

PHYSICAL AND CHEMICAL CHARACTERIZATION OF YELLOW MANGOSTEEN FRUITS¹

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ABSTRACT - The work had as objective the physico-chemical characterization of yellow mangosteen fruits. Six samples of 25 fruits were harvested in yellow mangosteen plants of the Active Germoplasm Bank of São Paulo State University and characterized by evaluation of length and width, weight, percentage and number of seeds per fruit, peel and pulp percentage, soluble solid (SS), titratable acidity (TA), vitamin C and SS/TA rate. Yellow mangosteen fruit is an intermediate vitamin C source with an average content 120.33 mg/100g of fresh fruit and has good technological quality.

Index terms: *Garcinia xanthochymus* Hook; fruit technology; exotic plant

CARACTERIZAÇÃO FÍSICAS E QUÍMICAS DE FRUTOS DE MANGOSTÃO AMARELO

RESUMO - O trabalho teve como objetivo a caracterização físico-química de frutos de mangostão amarelo (*Garcinia xanthochymus* Hook). Seis amostras de 25 frutos cada foram colhidas em plantas de mangostão amarelo do Banco Ativo de Germoplasma da Universidade Estadual Paulista e caracterizadas pela avaliação de diâmetro e altura, peso, percentagem e número de sementes por fruto, percentagem de casca, percentagem de polpa, sólidos solúveis (SS), acidez titulável (AT), vitamina C e relação SS/AT. O mangostão amarelo tem boas qualidades tecnológicas e é uma fonte intermediária de vitamina C com conteúdo médio de 120,33 mg/100g de fruta fresca.

Termos para indexação: *Garcinia xanthochymus* Hook; tecnologia de frutos; planta exótica.

The increase interest in exotic fruitful cultivation occurred due to fruit demand diversification in Brazil, where there are favourable climatic and soil conditions for cultivation of many fruit species from warm or dry climate, including exotic species as doyalis and yellow mangosteen. Thus, research works aiming to characterise these species in relation to quality and maturation of fruits become very important.

Yellow mangosteen (*Garcinia xanthochymus* Hook), also known as false mangosteen, belongs to Clusiaceae family, which includes 35 genus and more than 800 species. Among Clusiaceae species it detaches bacuri (*Platnia insignis*), bacupari (*Rheedea macoiphyllo*) and abricó do Pará (*Mammea americana*), however the most known is mangosteen (*Garcinia mangostana* L.) that is considered the most famous and delicious fruit of asiatic tropic (Sacramento, 2001).

Yellow mangosteen tree can reaches 20 m height; has erect trunk, brown-clear bark and pyramidal pantry; leaves in oval-oblong form, acute apex, rounded off base, salient ribbings in the two sides, yellow base, with 30 cm length and 10 cm width; white flowers with short pedicel and bloom period between November and February. The fruits are eatable with fruition between March and August, a spherical berry of green-yellowish colour at full maturity, with succulent pulp, lightly acid that can be consumed fresh, as juice or candy (Reyes, 2004).

According to Godas (2003) cited by Almeida (2004) in 1991 fruit sector put into motion 1.467.101 tons, being 22.000 t from exotic fruits, corresponding to 1.5 % of the sector. In 2001, in the Companhia de Entrepósitos e Armazéns Gerais de São Paulo (CEAGESP) the total movement of fruits was about 1.476.245 tons, and the exotic fruits represented 2.98 % of the sector, practically folding the commercialization and showing the importance of this market, which must be better explored. The work aimed the physical and chemical characterization of yellow mangosteen fruits.

The study was realized with yellow mangosteen fruits (*Garcinia xanthochymus* Hook) proceeding from the Active Germplasm Bank located at Horticulture Department of the Faculdade de Ciências Agrárias e Veterinárias, Jaboticabal, São Paulo State, Brazil. This local has tropical humid weather with a drought winter and hot rainy summer, classified by Köppen as Cwa.

Fruits of yellow mangosteen were harvested at full maturity, distributed in 6 samples of 25 fruits each one and conducted, in paper bags, to the Laboratory of Horticultural Products at Universidade Estadual Paulista (FCAV/UNESP) in São Paulo State, Brazil.

The methods used in physical and chemical analyses included:

1. Physical analyses

Length and width of fruits: These measures were obtained with a digital paquimeter and expressed in cm.

Weight of seeds and fruits: weight was measured using a Sartorius brand precision balance (0.01 g precision), expressed in g.

2. Chemical analyses (According to Instituto Adolfo Lutz, 1976)

Titratable acidity (TA): 20 gram of fruit pulp was taken from yellow mangosteen and brought to a final volume of 100 mL by adding distilled water. A 20 mL sample was taken from the mixture and three to four drops of phthalein was used as indicator. This suspension was titrated with 0.1 NaOH. The results were expressed in terms of percentage.

Vitamin C: 5 gram of fruit pulp was taken from yellow mangosteen and brought to a final volume of 100 mL by adding distilled water plus 1mL of 1% starch solution. A 20mL sample was taken from the mixture and titrated with 1N iod. The results were expressed in mg/100g of fresh fruit.

Soluble solids (SS): SS expressed as °Brix, were measured with an Abbe refractometer.

3. Other values

Number of seeds per fruit: After division of fruit in pulp, peel and seed, the number of seeds in one fruit was registered.

Pulp, seed and peel percentages per fruit: fruits were manually divided in pulp, seed and peel. A direct relation was established between fruit weight and weight of pulp, seed and peel, individually, adopting fruit weight as 100%, and obtaining the correspondent percentage of pulp, seed and peel.

SS/TA ratio: After chemical analyses the relation between soluble solids and and tritatable acidity was calculated.

The standard deviation of each variable was calculated using the equation proposed by Banzatto & Kronka (1995).

Table 1 shows the results of weight, length, width, number

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TABLE 1 - Average values of physical characteristics (weight, length, width, number of seeds/fruit and weight of seeds/fruit) of yellow mangosteen fruits. Jaboticabal-SP, 2005.

	Weight	Length	Width	Number of seeds/fruit	Weight of seeds/fruit
	----- g -----	----- cm -----			----- g -----
1	76.03	5.09	5.72	1.70	6.34
2	86.60	5.20	5.60	1.95	7.08
3	95.04	5.50	5.94	1.70	7.27
4	94.10	5.40	5.65	1.90	6.98
5	83.29	5.30	5.54	1.45	6.93
6	90.12	5.20	5.57	1.50	6.97
Average	87.53	5.28	5.67	1.70	6.93
s.d.	6.52	0.14	0.13	0.18	0.29

s.d. = standard deviation.

TABLE 2 - Average values of fruit components proportion (pulp, peel and seeds) of yellow mangosteen fruits. Jaboticabal-SP, 2005.

	Pulp	Peel	Seed
	----- % -----		
1	76.10	6.21	11.79
2	76.61	6.54	15.95
3	75.96	5.00	13.00
4	75.46	5.64	14.10
5	75.65	6.51	12.07
6	71.13	6.02	11.62
Average	75.15	5.99	13.09
s.d.	1.87	0.54	1.53

s.d. = standard deviation.

of seeds/fruit and weight of seeds/fruit in yellow mangosteen fruits.

The values of fruit weight were between 76.06 and 95.04g, corresponding to an 87.53g average, nevertheless close to 93-120g range obtained by Silva et al. (2003). In comparison to guava, these results are below 114.54g reported by Gonzaga Neto et al. (2003).

Results referring to length and width of yellow mangosteen fruits ranged from 5.09-5.50cm and 5.54-5.94cm, respectively. These values are compatible to 6.6-6.9cm (length); 5.6-6.2cm and 5.84-5.60cm (width) reported by Silva et al. (2003). Comparably to mangosteen, yellow mangosteen fruits are larger than 2-3cm (Kanchanapoom & Kanchanapoom, 1998) but close to 3.4-7.5cm range indicated by Morton (1987).

Yellow mangosteen fruits presented, at most situations, the lowest number of seeds/fruit of those mentioned in the literature, what constitutes an important characteristic for fruit quality. The variation from 1.45 to 1.95 is into range referred by Morton (1987) for mangosteen.

The average weight of seeds/fruit presented an average of 6.93g, therefore corresponding, in average, to 13.09% of the fruit (Table 2). The percentages of seed (11.62-15.95%) and peel (5.00-6.54%), did not contribute for a low pulp percentage. It was registered a high pulp percentage (71.13-76.61%), that revealed pulp percentage as the greatest part of the fruit, detaching the high technology quality of fruit, although lower than 80% related by Silva et al. (2003), in study

about yellow mangosteen.

The percentages of titratable acidity (TA) ranged between 3.85 and 4.42% (Table 3), thus above 0.7-0.8% interval obtained by Kader (2002) for mangosteen fruits, 2.4% (Lima et al., 2002) for *Spondias* and 1.06% for yellow monbim (Pinto et al., 2003). This chemical variable indicates the acid characteristic of this exotic fruit in relation to other fruits.

In spite of soluble solids (SS) rates, the results with an 11.73°Brix average are above 10.0°Brix (Silva et al., 2003) for yellow mangosteen fruits, expressively below 17-20°Brix related by Kader (2002) for mangosteen fruits and 14.3°Brix (Almeida, 2004) for dovyalis fruit.

TSS/TA ranged between 2.60 and 3.06, therefore lower than 24.28-25.00 registered by Kader (2002) in study about mangosteen. This relation can be considered a maturation index of yellow mangosteen fruit with high relevance on fruit quality for fresh consumption.

The contents of vitamin C were from 31.21 to 46.82 mg/100g of fresh fruit, thus higher than 15.60-23.40 mg/100 g of fresh fruit indicated for the same species (Silva et al. 2003), 4.1 mg/100 g of fresh fruit (Leong & Shui, 2002), 2.9 mg/100 g of fresh fruit (USDA, 2003), 1.0-2.0 mg/100 g of fresh fruit (Morton, 1987) for mangosteen; compatible to 28.01 mg/100 g of fresh fruit (Moy & Wong, 2002) for carambola, 31.71 mg/100 g of fresh fruit (Nascimento et al., 1998) for

TABLE 3 - Average values of chemical characteristics (SS, TA, SS/TA and vitamin C) of yellow mangosteen fruits. Jaboticabal-SP, 2005.

	SS	TA	SS/TA	Vitamin C
	-----°Brix -----	----- % -----		(mg/100g of fresh fruit)
1	11.7	4.42	2.79	46.82
2	12.3	4.30	2.86	46.82
3	11.8	3.85	3.06	31.21
4	11.2	4.31	2.60	31.21
5	12.6	4.40	2.86	39.02
6	10.8	3.88	2.78	46.82
Average	11.73	4.19	2.83	40.32
s.d.	0.61	0.24	0.14	7.01

SS = soluble solids; TA = titratable acidity; s.d. = standard deviation.

passion fruit; and below 47.1 mg/100 g of fresh fruit (Moy & Wong, 2002) for ranbutan and 100-300 mg/100 g of fresh fruit (Martins & Pereira, 1989) for kiwi fruit.

The results indicate that yellow mangosteen has a good pulp percentage, what is important for fruit industry; this is a very acid fruit with a TA average 3.51% and a good natural source of vitamin C.

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