously in 9 human volunteers from the Philippine General Hospital did not show any change in the electrolyte composition of the blood in selected patients. No significant change in the blood pressure, pulse rate, respiration or any untowed reaction of any type was observed.

A technology for the enzymatic production of dextran and high fructose syrup from sugar supplemented coconut water has been developed in Philippines. The dextransucrose, which had been produced by a local isolate of *Leucorostoc mesenteroides*, polymerized the glucose of sucrose into dextran and freed fructose at high conversion efficiency and degree of purity. The use of coconut water as a vehicle resulted in the production of low molecular weight dextran, which can be used directly as blood plasma extender.

Philippine scientists have discovered that coconut water is a simple medium for the production of a powerful antibiotic called ' oxytetracycline' commonly known as tetramycine. In a study conducted in Thailand among the patients with diarrhoea, it was found that coconut water would be absorbed by the system more easily than other soft drinks such as cola, sprite etc.

It is reported that studies on coconut water for intravenous therapy have been made in Bangladesh, Indonesia, Korea, Thailand, United States, Cuba and Sri Lanka. In 1933, Bejarano found that coconut water gives good results in infant gastric disorders. Coconut water has been used successfully in cases of severe malnutrition among Gilbert Islanders. Coconut water is also reported to cause diuretic response in case of nephritis and in atrophic cirrhosis with ascites.