

PHYSICO-CHEMICAL AND TECHNOLOGICAL STUDIES ON PERSIMMON FRUITS:

1- PHYSICO-CHEMICAL STUDIES ON PERSIMMON FRUITS

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ABSTRACT

This study was performed to make an evaluation for one of the new untraditional recently cultivated fruits in Egypt. This fruit is known "Kaki" (*diospyros kaki* L.) which includes two varieties i.e. Costata cultivar, and Hachiya cultivar (astringent varieties). This evaluation included physical properties and chemical composition for fresh fruits to identify their nutritional value. The obtained data revealed that Costata variety was better for its color , taste and firmness than Hachiya one . This variety has a low moisture content if compared to the other variety called Hachiya. The obtained results indicated that total soluble tannins in Costata variety was 3.25% which less than that of Hachiya variety 4.94% on dry weight basis and perhaps for this reason the taste of Costata was more available and desirable than the taste of Hachiya. On the other hand, Costata variety had total acidity 0.499% as citric acid, ascorbic acid was 52.44mg/100g on dry weight basis, total carotenoids 416,5 mg\100g, total sugars 66.77% than Hachiya variety which has total acidity 0.374% as citric acid, ascorbic acid 47.83 mg/100g, total carotenoids 348.9 mg/100g and total sugars 26.16% respectively (on dry weight basis).

Keywords, *Diospyros Kaki* Costata cultivar,*Diospyros Kaki* Hachiya cultivar.

INTRODUCTION

Persimmon fruit belongs to the family *Ebenaceae* , genus *Diospyros*.

There are nearly 190 different species related to this genus. However, only four species have been used commercially for production of fruits meaning that there are some other uses of these cultivated trees such as wood utilization. They are *D. kaki* L., *D.lotus* L.,*D. virginiana* L.and *D .Oleifera chene*. (Homnava *et al.*, 1990).

Annual world production of the persimmon fruits was found that China has the higher world production level followed by Korea Republic, Japan, Brazil and Italy (F.A.O 2005).

The annual Egyptian yield of kaki fruits is about 8516 tons produced from 1420 feddans (Anon, 2004).

There are two major kinds of persimmon fruits based on its astringency.The first group is the non-astringent type such as Fuyu and Jiro, which would be eaten, while the fruit is still mature and firm . Fruits of the other group must be soft after astringency is lost (Parker, 1993).

The most common persimmon varieties in Egypt are Costata, Kenokoma, Ormond, Fuyu, Hachiya and Tamopan. Costata and Hachiya are less desirable for the Egyptian consumer due to its astringent taste.

Moreover, they are usually used in baked products such as puddings, breads and cookies (Miller, 1984).

The fruits are considered a good source of fibers, tannins, calories, carbohydrates as well as vitamin A and C (Homnava *et al.*, 1990).

The fruits are perishable, due to its high moisture content (80%) and pH value (6.01) therefore; it is rapidly subjected to spoilage. It has a short marketing season starting from the end of October till the end of December, for such reasons new methods for preservation are needed to be adopted. Proper processing of such fruits should extend their shelf-life and give it an opportunity to be used all-over the year. It was also planned to produce some new untraditional products which are not consumed before, among the majority of consumers. This will help to expand the cultivated area of these fruits with expected economical benefits.

MATERIALS AND METHODS

Materials:

Two persimmon cultivars were chosen as the main raw materials in this research work. The first one known as kaki (*Diospyros Kaki Hachiya cultivar*) in the mature stage was brought from the local market in Mansoura city, Dakahlyia governorate. The samples weighted about 50 kg (9±1 fruit per kg). While the other cultivar known as kaki (*Diospyros Kaki Costata cultivar*) was brought from a farm in Sahrgt village, Meetghamer, Dakahlyia at the same quantity (16 ±2 fruits per kg). Mature fruits were brought at the end of December.

Chemical materials including - plus other- 2,6-dichloro phenol indophenol dye and indigo Carmen dye were brought from El-Gomhoreya company branch in Mansoura, Egypt.

Methods:

1- Physical properties:

Physical properties (number of fruits per kg, weight, diameter, length and shape of the fruit, diameter/length, the color of skin and flesh (texture, taste, flavour of fruits) were determined according to Barbary (1991).

2-Chemical Analysis:

Moisture content, total soluble solids, total acidity, were determined according to A.O.A.C. (1990). pH value was determined by a Peckman glass pH meter (type Hann 9124) at 25°C. Ascorbic acid, total tannins, total carotenoids were determined according to Ranganna (1979). Total and reducing sugars were determined using the colorimetric methods of sulfuric acid and standard curve of glucose as described by Smith *et al.* (1956). Non-reducing sugars were calculated by difference.

Fractionation of sugars (glucose, sucrose, fructose, galactose and manitol) by chromatography were determined according to Black, and Bagley (1978).

RESULTS AND DISCUSSION

5-1: Physical and morphological properties of fresh persimmon cultivars (Costata and Hachiya):

Physical and morphological properties of two persimmon cultivars, i.e. Costata and Hachiya were determined. Data presented in Table (1) indicate that there are some variations in morphological properties between two persimmon cultivars (Costata and Hachiya). Costata fruits, had orange skin color while flesh color was yellow-orange to red-orange. In the case of Hachiya skin color was orange and flesh color ranged from dark-orange to light brown, it could be concluded that the flesh color of Hachiya fruits was darker than Costata fruits. These results are in agreement with those reported by El-shaikh (1986) and Lyon *et al.* (1992) who showed that the color of persimmon would be characterized as deep orange-red and Hachiya fruits had darker color than the other studied persimmon cultivars.

Costata fruits had the short cylindrical shape like tomato fruits while characterized Hachiya fruits shape was conical. Fruit weight of Costata fruits was 70.22 gm while it was 168.9 gm in the case of Hachiya fruits.

Meanwhile, the two cultivars of persimmon are similar in fruit skin, taste and flavours but diameter/length ratio of Hachiya fruits was higher than Costata fruits. Besides, the texture of Costata fruit was harder than the texture of Hachiya fruit. This may be due to the higher moisture content of Hachiya fruits (78.35%) than the Costata fruit (70.05%).

2: Chemical composition of fresh persimmon cultivars :

The chemical composition of these fruits is illustrated in Table (2). From this table it could be noticed that moisture content of Costata fruits was lower than that of Hachiya fruits, and sequentially they had 29.95% and 21.65% (dry matter). Similar results of moisture content of persimmon fruits were obtained by Thabit (2001), and Abd El-Wahab (2004), they reported that the moisture content of persimmon cultivars ranged between 65 to 83%.

Table(1) Physical properties of two fresh persimmon cultivars :

Properties Description	Costata cultivar	Hachiya cultivar
Number of fruits/kg	16 ± 2	9 ± 1
fruit weight(gm)	70.22 9±0.725	168.900±1.610
Fruit diameter (cm)	4.130±0.324	5.750±0.613
Fruit length(cm)	5.750±0.721	6.300±0.4
Diameter/Length ratio	0.71	0.91
Skin color	Orange	Orange
Shape of fruit	Short cylindrical like tomato	Conical
Flesh color	Yellow-orange to red-orange	Dark-orange to light brown
Fruit texture	Firm	Soft
Skin characteristics	Thin	Thin
Taste	Sweet	Sweet
Flavour	Good	Good

As regards to total soluble solids (T.S.S) content of Costata and Hachiya cultivars It was found to be 18.75 and 21.87% respectively. These results are in agreement with those obtained by Barbary (1991) , Attia *et al.* (1998) , Thabit (2001) who stated that T.S.S content of persimmon cultivars ranged from 17.8 to 22.6 %. Concerning pH value of fresh persimmon cultivars (Costata and Hachiya) at ripening stage ,from the results presented in Table (2) it could be shown that pH value for Costata fruits was 5.89 while it was 5.45 for Hachiya fruits .The results in Table (2) show clearly also, that the two fresh cultivars had almost the same pH values. These results were in the range of the data obtained by Homnava *et al.*, 1998 and Abd El-Wahab 2004, who found that pH value of different varieties of fresh persimmon was in the range of 5.5 to 6.06 while it was considered higher comparing with the pH value of other fruit types , (3.8-4.2) . (Ranganna 1979). Regarding the total acidity percentage of fresh persimmon fruits calculated as citric acid its results were recorded in Table (2). It could be seen from these results that the total acidity contents were 0.49% and 0.37% (as citric acid) on dry weight basis for Costata and Hachiya cultivars respectively. These results were higher than those obtained by Attia *et al.* (1998) and Abd El-Wahab (2004) who found that total acidity content of persimmon fruits ranged from 0.14 to 0.30 % (as citric acid) on dry weight basis. While the results were lower than those obtained by Senter *et al.* (1991) who stated that total acidity content ranged from 0.88% to 1.36% on dry weight basis (as citric acid) of fresh persimmon cultivars.

Table (2): Chemical composition of fresh persimmon fruits of two cultivars (Costata and Hachiya) on dry weight basis

Constituents Fresh fruits	Costata cultivar		Hachiya cultivar	
	On wet weight	On Dry weight	On wet weight	On Dry weight
Moisture %	70.05	-	78.35	-
Total Solids %	29.95	-	21.65	-
Total soluble solids %	18.75	-	21.87	-
pH value	5.89	-	5.45	-
Total Acidity (as citric acid)	0.149	0.499	0.080	0.374
Total carotenoids (mg/100g)	124.741	416.5	75.536	348.9
Total tannin %	0.973	3.25	1.069	4.94
A scorbic acid (mg/100g)	15.70	52.44	10.46	47.83
Total sugars %	19.996	66.77	5.663	26.16
Reducing sugars %	14.998	50.08	4.834	22.33
Non-reducing sugars %	4.998	1 6.6 9	0.829	3.83

Concerning total carotenoids content of fresh persimmon cultivars (Costata and Hachiya) at ripening stage results in Table (2) show that Costata fruits had 416.5 mg/100g (on dry weight basis) being higher than that of Hachiya 348.9 mg\100 g(dry matter). These values are higher than those reported by Forbus *et al.* (1991) who found that total caroten as B-carotene ranged from 212.0-265.6 mg/100g dry matter in astringent cultivar . while those results were lower than that obtained by Thabit (2001) who

reported that total carotenoids in Costata and Ormond cultivars were 1400-2330 mg/100g (fresh weigh) respectively.

These variation could be attributed to differences in cultivars, climate condition, fertilization and some other variable circumstances. From the same results obtained in Table (2) it could be clearly observed that total tannins content in persimmon fruits under investigation. Costata fruits had lower amount of tannin content than of Hachiya fruits. These contents were 3.25 and 4.94 % respectively (on dry weight basis). These results are in the range of the data reported by Barbary (1991) and Thabit (2001) ,who reported that the total tannins content of persimmon cultivars was in the range of 0.9-12.3% (on dry matter).

As regards, ascorbic acid from Table (2), the results show that ascorbic acid content for ripe flesh of two cultivars persimmon fruits Costata and Hachiya were 52.44 and 47.83 mg/100g (on dry weight basis) respectively .These results are in agreement with those obtained by Kolesova (1991) and Thabit (2001) who found that ascorbic acid content ranged from 20 to 218 mg/100g (on dry weight basis) in flesh persimmon cultivars .

Regarding the total, reducing and non-reducing sugars of two persimmon Fruits (Costata and Hachiya) cultivars results were presented in Table(2). It could be noticed from these results that the total sugars of the two persimmon fruits Costata and Hachiya were 66.77 and 26.16% respectively. while reducing sugars contents of them were 50.08 and 22.33% respectively. However non-reducing sugars content was 16. 69 and 3. 83 %. These results are in agreement with Senter *et al.* (1991) and those obtained by Thabit (2001) who stated that total sugars content ranged between 34.15 to 63.25 gm/100gm (dry matter) in an astringent persimmon cultivars while Red-sugars (31.22-32.21) and non-Red-sugars (17.81-18.33%) on dry weight basis.

From Table (3) it could be noticed that fractions of sugars of two persimmon fruit cultivars (Costata and Hachiya) which were determined by HPLC were : Glucose , Sucrose , Fructose , Glactose , and Mannitol.

From the same table, it could be also observed that fructose component was the predominant sugar in the two cultivars of persimmon fruits. These results are in harmony with those obtained by Senter *et al.* (1991) who found that Glactose, Fructose, Glucose and Sucrose were presented in all persimmon cultivars and that Fructose, Sucrose and Glucose were the predominant sugars.

Table (3): HPLC sugars Fractionation of Costata and Hachiya fruits

Sugars Frations %	Costata fruits		Hachiya fruits	
	On wet weight	On dry weight	On wet weight	On dry weight
Glucose	1.6176	5.4010	1.2320	5.6905
Sucrose	0.9292	3.1025	1.6465	7.6050
Fructose	1.9763	6.5986	2.3316	10.7695
Glactose	1.3282	4.4347	1.5670	7.2378
Mannitol	1.6489	5.5055	1.9435	8.9769
Total	7.4999	25.0423	8.7206	40.2797

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دراسات فيزيوكيميائية وتكنولوجية على ثمار نبات الكاكي:

١- دراسات فيزيوكيميائية على ثمار نبات الكاكي

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**معهد بحوث تكنولوجيا الأغذية - مركز البحوث الزراعية - الجيزة .

تهدف هذه الدراسة الى اجراء تقييم لأحد أصناف الفاكهة الغير تقليدية والمزرعة حديثا
وشتويا فى مصر وهى ثمار فاكهة الكاكي . وقد اختصت هذه الدراسة بصنفين هما الكوستاتا
والهاشيا وهما من الأصناف القابضة .

وقد تناول هذا التقييم الصفات الطبيعية والتركيب الكيماوى لهذه الأصناف الطازجة السابق
ذكرها لمعرفة قيمتها الغذائية

وقد دلت النتائج على أن صنف الكوستاتا تميز بصفات طبيعية وكيماوية أفضل عند مقارنته
بصنف الهاشيا بالنسبة للون الثمار والطعم والصلابة , فقد وجد أن لون ثمار الكوستاتا البرتقالى
المحمر Red-orange فى فترة النضج تشبه فى شكلها ثمرة الطماطم الأسطوانية , وذات طعم
ومذاق حلو عند تمام النضج بعكس ثمار الهاشيا التى كان لونها بين البرتقالى الغامق والبني الفاتح
ومذاقها تشوبه بعض التانينات الى حد ما لكن شكلها مخروطى وحجمها أكبر من الكوستاتا، وعن
الصلابة فإن الكوستاتا ثمارها ذات نسيج أكثر تماسكا من ثمار الهاشيا ولعل ذلك راجع الى انخفاض
محتواها من الرطوبة مقارنة بثمار الهاشيا ولذلك فهى أقل عرضة للفساد من الهاشيا .

وعن التركيب الكيماوى لثمار الكاكي الطازجة فقد اختلف تبعا للصنف حيث اشارت النتائج
الى ان ثمار الكوستاتا أقل فى المحتوى الرطوبى (٥٠,٠ ٪) مقارنة بثمار الهاشيا(٣٥,78 ٪)
كذلك نقصت التانينات الكلية الذاتية فى الكوستاتا (3,25 ٪) على أساس الوزن الجاف عن مثيلاتها
فى الهاشيا (4,94 ٪) ولعل ذلك سبب تفوق طعم ثمار الكوستاتا الطازجة عن طعم ثمار الهاشيا
التى زادت بها نسبة المواد الصلبة الكلية الذاتية (21,87 ٪) عن الكوستاتا (18,75 ٪) . ومن
ناحية أخرى فقد تميز صنف الكوستاتا بارتفاع محتواه من الحموضة الكلية (4,99 ٪) مقدرة
كحامض ستريك، حمض الأسكوربيك ٤٤ و ٥٢ ملجم/ 100 جم وزن جاف)، والكاروتينات الكلية
(416,5 ملجم/ 100 جم وزن جاف) والسكريات الكلية (66,77 ٪ عن مثيلاتها فى الهاشيا التى
سجلت (374, ٪) , (٨٣ و ٤٧ ملجم / 1٠٠ جم) , (348,9 ملجم / 100 جم وزن جاف) ,
(26,16 ٪) على التوالي وقد دلت نتائج التحليل الكروماتوجرافى للسكريات فى صنفى الكوستاتا
والهاشيا الطازجين على أنه تم التعرف على خمس مكونات للسكريات فى تلك الأصناف الطازجة
وهذه المكونات هى السكروز- الجلوكوز - الفركتوز - الجالاكتوز - المانيتول كما أوضحت النتائج
أن سكر الفركتوز هو السكر السائد فى تلك الأصناف الطازجة.