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PREPARING NEW BLENDS OF FRUIT JUICES TO MEET THE NEEDS OF THE POTENT ANTIOXIDANT EFFECTS

[19]

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ABSTRACT

New fruit juice blends which contain several potent antioxidants (carotenoides, ascorbic acid and selenium) in combination with other favorable aspects of flavor and color were tried. The trial included locally produced fruits such as Kaki, Papaya, Guava and Pomegranate. Five blends were prepared with different percentages of the prepared juices in trying to maximize the required nutrients such as carotenoides, ascorbic acid and other micro-nutrients. The best blend which had the highest content of ascorbic acid 45.73mg/100gm was blend No.(2) which contained 30% kaki, 30% papaya, 30% guava and 10% pomegranate whereas blend No.(4) (50% kaki, 30% papaya, 10% guava, and 10% pomegranate had the highest content of carotenoids (33.58 mg/100gm). Selenium content of different blends were almost always the same. Organoleptic scores revealed that the best consumer preference was for blends No. (2 and 4). As for main components of different blends a slight difference could be observed between percentages of sugars and titratable acidity.

Keywords: Blend fruit juices, Antioxidant effects

INTRODUCTION

New fruit juice blends which contain several potent antioxidants in combination with other favorable aspects of flavor and color were tried.

Nowadays the consumption of juices of high nutrient value is recommended to satisfy the needs of vitamins, minerals and organic acids. In this respect, many investigators prepared several juice blends to maximize the required micro-nutrients.

Locally produced fruits such as Kaki, Papaya, Guava and Pomegranate could be used to prepare such blends of high nutritious value.

In this respect, Kaki or Persimmon (*Diospyros kaki*), Papaya (*Carica papaya L.*), Guava (*psidium guajava L.*) and pomegranate (*Punica granatum*) were used.

Kaki fruits differ from orange to red in color, firm to soft in texture, astringent to non-astringent in taste, and seedy to seedless according to cultivars (**Philip and Chen 1988**).

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Generally, the pulp of this fruit has 76.3-79.7% moisture, 16.4-20.7% total soluble solids, 11.4-16.2% total sugars, 0.76-1.09% crude fiber, 0.49-0.80% protein, 0.08-0.23% lipids, 0.48-0.80% ash, 0.14-0.30% total acidity as citric acid and 6.01-6.03 pH value (**Homnava *et al* 1990 and Aksu *et al* 1994**). However, It is considered a poor source of ascorbic acid (18.28mg/100g) while it is rich in carotenoides (43mg/100g as β. carotene) (**Lee and Kin 1994**). In Egypt, the cultivation and production of this fruit are recently introduced.

On the other hand, Papaya (*Carica papaya L.*) is melon like and when becomes fully ripe its flesh is slightly aromatic with yellow to orange color. (***Pal et al 1980)*** studied the chemical composition of twelve Papaya fruit varieties and stated that they contained from 2.03 to 3.37% sucrose, 2.77-5.98% glucose, 2.86-3.57% fructose, 46.3-125.9 mg/100g ascorbic acid and 0.058 – 0.116% total acidity as citric acid on fresh weight basis (FWB).

The Papaya plantation is growing up quickly in Egypt. People demand it for stomach problems, in addition to its high protiolytic activity due to the presence of Papin enzyme (**Subramanyam *et al* 1986**).

Recently, **(Chandrika *et al* 2003)** mentioned that Papaya is one of the main fruits recommended for vitamin A deficiency in Sri-Lanka. The carotenoids are known to be involved in immune enhancement, treatment and prevention of cancer and of antioxidant capacity **(Bendich 1991 and Mathews-Roth 1991).**

Beside, Guava (*Psidium guajava L.*) is a tropical fruit grown in several areas and in Egypt.

However, it is grown successfully and considered as excellent fruit for its highest ascorbic acid content, and some other nutrients as well as the pronounced delicate flavour.

Chemical composition of fresh guava fruits has been studied by **Scudamore (1987),** who reported that guava juice had pH value ranging from 3.1 to 3.8, titratable acidity 0.6 – 1.8mg/100ml as citric acid and 66 – 171 mg/100g ascorbic acid.

The pomegranate (*Punica granatum*) is a tropical and or subtropical tree. **(Tressler and Joslyn 1971)** mentioned that pomegranate had reducing sugars 16.9% and organic acid 1.6% as citric acid.

(Shrede *et al* 1992), found that anthocyanins are the main natural pigments of pomegranate juice and these pigments could easily be oxidized or reduced by heat, metals and enzymes.

Accordingly, several blends were prepared from the different fruits juices in order to reach a high level of total antioxidant activity such as (carotenoids, vitamin C and selenium as well as valuable nutrient elements as Ca, Zn and Fe in combination with good color, flavor and aroma.

MATERIAL AND METHODS

Kaki fruits (*Diospyros kaki*), Guava (*Spidium guajava L.*), Pomegranate (*Punica granatum*) were obtained from local market, whereas, papaya fruits (*Carica papaya L.*) variety cylon red, were brought from an orchard in El-Kassasine.

All the fruit samples were purchased at their top seasons in 2003 and 2004 respectively at their optimum maturities.

Fruits pulp were extracted from the above mentioned fruits and homogenized through the use of high rotating blender, the pulps were strained through the muslin cloth to separate the seeds.

The obtained pulps were blended at different proportions according to the following Table (1).

Fruits	% of different juices incorporated in the blends				
	1	2	3	4	5
Kaki	25	30	40	50	30
Papaya	25	30	20	30	40
Guava	25	30	20	10	10
Pomegranate	25	10	20	10	20

Thereafter, juices were bottled in 200ml – glass containers and pasteurized in water bath at 90°c for one minute, then the filled bottles were sealed with crown caps and followed by sudden cooling to room temperature before placed in the refrigerator at 7°C$\pm$2°C. The juice blends were sensory evaluated by well trained panelists, who gave scores for the color, flavor and over all acceptability as described by **Larmond, (1970)**.

The data obtained were statistically analyzed for the Least Significant Differences (L.S.D.) as described by **Ott, (1984)**.

Fresh as well as processed juice blends were analyzed for moisture content, total soluble solids, total acidity (as citric acid), total sugars (reducing and non-reducing) ash, proteins, proteins and ascorbic acid (V.C) according to the methods described by **AOAC, (1990)**. Pectin and β-carotene were determined as described by **Ranganna, (1979).** Whereas minerals Ca, Fe, Zn and Selenium were analyzed using the spectrophotometer – Perkin Elmer – 3300 after **(Chapman and Pratt, 1961)**.

RESULTS AND DISCUSSION

Guava Fruit has a distinct strong flavor and white color, while persimmon (kaki) and papaya fruits have a weak flavor and orange to red color. Beside pomegranate has characterized flavor and naturally brilliant red color in acid media due to anthocyanins pigments **(Hamed, 1999)**. Results in Table (2) indicate that moisture content of kaki pulp was 78.7% on (FWB). This result is in agreement with **Aksu *et al* (1994)**. This value was less than that of papaya, guava and pomegranate which were 87.32, 86.23 and 85.87 respectively. A reverse trend was found for total sugars which was 17.11% and lower than that for both papaya and pomegranate except for guava fruit which had sugars level of 26.7% on FWB.

Both reducing and non-reducing sugars were 16.85, 0.26; 3.77, 5.13; 12.20, 14.50 and 6.20, 3.31 on FWB for kaki, papaya, guava and pomegranate, respectively.

According to **(Tsuji and Komiyama 1987),** sucrose was completely hydrolyzed after 10 minutes of kaki pulp homogenization. **(Hirai and Yamazaki 1983)** found that total sugars of Kaki fruit consisted of 39% fructose, 38% glucose, 23% sucrose. It differed from 11.5 – 19% according to kaki cultivars **(Barbary, 1991; Manaba, 1993 and Aksu *et al* 1994**).

Titratable acidity in kaki fruits and in papaya fruits were almost the same since they were 0.1 and 0.12% (as citric acid) respectively, whereas pomegranate had higher value (0.69%) than guava (0.42%). Results in the same table show that kaki and pomegranate were poor in ascorbic acid which was 14.79 and 12.40mg/100g respectively on (FWB). Guava and papaya fruits had a high level of ascorbic acid which was 64.58 and 69.50mg/100g (on FWB) respectively.

Both guava and papaya fruits could be considered as a very good source of vitamin C comparing with orange juice. The above mentioned results are in agreement with those reported by **(Handwerk and Coleman, 1988 and Sapers 1993).**

On the other side, It was found that kaki fruit was very rich in Carotenoids which reached to 49.35mg/100gm. **Homnava *et al* (1990)** mentioned that β-carotene was the predominant carotenoid compounds among 11 of 15 persimmon fruit varieties.

While papaya fruit pulp contained carotenoids about 26.89mg/100g on (FWB). These results are in agreement with results obtained by **Nasr *et al* (2001)**.

Results in Table (2) show that pomegranate had a high value of anthocyanin 140.73mg/100g of juice. These results go in line with the results obtained by **Hamed (1999)**.

The tannin content of kaki fruits was 1.37% while in pomegranate it reached to 0.530%. Tannin is an infavorable component since it negatively affects taste.

The results in Table (3) show that moisture content of different blends were in the same level. Since they ranged from 82.75 to 84.5%.

Total sugars were ranged from 13.26% (in blend 5) to 16.76% (in blend 2).

The reducing sugar was always higher than that of non-reducing sugar. The latter constituted about 30.7% of the total sugars on average.

Total titratable acidity usually affects the taste of the final product. Its highest value was found in blend (1) 0.35% as citric acid whereas the lowest value was in blend (5) 0.199%. It seems that the acid values were very low when compared with that of total sugars (a phenomenon which could affect the taste) since the ratio of sugar/acid value fluctuated from 44.37:1 in blend No. (1) to 71.39:1 in blend No. (4).

Both ascorbic acid and total carotenoids are considered as potent antioxidant and hence it protects the cells from being damaged by undesirable free radical. In this context, the highest value of ascorbic acid was found in blend No. (2) 45.73 mg/100g, whereas the lowest value was found in blend No. (3) 35.22mg/100g. These values could be considered about equal to ascorbic acid content available in the citrus fruits which usually considered as a favorable source of vitamin C. As for carotenoids, the highest value was found

Table 2. Chemical constituents of different fresh juices extracted from different mature fresh picked fruits

Chemical constituents	Kaki	Papaya	Guava	Pomegranate
Moisture content (%)	78.70	87.32	86.23	85.87
Total sugars%	17.11	8.90	26.7	9.51
Reducing Sugars%	16.85	3.77	12.20	6.20
Non-reducing sugars%	0.26	5.13	14.50	3.31
Ash %	0.63	0.57	0.54	0.38
Crude protein (TN x 6.25)	0.74	0.46	0.50	0.14
Ascorbic acid mg/100g	14.79	69.50	64.58	12.4
Carotenoids mg/100g	49.35	26.89	7.980	-
Anthocyanin mg/100mg	-	-	-	140.73
Tannin %	1.37			0.530
Titratable acidity% (as citric acid)	0.1	0.12	0.42	0.69

Table 3. Chemical Constituents of different juice blends

Chemical Constituents	Different blends				
	1	2	3	4	5
Moisture content%	84.5	84.25	83.36	82.75	84.5
Total sugars%	15.53	16.76	15.86	14.85	13.26
Reducing sugars%	9.75	10.46	11.17	11.4	9.03
Non-reducing sugars%	5.79	6.30	4.69	3.44	4.23
Titratable acidity%	0.35	0.29	0.299	0.208	0.199
Ascorbic acid mg/100g	40.32	45.73	35.22	35.94	41.18
Carotenoids mg/100g	20.92	25.27	26.67	33.58	26.37
Anthocyanin mg/100g	35.18	14.07	28.15	14.07	28.15
Tannin% as tannic acid	0.47	0.46	0.65	0.74	0.52

was in blend No. (4) 33.58 mg/100g whereas the lowest value was found in blend No. (1) 20.92 mg/100g. The carotenoids usually act as a potent antioxidant product which is usually recommended to protect against cancer **(Bendich 1991 and Mathews-Roth 1991)**

Anthocyanin in acid media has acceptable red color. Its value ranged from 14.07 mg/100gm in blend No. (4) to 35.18 mg/100g in blend No. (1). The anthocyanin is considered a good natural pigments which usually is used as colorant for food products.

Finally, the tannins are found in large amount in unmature fruits then decrease drastically upon maturation. The final amount of tannin in the prepared blends ranged from 0.46% in blend No. (2) to 0.74% in blend No. (4) as tannic acid. These level of tannin however could not affect negatively the organoleptic properties.

Elements in general are of top importance however Ca, Zn, Fe and Se have special nutritional values. Selenium could be considered a good antioxidant and hence it could protect the cells from the attack of free radicals.

Results in Table (4) reveal that pomegranate in general had lower level of different elements. However papaya was the highest (24mg/100gm) in calcium, but was the lowest in iron (0.10mg/100g) meanwhile, the kaki was the highest in iron (1.76mg/100g). As for selenium the amounts were almost the same in different fruit juices.

It could be concluded that the variation of different elements could be compensated by blending of different fruit juices.

Table 4. Some selective elements in different fruits

Fruits	Ca mg/100g	Zn mg/100g	Fe mg/100g	Se μ/100g
Kaki	17.6	1.52	1.76	0.53
Papaya	24.0	1.37	0.10	0.60
Guava	20.0	3.0	0.31	0.51
Pomegranate	3	0.12	0.30	0.49

Organoleptic properties are always of high importance since they affect the consumer preference. Results in Table (5) reveal that the higher scores were given to blend No. (2), however the color in general fluctuated between slight pink (No. 2) to deep pink No. (3,4). The scores could be arranged in descending order No. (2) 8.0, No. (1 and 4) 7.9, No. (3) 7.6 and No. (5) 7.15. No significance differences could be observed in color, between different blends.

As for flavor including taste and aroma the differences between scores were almost always insignificant except for blend No. 1 which had the least flavor scores.

Table 5. Average scores of organoleptic parameters for prepared juice blends

Blend No.	Means (x)		
	Color	Flavor	Overall Accep.
1	7.900 ab	6.550 b	6.750 b
2	8.000 a	7.400 ab	7.850 A
3	7.600 ab	7.150 ab	7.650 A
4	7.900 a	7.900 a	7.850 A
5	7.150 b	7.050 ab	7.325 ab
L.S.D (0.05)	0.8026	0.8985	0.7194

* Values within column followed by the same letter are not significant different (P>0.05)

The overall acceptability scores had the same trend as scores given to flavor. Exclusively, all blends were considered good in the sensory attributes except for blend No. (1). But it could be observed that blends No. (2 and 4) were superior than other blends when compared to flavor and overall acceptability.

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مجلة اتحاد الجامعات العربية للدراسات والبحوث الزراعية ، جامعة عين شمس ، القاهرة ،١٤(١) ، ٢٨٩-٢٩٧ ، ٢٠٠٦

تحضير مخاليط جديدة من عصائر الفاكهة لتقابل الاحتياجات الخاصة لمضادات الأكسدة الفعالة

[١٩]

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تم تحضير مخاليط جديدة من عصائر الفاكهة التى تحتوى على العديد من مضادات الأكسدة الفعالة (كاروتينيدات ، حمض الاسكوربيك، السلينيم) مع الأخذ فى الاعتبار للصفات المرغوبة من الطعم واللون.

وشملت المحاولة بعض الإنتاج المحلى من الفاكهة مثل الكاكى ، الباباظ، الجوافة والرمان.

ولقد حضرت ٥ مخاليط بنسب مختلفة من العصائر فى محاولة لتعظيم المتطلبات الخاصة بالمغذيات مثل الكاروتينيدات، فيتامين (ج) ، وغيرها من المغذيات الصغرى.

وكانت أفضل المخاليط التى احتوت على أعظم نسبة من حمض الاسكوربيك (٤٥,٧٣مجم/١٠٠جم) هو مخلوط رقم (٢) والمحتوى على ٣٠% من كل من الكاكى والباباظ والجوافة و١٠% من الرمان فى حين أن مخلوط رقم (٤) ٥٠% كاكى، ٣٠% باباظ و١٠% من كل من الجوافة والرمان أحتوى على أعلى نسبة من الكاروتينيدات ٣٣,٥٨ مجم/١٠٠ جم ولقد كانت محتويات السلينيوم للمخاليط المختلفة تقريبًا ودائمًا متساوية.

وأثبتت الدرجات الحسية أن أفضل اختيار للمستهلك هو مخلوط رقم (٢)، (٤). ومن الملاحظ أن المكونات الرئيسية للمخاليط المختلفة تختلف اختلافًا بسيطًا فى محتواها من السكر والحموضة الكلية.

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