

UTILIZATION OF SOME NATURAL PLANT SOURCES IN PRODUCTION OF SOME ICE DRINKS FOR CHILDREN

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Abstract

This study was carried out or performed to investigate the possibility of producing some natural drink mixes with different ratios compared to the singular natural drinks without any mixing. Those natural drinks were extracted and processed from some popular, known and available plant sources such as Roselle, Tamarin and Daum. Besides, fixing and evaluating the palatability of those aforementioned natural drinks and their mixes among representative samples of consumers especially school children (the most important consumers for those products). The effect of storage at -18°C for (6) months on both physical, chemical properties and sensory evaluation of those previous natural drinks and their mixes was also put into consideration in this study. However, the obtained results reveal that nearly all natural mixes (1: 1) were more preferable than the singular ones. It was also found through this study that storage at -18°C for six months had no harmful effect or non desirable changes on the different quality attributes of those stored natural drinks and their mixes.

Finally, it could be concluded through this study that, it was possible, successful and economic to produce natural drinks mixes to be consumed by children as those natural drink mixes rich source of minerals and vitamins which are necessary to their health.

INTRODUCTION

Roselle (*Hibiscus sabdariffa* L.) petals are boiled in water and used as a drink in bilious attacks petals which contain gossypetin and glucoside hibiscin, which may have diuretic choloretic effect, decreasing the viscosity of the blood, reducing blood pressure and stimulating intestinal peristalsis (Onyenekwe *et al.*, 1994).

Dried Roselle petals powder is used for acid flavor of jam, jillies, sauces, drinks, marmalade and ice-cream. Karkade powder contains high level of minerals such as Fe (188 mg/100gm), Mg (442 mg/100gm) and Ca (1.28%) as mentioned by Machiko and Masahara (1998).

Abdel El-Latif *et al.* (1992) reported that Roselle petals contained high level of dietary antioxidant. These active compounds play an important role to prevent the oxidative stress in hypercholesterlaemic patients and animals, as effective agents in inhibiting lipid peroxidation, preventing coronary heart diseases and improve liver enzymes.

The Daum palm (*Hyphaene thebacia* L.) Family palmae is growing wild throughout the dried regions of tropical Africa, the middle East and Western India. It has been cultivated in Egypt since immemorial times. Such plant is mentioned as garden tree under the name of MAMA which means divided in two (owing to its forked stem). The fruit is known in Egypt as (ququ) or Daum. The mesocarp of the fruit is usually eaten by children due to its delicious and sweet taste. In Upper Egypt, the aqueous extract (as decoctions or infusions) is used by the public in Folk medicine as a remedy for hypertension. The extraction of Daum fruit had significant effect as antifungal activity agents (Irob and Adedayo, 1999).

Shaker (1979) stated that Tamarin pulp had 19.06% moisture, 11.3% fiber, 3.26% ash and 59.5% total carbohydrate. The highest yield of extracted pulp was achieved using hot water and the concentration of 6% was more preferable among consumers. Furthermore, he added that pulp extracted by using hot water, contained high amount of sugars and minerals, which reflected their importance as refreshing drink.

The selected common drinks as Daum and Tamarind were excellent sources of polyphenols, catechin and antioxidants (Abdel Latif *et al.*, 1992).

On the other hand, there is a substantial demand for natural drinks processed from natural plant sources especially those consumed by children instead of artificial or synthetic ones which have been proved to be harmful to human health. Recently, it has been proved through a lot of investigations that artificial drinks spread in local markets and consumed by the majority of children cause many health problems and different diseases to those children. Thus scientific attempts to produce material drinks processed from material plant sources such as Roselle, Tamarin, Daum, and utilized as substitutes of those artificial drinks is a matter of great importance (Bordignon-luz *et al.*, 2007).

Thus, this study aims to investigate the possibility of producing some natural drink mixes processed from some natural plant sources such as Roselle, Tamarin and

Daum and evaluating the palatability of those aforementioned drinks among different consumers especially children. And also, to study the effect of storage at -18°C for 6 months previously for these mentioned extracts on different quality attributes of those products.

MATERIALS AND METHODS

Materials

Roselle, Daum and Tamarin were purchased from local market.

Preparation of different aforementioned ice drink mixes

Roselle and Tamarin drinks were extracted by boiling with water using a ratio (1 : 4 w/w). Meanwhile, Daum drink was extracted by boiling in water (1 : 3 w/w, respectively) for 30 min. T.S.S. (Total Soluble Solids) in all aforementioned extracts were adjusted to 18% by adding the required calculated amount of sucrose. Meanwhile, the acidity of all drinks was adjusted by adding citric acid (3 g/kg sugar). Sodium benzoate was added (0.3g/Liter) as preservative). Different mixes of processed drinks were shown in Table 1.

Table 1. Different mixes of processed drinks.

No.1	Karkade drink 100%
No.2	Tamarin drink 100%
No.3	Daum drink 100%
No.4	50% Daum + 50% Tamarin (1:1 v/v)
No.5	50% Karkade + 50% Daum (1:1 v/v)
No.6	50% Tamarin + 50% Karkade (1:1 v/v)

All ice drinks and their mixes were packed in polyethylene (6 × 16 cm) containing about 100 cm in every package, then stored at -18°C for six months and were analyzed every 3 months.

Methods

The previous preserved packages containing the ice drink mixes were analyzed for their moisture, total soluble solids (T.S.S.), total sugars, reducing sugars, fiber, ash and total acidity (as citric acid) as described in A.O.A.C. (2000).

The pH values of all the aforementioned ice drink mixes were adjusted by pH meter (Backman pH meter with glass electrode at 25°C) as described in A.O.A.C. (2000). Meanwhile, the color values of these ice drink mixes were measured according to Hunter (1958) using Hunter instrument Model D25 color and color difference in 90 MMX heigh 12 MM.

All the processed ice drink mixes were organoleptically tested for their color, taste, odor and appearance according to Walter and Hoover (1986), 15 (fifteen) panelists of different age children in a preparatory school in our environment were asked to detect or to evaluate different mentioned properties of these ice drink mixes. The degree of significance were calculated according to the methods described by Senedecor and Cochran (1980).

RESULTS AND DISCUSSION

Chemical composition

Data given in Table (2) show the chemical composition of Roselle, Daum and Tamarin natural drinks. From the obtained results it could be clearly observed that the moisture contents were 79.15, 78.34 and 78.48% for Roselle, Daum and Tamarin natural drinks, respectively. The total soluble solids contents (T.S.S.) were 18.04, 18.32 and 18.64 for Roselle, Daum and Tamarin natural drinks, respectively. On the other hand, total acidity has higher values for Tamarin (0.982) and Roselle (0.824), while, it was lower (0.631) in Daum natural drink. Those aforementioned values of acidity contents for different investigated natural drinks were logic if compared to the pH values of those natural drinks (present in Table 3).

Table 2. The chemical composition of Roselle, Daum and Tamarin drinks.

	Roselle drink	Daum drink	Tamarin drink
Moisture	79.15	78.34	78.48
T.S.%	20.85	20.66	21.52
T.S.S.	18.04	18.32	18.64
Total acidity (as citric acid)	0.824	0.631	0.982
Total sugars %*	88.69	87.74	88.62
Reducing sugars %*	34.35	32.37	33.42
Non-reducing sugars %*	54.34	55.37	35.20
Fibers %*	6.43	5.84	6.92
Ash %*	4.88	3.42	4.46

* Dry weight basis

From the same data shown in the same Table (2), it could be also noticed that the total sugars contents of Roselle, Daum and Tamarin natural drinks, were 88.69, 87.74 and 88.62% (on dry weight bases), while reducing sugars contents were 34.35, 32.37 and 33.42% for the same natural drinks. The fiber and ash contents of Roselle and Tamarin natural drinks were higher than those in Daum natural drink. All the

previous results concerning the chemical composition of the investigated natural drinks possessed no great differences when compared to those results reported by many others investigators searching with the same materials. These results are in agreement with those reported by (Omar *et al.*, 2002).

Data in Table (3) show the physical properties of Roselle, Daum and Tamarin drinks. From the obtained results, it could be noticed that the pH values were 5.64 of Roselle drink, 6.82 of Daum drink and 4.93 of Tamarin, respectively.

From the same mentioned Table (3), it could be also mentioned that Tamarin is more acidic than other material drinks. This may be the cause of why Tamarin is more popular and more delicious among different consumers especially small children. These results are in agreement with those found by Omer *et al.* (2002).

Table 3. The physical properties of Roselle, Daum and Tamarin natural drinks.

Parameters	Roselle drink	Daum drink	Tamarin drink
pH values	5.64	6.82	4.93
Hunter lab measurements			
L	+ 74.38	+76.30	+ 36.43
a	+ 8.42	+ 5.31	+ 2.45
b	+ 4.33	+ 7.22	+ 3.84

L = lightness

a (+) or (-) = Redness or greenness

b (+) or (-) = Yellowness or blueness

Data in Table (3) show the color measurements determined by Hunter lab as L, a and b factors for Roselle, Daum and Tamarin, results were L= 174.38 of Roselle, +76.30 of Daum and +36.43 of Tamarin drinks, respectively. It could be also noticed that the drinks of Daum and Roselle were found to be very light in color as reflected in higher values of L values. On the other hand, it was clearly concluded that L values of Tamarin natural drink were less bright than those of other drinks, interpreting this as a result of dark substances existing in Tamarin.

Additionally, both of "a" and "b" values were +8.42 and 4.33 of Roselle drink, +5.31 and 7.22 of Daum drink and +2.45 and +3.84 of Tamarin drink, respectively. It could be noticed that Roselle had high values of + a (redness), meanwhile, Daum drink had high values of +b (yellowness), on the other hand, Tamarin had low values of both a and b. These results are good with those reported by Mona *et al.*, (1992).

In addition to physical, chemical criteria, a set of objective sensory quality criteria that describes the most relevant and most reliable variation for a given product is required (Martens, 1986). Mean values of sensory scores namely color, taste, odor

and appearance of prepared natural drinks processed from Roselles, Tamarin and Daum and their mixes are shown in Table (4). Significant differences were obtained among the tested samples. Analysis of variance showed that Roselle natural drink (100%) had the moderate scores for palatability compared to those of the other investigated drink. Meanwhile, Tamarin and Daum natural drinks (100%) recorded lowest scores than Roselle natural drink for acceptance color, taste, odor and appearance. On the other hand, mixed natural drink of Roselle and Tamarin (50% : 50%), Roselle and Daum (50% : 50%) and Daum and Tamarin (50% : 50%) had the highest scores for a palatability compared to those singular mixes.

Table 4. Organoleptic evaluation of Roselle, Daum and Tamarin natural drinks and their mixes.

Samples drinks	Organoleptic evaluation				
	Color	Taste	Odor	Appearance	Overall score
Roselle (100%)	9.17 ^a	8.43 ^c	8.44 ^a	8.71 ^a	8.69
Tamarin (100%)	8.13 ^c	8.91 ^b	7.33 ^c	7.15 ^c	7.88
Daum (100%)	7.87 ^b	7.56 ^d	6.01 ^d	7.33 ^b	7.19
Roselle 50% + Tamarin 50%	9.19 ^a	9.63 ^a	8.64 ^a	9.14 ^a	9.15
Roselle 50% + Daum 50%	9.54 ^a	9.01 ^b	8.54 ^a	8.13 ^b	8.81
Daum 50% + Tamarin 50%	9.14 ^a	8.64 ^b	7.91 ^b	7.39 ^b	8.97
L.S.D. at 0.05	0.371	0.343	0.483	0.434	

These more clear palatability that the mixed processed drinks were more preferable among panelists than singular natural ones. On the other hand, it was clearly observed that the mix of Roselle-Tamarin had the highest palatability followed by Roselle-Daum, then Tamarin-Daum mixes.

Generally, sensory evaluation indicated that mixed (50% : 50%) natural drink of Roselle, Tamarin and Daum had the highest palatability scores followed by the natural drink singular of Roselle, Tamarin and Daum, respectively.

These results are in agreement with those obtained by Shaker (1979) and Omar *et al.* (2002).

Effect of storage period on some chemical properties of Roselle, Tamarin and Daum natural drinks and their mixes at -18°C for 6 months. Results in Table (5) illustrated that moisture content had slightly decreased during storage period at -18°C for (6) six months.

Table 5. Effect of storage on chemical analysis of Roselle, Tamarin and Daum natural drinks and their mixes for 6 months at -18°C.

Storage period (month)	Zero time						3 months						6 months						
	R	T	D	R+T	R+D	D+T	R	T	D	R+T	R+D	D+T	R	T	D	R+T	R+D	D+T	
Chemical composition																			
Moisture	79.15	78.48	78.34	78.54	78.74	78.41	78.83	78.31	78.14	78.31	78.53	78.24	78.92	78.46	78.63	78.84	78.82	76.79	
T.S.	20.85	21.52	20.66	21.46	21.26	21.59	21.17	21.69	21.86	21.69	21.47	21.76	21.18	21.54	21.37	21.16	21.18	23.21	
T.S.S.	18.04	18.64	18.32	18.34	18.18	18.48	18.15	18.736	18.52	18.44	18.26	18.51	18.84	19.03	18.92	18.86	18.73	18.98	
Titrateable Acidity (as citric acid)	0.824	0.982	0.631	0.903	0.73.6	0.808	0.865	1.13	0.682	0.997	0.775	0.906	0.932	1.451	0.731	1.191	0.832	1.091	
Total sugars	88.69	88.62	87.74	88.66	88.25	88.18	87.94	87.42	86.51	87.37	87.51	86.32	87.01	86.81	85.82	86.74	86.31	85.48	
Reducing sugars	34.35	33.42	32.37	33.88	33.36	32.89	35.62	33.84	33.01	34.75	34.15	33.81	36.48	34.15	33.89	35.61	35.34	34.08	
Non reducing sugars	54.34	55.20	51.87	55.78	54.89	55.29	52.32	54.58	53.50	52.62	53.36	51.51	50.53	52.66	51.93	51.13	50.97	53.40	

R = Roselle 100%, T = Tamarin 100%, D = Daum 100%

R+T = Roselle 50% + Tamarin 50%, R+D = Roselle 50% + Daum 50%, D+T = Daum 50% + Tamarin 50%

T.S. = Total Solids, T.S.S. = Total soluble solids.

On the other hand, it could be noticed that the total soluble solids (T.S.S.) had slightly increase in their values during storage. This may be due to the decrease in moisture. The increment in T.S.S. may be related to the hydrolysis of insoluble polysaccharides such as starch to soluble sugars, and also insoluble pectin to soluble pectin. These results agree with those obtained by Sedki (1978). Moreover, the total acidity of natural drink (Roselle, Tamarin and Daum and their mixes) were slightly increased during storage period for 6 months at -18°C . The obtained data are in good agreement with those found by Kerolles *et al.*, (1994) as they reported that the titratable acidity was slightly increased in Papaya blends during storage for 5 months. They attributed this increase to slight degradation of some reducing sugars.

From the same table (5) data shows less increase in reducing and total sugars during storage of the natural drink, it might be due to the decomposition of some polysaccharides such as starch or inversion of sucrose into reducing sugars. These data are in accordance with those obtained by El-Deeb (1990).

Physical characteristics of prepared natural drink processed from Roselle, Tamarin and Daum and their mixes were tested during storage for 6 months at -18°C . pH Values and Hunter lab difference were measured after 3 months and 6 months, results are tabulated in Table (6). Data in Table (6) reveal that the pH values of processed natural drinks were almost constant. Some slight changes could be noticed for pH values. The slight decreases in pH values during storage for 6 months were attributed to the formation of CO_2 as a result of the browning reaction developed or due to the reaction of sugars and amino acid (Abou Zaid (1995).

The results in Table (6) shows also the changes in color difference measured by Hunter lab, during storage for 6 months at -18°C . All the tested parameters of Hunter lab difference, i.e. L, a and b were decreased throughout storage. These results indicated that the L value of prepared natural drinks slightly decrease, the color become slightly darker as compared with the fresh one (without storage). Moreover, the a value means the redness degree of the prepared drinks. Thus the decrements in (a) value means that the all drinks become pale without shining specially Tamarin and Tamarin mixes. In addition, the lowest in (b) value reflect the reduction into the color of the prepared drinks. These findings are in agreement with the results obtained by Mona *et al.*, (1992).

Table 6. Effect of storage on some physical properties of natural drinks and their mixes during storage for 6 months at -18°C.

Storage period (month)	Zero time						3 months						6 months					
	R	T	D	R+T	R+D	D+T	R	T	D	R+T	R+D	D+T	R	T	D	R+T	R+D	D+T
Physical properties																		
pH values	5.64	4.93	6.82	5.28	6.25	5.88	5.30	4.42	6.63	4.83	5.72	5.44	4.87	4.03	5.57	4.33	5.10	4.93
Hunter lab measurements																		
L	74.38	52.43	76.30	63.39	75.34	64.37	73.82	51.74	75.41	62.24	74.80	63.77	72.81	50.33	74.33	61.74	73.77	62.54
a	+8.42	+2.45	+5.31	+5.43	+5.44	+3.88	+7.92	+2.05	+4.82	+4.73	+4.07	+3.46	+7.12	+7.89	+4.05	+4.25	+3.78	+3.05
b	+4.33	+3.44	+7.22	+3.89	+5.78	+2.32	+4.05	+3.10	+6.51	+3.45	+4.08	+2.05	+3.83	+2.92	+6.07	+3.10	+3.72	+1.48

R = Roselle 100%, T = Tamarin 100%, D = Daum 100%

R+T = Roselle 50% + Tamarin 50%, R+D = Roselle 50% + Daum 50%, D+T = Daum 50% + Tamarin 50%

L = lightness, a (+) or (-) = Redness or greenness , b (+) or (-) = Yellowness or blueness

The organoleptic evaluation of reconstituted drinks was carried out. The effect of storage of natural drinks processed from Roselle, Tamarin and Daum and their mixes for 6 months at -18°C were tested organoleptically. Data were statistically analyzed. The obtained results are shown in Table (7) for color, taste, odor and appearance. From Table (7), it could be clearly observed that there were no noticeable or important differences in sensory attributes such as color, taste, odor and appearance during storage of all those natural singular drinks and their mixes. This indicated that the processing of those natural drinks and their mixes was completely perfect either on the zero time or during storage and after storage. They were keeping their characteristic, in good sensory properties to the extent that they were very palatable after this period.

Table 7. Effect of storage for 6 months at -18°C on sensory evaluation of Roselle, Daum and Tamarin natural drinks and their mixes.

Samples	Storage time (month)	Color	Taste	Odor	Appearance
Roselle (100%)	0	9.17 ^a	8.43 ^c	8.44 ^a	8.71 ^a
	3	9.08 ^a	8.33 ^c	8.23 ^a	8.63 ^a
	6	9.00 ^a	8.30 ^c	8.17 ^a	8.24 ^a
Daum (100%)	0	7.87 ^b	7.56 ^d	6.31 ^d	7.33 ^b
	3	7.68 ^c	7.34 ^d	6.20 ^d	7.08 ^d
	6	7.00 ^c	7.02 ^d	6.15 ^d	7.02 ^d
Tamarin (100%)	0	8.13 ^c	8.91 ^b	7.33 ^c	7.15 ^c
	3	8.64 ^b	8.23 ^d	7.00 ^c	7.00 ^d
	6	8.42 ^b	8.05 ^d	6.91 ^d	6.84 ^d
Roselle 50% + Tamarin 50%	0	9.19 ^a	9.63 ^a	8.64 ^a	9.14 ^a
	3	9.12 ^a	8.53 ^b	8.59 ^a	8.87 ^b
	6	9.04 ^a	8.42 ^b	8.43 ^b	8.62 ^b
Roselle 50% + Daum 50%	0	9.54 ^a	9.01 ^b	8.54 ^a	8.13 ^b
	3	8.54 ^b	8.90 ^b	8.25 ^a	8.07 ^b
	6	8.41 ^b	8.83 ^b	7.96 ^b	8.00 ^b
Daum 50% + Tamarin 50%	0	9.14 ^a	8.64 ^b	7.91 ^b	7.39 ^b
	3	9.07 ^a	8.44 ^b	7.68 ^b	7.22 ^b
	6	9.00 ^a	8.13 ^c	7.46 ^b	7.10 ^b
L.S.D. at 0.05		0.371	0.328	0.458	0.432

The findings agreed with those reported by Omar *et al.*, (2002).

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الإستفادة من بعض المصادر النباتية الطبيعية في إنتاج مشروبات للأطفال

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أجريت هذه الدراسة بغرض بحث إمكانية إنتاج بعض خلطات من المشروبات الشعبية الطبيعية بنسب مختلفة ومقارنتها بتلك المشروبات فردياً كلاً علي حدة بدون أي خلطات. وقد تم إستخلاص هذه المشروبات وتصنيعها من مصادر طبيعية نباتية معروفة والشائعة لدي جموع المستهلكين مثل الكركديه والتمر هندي والدوم إضافة إلي ذلك تهدف هذه الدراسة إلي تحديد وتقييم مدي قابلية تلك المشروبات وخلطاتها لدي جموع المستهلكين (عينة ممثلة من المستهلكين خاصة أطفال المدارس هم الفئات المستهدفة والمستهلكة لتلك المشروبات) كما أن تأثير التخزين علي -١٨م لمدة ٦ شهور علي كل من الخصائص الطبيعية والكيمائية لتلك المشروبات وخلطاتها كان أيضاً محل إهتمام البحث وعلي أي حال ثبت من خلال النتائج المتحصل عليها من خلال تلك الدراسة أن خلطات المشروبات بنسبة ١ : ١ (كركديه : تمر هندي ، كركديه : دوم ، تمر هندي : دوم) كانت أكثر تفضيلاً لدي المستهلكين من المشروبات الفردية التي صنعت بدون أي خلطات كما ثبت أيضاً أن التخزين علي درجة -١٨م لمدة ٦ (سنة) شهور لم يكن له تأثير ضار أو محدثاً لأي تغييرات غير مرغوبة علي خصائص الجودة المختلفة لتلك المشروبات التي تم تخزينها.

ومن هذه النتائج يمكن إستخلاص أنه من الممكن ومن الوجهة الصحية الإقتصادية إنتاج مشروبات طبيعية بخلطات معينة لتحظى بقبول عالي لدي المستهلكين حتي يشجع علي الحد من إستهلاك مشروبات أخري مضاف إليها الملونات الصناعية والكيمائية التي من المؤكد أنها ليست آمنة للأطفال.