QUALITY EVALUATION OF TENDER NUT WATER, COPRA AND OIL IN COCONUT

M.J. Ratnambal

INTRODUCTION:

The coconut palm, *cocos nucifera* L., is one of the most useful palms grown in the tropical regions of the world. Because of its predominantly cross pollinating nature, cultivars or types widely differ from each other in their gross morphological characters and fruit components in particular.

In coconut, there are two distinct types- talls and dwarfs. Talls are mostly grown on plantation scale in all the coconut growing countries of the world. They are taller in stature, growing to a height of 15-18 m. Their life-span range between 60 to 80 years or more. They normally come to bearing in about 5-7 years after planting. The nuts of tall varieties are generally medium to large in size with good quality and quantity of copra and fairly high oil content i.e, 68-70 %. West Coast Tall, East Coast Tall, Lakshadweep Ordinary and Andaman Ordinary are some of the distinct tall varieties grown in India.

Dwarf palms are characterized by short stature. They come to bearing quickly i.e, 3-4 years after planting, have thin trunk and fully developed fronds rarely exceed 4 m. Dwarfs are identified by the colour of the nuts. In India, three important dwarf types found are Chowghat Orange Dwarf, Chowghat Green Dwarf and Gangabondam.

EVALUATION FOR TENDER COCONUTS

Tendernuts are used in large numbers in all the coconut producing countries. In India, annual consumption of tendernuts is about 200 million. Tendernuts are valued both for sweet water which is a refreshing drink and its gelatinous kernel is a delicious food. Moreover, the tendernut water has a number of medicinal properties and it is an essential component in many of the ayurvedic preparations. The use of tender coconut water is recommended in cases of gastro-enterites and as a useful substitute to saline glucose in intravenous infusion. It is also prescribed in serious case of diarrhoea and vomitting against dehydration of body tissues. It increases the blood circulation in the kidneys and causes profuse diuresis.

The tendernut water has a caloric value of 17.4 per 100 g of water. The following is the composition of tendernut water; water (95.4%), protein (0.1%), fat (< 0.1%), mineral matter (0.4%), carbohydrates (4.0%), calcium (0.02%), phosphorous (< 0.01%) and iron (0.5 mg/100 g)

The percentage of arginine, alanine, cystine and serine in the protein are higher than those in the cow's milk. The pH of tender water varies from 4.8 to 5.3 and the water contains both ascorbic acid (vitamin C) and vitamin B group. The following values for the vitamins of B group have been reported (Anon, 1950): nicotinic acid (0.64 g/cc), panthothenic acid (0.52 g/cc), biotin (0.02 g/cc), riboflavin (< 0.01), folic acid (0.003), and traces of thiamin and pyridoxine.

The tendernut water also contains various minerals of which potash is the major

constituent. The mineral composition (in mg per 100 ml of nut water) is as follows: sodium (105), potassium (312), calcium (29), magnesium (30), iron (0.1), copper (0.04), phosphorus (37), sulphur (24) and chlorine (183).

When the nut ripens, the composition of water, especially that of sugar content, undergoes significant changes. The concentration of invert sugar increases and reaches maximum when the nut is about 220 days old. After this period, sucrose appears and the concentration of total sugars falls.

At CPCRI, 46 cultivars, belonging to both exotic and indigenous types were subjected to a preliminary organoleptic screening for quality of tendernut water. Of these, 12 cultivars were subjected for a detailed biochemical analysis like total sugars, reducing sugars, amino acids, sodium and potassium contents. Seven month old nuts were taken for the analysis and the study was carried out during April-May, for 4 years (1988 to 1991).

The mean values for 4 years, for different biochemical parameters of tendernut water is given in Table 1. Significant cultivar differences were seen in total sugars, reducing sugars, free amino acids, sodium and potassium contents. Of these cultivars, Chowghat Orange Dwarf (COD) has maximum total sugars as well as reducing sugars i.e; 7.0 g and 4.7 g/100ml of tendernut water respectively. The sodium and potassium contents in this cultivar is 20 ppm and 2000 ppm respectively. In view of the superior quality of tendernut water, Chowghat Orange Dwarf was recommended for release in 1991 by CPCRI for tendernut purpose.

EVALUATION OF COPRA

Copra is the dried kernel of coconut, which is a highly valued commodity in the world market for oil seeds, oils and fats. With an oil content of about 65 to 70 per cent, copra is the richest source of fat.

The yield of copra depends upon various factors, such as variety, age of palm, soil, climate, maturity of nuts, season of harvest and period of storage.

Among the 100 accessions evaluated for copra, the cultivar San Ramon(from Philippines) has the maximum copra content (350 g/nut) followed by the cultivar Kappadam (from Kerala) with 284 g/nut. Among the 11 released hybrids, Chandra Sankara (CODxWCT) has the highest copra content per nut (215 g) with 4.4 t of copra yield per hectare.

The percentage of copra in the dried whole nuts varied from 15 (in WCT) to 25 per cent in Laccadive Ordinary, the same in husked nuts was highest (48.1 %) in Fiji Tall and lowest (31.0 %) in Fiji Rotuma.

The proximate composition of copra is: moisture (6.8 %), ash (2 %), ether extracts (63.7 %), proteins (7.6 %), fibre (3.8 %) and carbohydrates (16.1 %).

Edible copra is of two types - ball copra and cup copra. Ball copra is made from fully matured (< 12 months) whole unsplit nuts. The cultivar Lakshadweep Micro, a local type grown in Lakshadweep Islands is considered to be the best for ball copra.

The quality of copra:

The quality of milling copra determines the quality of oil and the residual meat. The

rubberiness of the copra is determined by the variety from which the product comes and storage conditions of matured nuts. Copra from most of the dwarf palms is soft and rubbery unlike that of ordinary tall variety. Similarly, the endosperm of the unripe nuts from tall palm is soft, difficult to dry and driage loss is heavy. The rubbery copra has a poor extraction percentage and is susceptible to various damage like insect, mould attacks etc.

In some cases, sulphur deficiency causes palm to produce nuts with rubbery copra. The oil extracted from this type of copra contains high amount of unsaturated fatty acids, causing high iodine value and low saponification value (Southern, 1957).

For good quality of copra, fully matured nuts from selected varieties with proper storage, seasoning of nuts for a few days and adequate drying to bring down the moisture content to 5-6% are the basic requirements.

EVALUATION OF OIL

A wide range of variation is reported in the oil content of copra from different countries. In the individual nuts, the oil content of copra shows considerable variation depending upon the storage of nuts, maturity at which the nuts are harvested and the place of origin of the variety. In the tall palms, the oil content of fully matured and properly dried copra varies from 65 % in Benaulim Tall to 75 % in Laccadive Micro. In most of the dwarf palms, the oil content is comparatively lower than talls i.e, around 65 %.

Physical properties of coconut oil:

The coconut oil is a colourless to pale brownish oil. In temperate climate, it appears as greasy, some what crystalline white to yellowish solid fat.

The commercial product has the characteristic odour of coconut. It has the following characteristics(Jamieson, 1943) : Specific gravity at 15°C (0.926), specific gravity at 25°C to 40°C (1.4477 - 1.4495), specific gravity at 60°C (1.4410 - 1.4420), saponification value (251 - 263), iodine number (8.0 - 9.6), polenske value (15 - 18), melting point (23 - 26°C), titre of fatty acids (20.4 - 23.5) and melting point of completely hydrogenated fat (44.5°C)

Chemical properties of oil:

Coconut oil is more or less constant in its composition irrespective of cultivars. It is high in saturated fatty acids in particular, lauric and myristic acids with notable proportions of still lower fatty acids. In comparison with the leading edible vegetable oils, coconut oil is low in saturated and polyunsaturated acids, particularly, linoleic acid (Thampan, 1981) (Table 2).

In addition, coconut oil has the highest saponification value, ie., 253 and the lowest iodine value, ie., 8.0 to 9.6. Coconut oil contains the largest percentage of glycerol compared with other oils (Table 3).

Coconut oil has the maximum digestability coefficient and is more easily digested than any other fat including butter. The popular belief that consumption of highly saturated oils like coconut oil raises the level of blood lipids, has in fact no scientific basis. On the other hand, there are a number of practitioners of ayurveda and nature care, who attribute several beneficial properties of coconut oil and kernel in relation to heart diseases.

A preliminary study conducted at CPCRI has revealed variations among the cultivars in fatty acid composition.

Not much work has been done with regard to the flavour components in coconut. However, a study conducted in 1991 could reveal that pyrazines and its derivatives, α lactones, ketones and fatty acids are responsible for aroma in coconut oil (Jayalakshmi et al 1991).

REFERENCES

Anonymous (1950). A dictionary of Indian raw materials and industrial products. *CSIR II*: 277-278.

Jamieson GS (1943). Vegetable fats and oils, New York.

Jayalakshmi A, Narayanan CS and Mathew AG (1991). *J. Aor. Oil Chem. Soc.* 18(11): 873.

Southern PJ (1957). Sulphur deficiency in coconut: a wide spread field condition in Papua & New Guinea, II. The effect of sulphur deficiency in copra quality. *Pap. New Gui. Agri.* J., 18 (1): 38-42.

Thampan PK (1981). Handbook of coconut palm. Oxford & IBH Pub. Co. Pvt. Ltd. p. 311.

Table 1 : Biochemical constituents of tendernut water and nut yield in 12 coconut cultivars (Mean values for 1988 to 1991)

Cultivar	Volume of water (ml)	Total sugars (g/100 ml)	Reducing sugars (g/100 ml)	Free amino acids (mg/100 ml)	K (ppm)	Na (ppm)	Mean annual yield (nuts/ palm)
New Guinea	358	5.8	3.0	1.4	2258	21	73
Phil. Ordy.	451	5.8	3.7	1.3	2273	24	113
Fiji Longtongwan	390	4.9	3.6	1.4	2641	29	105
Spikeless	275	5.3	3.2	1.7	2617	38	149
WCT	240	5.6	3.2	1.3	2797	37	92
Anadaman Ordy.	274	5.3	3.3	2.1	2272	27	94
Jamaica Sanblas	263	6.0	3.4	1.7	2703	28	65
MYD	238	6.2	3.8	1.7	1998	36	53
MOD	303	6.7	4.1	1.8	2142	35	75
GB	267	5.6	3.5	1.7	2125	28	68
COD	351	7.0	4.7	1.8	2003	20	67
Guam III	278	6.0	3.7	2.0	2434	34	96
Gen. Mean	307	5.9	3.6	1.7	2335	30	-
SE/Plot	101.7	1.2	0.79	0.51	258.0	9.0	-
CD	73.0	0.89	0.56	0.36	185.1	6.4	-

Table 2 : Percentage fatty acid composition of coconut oil compared with other oils

	Fatty acids	Coconut	Palm kernel	Babassu	Soybean
Saturated	Caprylic	8.24	1.40	3.50	-
	Capric	7.19	2.90	4.50	-
	Lauric	47.31	50.90	44.70	-
	Myristic	17.00	18.40	17.50	-
	Palmitic	8.85	8.70	9.70	10.50
	Stearic	2.27	1.90	3.10	3.20
	Arachidic	-	-	-	0.20
Unsaturated	Palmitoleic	1.00	-	-	-
	Oleic	6.27	14.60	15.20	22.30
	Linoleic	1.87	1.20	1.80	54.50
	Linolenic	-	-	-	8.30
	Arachidonic	-	-	-	0.90
		100.00	100.00	100.00	100.00
Percent unsaturated		9.14	15.80	17.00	86.00

Table 3 : Percentage of glycerol in oils of different saponification values

Type of oil	Glycerol content (%)	Saponification value
Coconut oil	13.84	253
Palm kernel oil	13.57	248
Olive oil	10.45	191
Groundnut oil	10.45	191
Gingelly oil	10.45	191
Cotton seed oil	10.83	198
Palm oil	10.83	198
Sunflower oil	10.45	191
Rape seed oil	9.57	175