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POSSIBILITY OF PRODUCTION HIGH β-CAROTENE CONTENT JUICES FROM EGYPTIAN COMMON FRUITS AND VEGETABLES

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ABSTRACT

Possibility of high β-carotene content juice production from our Egyptian common fruits and vegetables was the main goal of this work. So, chemical composition of raw mango, apricot, pumpkin and carrot were determined to be raw materials description then, many fruits and vegetables juice blends were processed until reached twenty blends to select the best six of them to study chemical composition mainly β-carotene content. From sensory evaluation, mango juice blends had the first order of sensory scores followed by cocktail juice blends and at last apricot juice blends. Finally, it could be concluded that it is possible to produce high β-carotene content juice from common Egyptian fruits and vegetables like mango, apricot, pumpkin and carrot with high consumer acceptability. The highest value of β-carotene was found in formula: 50% apricot + 50% carrot which represented 1000 µg/100ml.

INTRODUCTION

Fruits and vegetables had conferred on them the status of functional foods *(Hasler, 1998)*. They seem to be capable of delivering health benefits besides fulfilling physiological needs. Routine or habitual consumption of fruits and vegetables confers significant benefits to human health *(Steinmetz and Potter,1996)*. Epidemiological data as well as in vitro studies strongly suggest that foods containing phytochemicals with anti-oxidant potential have strong protective effects against major disease risks including cancer and cardiovascular diseases *(Knekt et. al., 1997 ; Elliott, 1999 ; Kaur and Kapoor 2001)*.

The protective action of fruits and vegetables has been attributed to the presence of antioxidants especially anti-oxidant vitamins including ascorbic acid, α-tocopherol and β-carotene *(Willett, 1994b; Kalt and Kushad, 2000; Prior and Cao, 2000)*.

However numerous studies have conclusively shown that the majority of the antioxidant activity may be from compounds such as flavonoids, isoflavone, flavones, anthocyanin, catechin and isocatechin rather than from vitamin C, E and β-carotene *(Wang et al., 1996 & Kahkonen et al., 1999)*.

The consumption of fruits and vegetables has been associated with lower incidence and lower mortality rates of cancer in several human cohort and case control studies for all common cancer sites *(Doll, 1990 ; Dragsted et al., 1993 ; Willett.1994a)*.

In animal experiments, vegetables that are common in human diets have been found to have antitumorigenic effects *(Bingham, 1990 and Bresnick et al., 1990)*. A highly significant negative association between intake of total fresh fruits and vegetables and ischemic heart disease mortality was reported by *Armstrong et al., (1975)* in Britain and by *Verlangieri et al., (1985)* in the United States; similar results were found among vegetarian groups *(Philips et. al., 1978; Burr and Sweetnam, 1982).*

A significant negative association was also reported between fruit and vegetable consumption and cerebrovascular disease mortality *(Acheson and Willams, 1983).*

The protection that fruits and vegetables provide against disease, including cancer and cardio and cerebrovascular diseases has been attributed to the various antioxidants contained in them *(Gey, 1990).*

However, fruits and vegetables contain many different antioxidant components. The majority of the antioxidant capacity of a fruit or vegetable may be from compounds other than vitamin C, vitamin E or β-carotene. For example, some flavonoids (including flavones, isoflavones, anthocyanins, catechin and isocatechin) that are frequently components of the human diet demonstrated strong antioxidant activities *(Bores et al., 1990 and Hanasaki et al., 1994).*

Therefore, it was of interest to measure the total antioxidant capacity of a fruit or vegetable. The objective of a study was to measure the total antioxidant capacity of some common fruits and commercial fruit juices by using the oxygen radical absorbance capacity (ORAC) assay, as modified and automated on the COBAS Fara H analyzer *(Cao et al., 1995).*

USDA, (2002) studied the chemical composition of mango and found that it contained 81.71% moisture, 65 Kcal/100g, 0.50% ash, 1.80% fiber , 14.8% total sugar, while content of iron, calcium, potassium, magnesium, were: 0.13, 10, 156, 9 mg/100g, 445 µg β-carotene, respectively while, chemical composition of apricot was 86.35% moisture, 48 Kcal/100g, 0.75% ash, 2.0% fiber , 9.24% total sugar, while content of iron, calcium, potassium, magnesium, were: 0.39, 113, 259, 10 mg/100g, 1094 µg β-carotene, respectively.

Chemical composition of fresh carrots was: 87.79, 1.03, 0.19, 0.86, 10.14, and 1.50% for moisture, protein, fat, ash, carbohydrate and fiber, respectively. Also, the following contents were found: 27, 0.5, 44, 323, 35, 0.20, 0.46, 0.142, 9.30, mg/100g and 28129 IU/100g for Ca, Fe, P, K, Na, Zn Cu, Mn , vitamin C and vitamin A, respectively, 8285 µg/100g β-carotene but the same author studied chemical composition of pumpkins and found that it contained 91.60% moisture, 26 Kcal/100g, 1% crude protein, 0.10% crude fat, 0.80% ash, 0.50% fiber and 6.50% carbohydrate. As for of vitamin A it was 1600 IU/100g and 9 mg/100g for vitamin C, while content of iron, calcium, potassium, phosphorus, copper, magnesium, manganese, zinc and sodium were: 0.80, 21, 340, 44, 0.13, 12, 0.12, 0.32 and 1 mg/100g, 3100 µg β-carotene, respectively.

Mixed juices and their derivatives such as, nectars prepared therefore are considered as the important untraditional product. Now it is largely distributed in the world wide markets due to pleasant mouthful feel, taste, color and aroma perception, as technological and sensorial advantages. Moreover it would lead to health promotion as therapeutically beverage and also to gain excessive economical benefits based on a lot of consumption *(Allam, et al., 2009).*

New technologies, production practices and food manufacturing processes are being developed to meet the society excessive needs. food companies are developing new foods (including functional foods) with better nutritional properties. Juice mixtures containing fruits and vegetables have the potential to contain a better and healthier diet., *(Rodrigo et al., 2003).*

So the main goal of such work was directed to study possibility of production high β-carotene content juices from our common fruits and vegetables.

MATERIALS AND METHODS

Materials:

Raw Fruits and vegetables:

Mango *(Mangifera indica L.)*, Apricot *(Prunus armeniaca L.)*, Carrots *(Daucus carota L.)* and Pumpkins *(Cucurbita moschata)* were obtained from the supermarket in Mansoura city.

Glass bottles:

Transparent glass bottles were purchased from local market in EL-Mansoura city, EL-Dakahlia, Egypt.

Methods:

Preparation of juice blends:

The following diagram explained processing steps which were carried out as a preliminary step, towards preparing formulated juice blends as described by *El-Sayed, (1966).*

Fresh fruit and vegetables
↓
Washing, sorting and trimming
↓
Extraction of juice
↓
Packing
↓
Deaeration + pasteurization
↓
Addition of 0.1 % citric acid + sucrose

Washing: Manual washing with 2% citric acid solution.
Sorting: visual sorting to discard defected fruits or vegetables.
Trimming: Manual trimming by knife.
Extraction of juice: Mango juice, pumpkin juice and apricot juice were extracted using a high speed blender and carrot juice was extracted using a kitchen machine.
Packing: juice blends were packed in glass jars in case of pasteurization.
Deaeration: juice was deaerated by heating at 88°C for one minute during pasteurization.

Prepared formulated fruit and vegetable juice blends were shown in Table (1).

Table (1): Formulated fruit and vegetable juice blends.

Blends	Ingredients %			
	Mango %	Apricot %	Pumpkin %	Carrot %
No. (1)	80	0	20	0
No. (2)	60	0	40	0
No. (3)	50	0	50	0
No. (4)	80	0	0	20
No. (5)	60	0	0	40
No. (6)	50	0	0	50
No. (7)	0	80	20	0
No. (8)	0	60	40	0
No. (9)	0	50	50	0
No. (10)	0	80	0	20
No. (11)	0	60	0	40
No. (12)	0	50	0	50
No. (13)	50	0	25	25
No. (14)	0	50	25	25
No. (15)	40	40	20	0
No. (16)	40	40	0	20
No. (17)	40	40	10	10
No. (18)	30	30	20	20
No. (19)	25	25	25	25
No. (20)	35	35	15	15

Preservation of juice blends:

Pasteurization at 88°C for one minute followed by cooling to 5°C in water bath.

The twenty fruit and vegetable juice blends were divided into three groups as followed:

Category (1): from 1 to 6 (Mango).

Category (2): from 7 to 12 (Apricot).

Category (3): from 13 to 20 (Cocktail).

Then, according sensory evaluation, the best two blends from each group will be chosen and chemically evaluated.

Chemical analysis:

Moisture, ash and total solids were determined according to *(AOAC, 2000).*

Energy value: It was calculated as follows:

Energy value = (% total sugars × 4.1) according to *(AOAC, 1995).*

Total, reducing and non-reducing sugars were determined according to the methods of *(AOAC, 2000).*

Total soluble solid was determined using refractometer and pH value was determined using pH meter according to *(AOAC, 1995).*

Minerals content were determined according to *(AOAC, 1995)* using Elmer, 2380, Atomic Absorption Spectroscopy (AAS) apparatus.

Determination of β-carotene (HPLC):

Extraction of yellow carotenoids:

Yellow carotenoids were extracted using acetone and petroleum ether solvents. To measure total carotenoids, 5ml of petroleum ether extract of the sample was pipetted to a 100ml volumetric flask containing 3ml acetone and diluted to mark with petroleum ether *(Rangana 1979).*

Then, β-carotene was determined according to the method described by *(Weissenberg , et al., 1997)* at Food Technology Research Institute, Agricultural Researches Centre, Giza, Egypt.

HPLC conditions:

An Agilent 1100 series liquid chromatograph (Agilent Technologies, Waldbronn, Germany), consisting of a vacuum solvent degassing unit, (a quaternary gradient pump), an automatic sample injector. Column: C18 5µm, 150mm×4.6mm i.d. (Zorbax, Germany) was used at ambient temperature.

Chromatogram were monitored at 450nm; the mobile phase was acetonitrile-2-propanol-ethyl acetate(40;40;20, v.v.v.) ; the flow rate was 0.8 ml/min.

The extracts obtained as described above were dissolved in mobile phase (1 ml), filtered through a 0.45µm membrane disc and injected into the chromatograph (injection volume, 10 µl). The column was regenerated by washing with 2-propanol after analysis, and then equilibrated with the mobile phase *(Weissenberg , et al., 1997)*

Sensory evaluation:

Different extracted juices and nectars blends were organoliptically evaluated as reported by *(Chan and Cavaletto, 1982).* The samples were judged through ten members (ten panelists) of the stuff located at the Department of Food Industries, Faculty of Agriculture, Mansoura University, Egypt. The panelists were requested for taste, color, aroma, appearance and overall acceptability.

Statical analysis:

The data of sensory evaluation were statically analyzed using program SPSS 10 version using one way ANOVA procedure *(SPSS, 1990).*

RESULTS AND DICSSIONS

Chemical composition of raw materials:

Data given in Table (2) show chemical composition of raw fruits and vegetables (Mango, Apricot, pumpkin and carrot). From these data, it could be noticed that the highest value of moisture was in pumpkin which represented 90.60% while the least value was in mango (82.30%). As ash content, it ranged from 0.5 – 0.8% but total sugar was 8.30% in carrot and 15.00% in mango. Reducing sugar which mainly pointed to glucose was 4.05% in pumpkin and was 7.20% in mango. Also, mango had the highest value of non-reducing sugar (7.80%) and carrot had the least value (2.05%). Total soluble solids content ranged from 9.20 to 16.50% in pumpkin and mango, respectively. In similar, total solids content was 9.40% in pumpkin and 17.70% in mango.

pH value of raw fruits and vegetables ranged from 3.50 (Apricot) to 5.70 (Carrot). Mango had the highest energy value per 100 g which represented 61.50 Kcal followed by apricot (56.76 Kcal.). Concerning of juices yield, apricot had the highest value (68.00%) and carrot had the least value (60.00%).

From tabulated data in Table (2), apricot had the highest value of iron (Fe) where it was 1.10 mg/100g but mango was very poor in iron (0.50 mg/100g). Calcium (Ca) content ranged from 10 to 30 mg/100g in mango and apricot, respectively. Magnesium (Mg) content was 11.30 mg/100g in pumpkin and 18.00 mg/100g in mango. Finally, potassium (K) found in pumpkin was 340 mg/100g and found in mango was 189 mg/100g.

From the previous data, It could be concluded that pumpkins contained the highest values of most studied components on dry weight base. Apricot showed the highest value of iron and calcium. While mango had the least value of iron and the highest value of magnesium. These findings were in good agreement with those obtained by *USDA, 2002.*

Table (2): Approximately chemical composition of raw fruits and vegetables.

Components		Raw materials			
		Mango	Apricot	Pumpkin	Carrot
Moisture %		82.3	84.2	90.6	87.5
Ash %	*W.W.*	0.5	0.7	0.7	0.8
	D.W.	2.82	4.43	7.45	6.40
Total sugar %	*W.W.*	15.0	12.9	9.3	8.3
	D.W.	84.75	81.65	98.94	66.40
Reducing sugar %	*W.W.*	7.20	5.60	4.05	6.25
	D.W.	40.68	35.44	43.09	50.00
Non-reducing sugar %	*W.W.*	7.80	7.30	5.25	2.05
	D.W.	44.07	46.20	55.85	16.40
T.S.S. %	*W.W.*	16.5	14.3	9.2	10.3
	D.W.	93.22	90.51	97.87	82.40
T.S. %	*W.W.*	17.7	15.8	9.4	12.5
	D.W.	100	100	100	100
pH value		3.85	3.50	4.30	5.70
Energy(Kcal/100g)		61.50	56.76	38.13	34.03
Juice yield %		63	68	65	60
Minerals (mg/100g)					
Fe		0.5	1.1	0.85	0.6
Ca		10	30	20.8	25
Mg		18	12	11.3	17.5
K		189	281	340	320

: W.W. means wet weight base and D.W. means dry weight base.

Organoleptic evaluation of the formulated fresh juice blends:

Sensory evaluation of the formulated fresh juice blends is considered one of the main important tests affecting their acceptability of the prepared fresh juices.

Results of Table (3) showed average scores of organoleptic evaluation of fruit and vegetable juice blends. Data in this table showed values of taste, color, odor, appearance, and overall acceptability of the formulated fruit and vegetable juice blends.

Table (3): Sensory evaluation scores of twenty fruits and vegetables juice blends.

Juice blends					Sensory parameters					
No.	Mango%	Apricot %	Pumpkin %	Carrot %	Taste (20)	Color (20)	Odor (20)	Appearance (20)	Total (80)	Overall %
1	80	0	20	0	15.2 ± 2.09^{a}	16.1 ± 2.18^{a}	16.4 ± 2.80^{a}	15.5 ± 1.65^{a}	63.2 ± 7.67^{a}	79.00
2	60	0	40	0	13.3 ± 2.45^{abcde}	15.2 ± 2.25^{ab}	13.4 ± 2.69^{bcder}	14.5 ± 2.22^{ab}	56.4 ± 7.97^{abcd}	70.50
3	50	0	50	0	13.7 ± 2.67^{abcd}	15.2 ± 2.44^{ab}	13.5 ± 2.02^{abcd}	14.3 ± 2.79^{ab}	57.1 ± 8.98^{abc}	71.38
4	80	0	0	20	14.5 ± 2.64^{ab}	15.1 ± 2.80^{abc}	14.4 ± 2.32^{ab}	13.7 ± 2.31^{abcde}	57.7 ± 8.88^{ab}	72.13
5	60	0	0	40	11.9 ± 2.28^{cde}	15.0 ± 2.62^{abcd}	12.8 ± 2.6^{bcder}	12.6 ± 2.67^{bcde}	52.3 ± 8.72^{bcde}	65.38
6	50	0	0	50	12.0 ± 2.98^{bcde}	14.5 ± 3.31^{abcde}	12.4 ± 3.84^{bcder}	12.7 ± 2.79^{bcde}	51.6 ± 11.50^{bcde}	64.50
7	0	80	20	0	11.2 ± 3.79^{de}	12.1 ± 2.02^{efg}	10.9 ± 3.48^{f}	11.8 ± 2.82^{de}	46.0 ± 10.10^{e}	57.50
8	0	60	40	0	12.0 ± 2.83^{bcde}	11.3 ± 2.45^{fg}	11.2 ± 2.04^{ef}	12.1 ± 2.59^{cde}	46.6 ± 8.08^{e}	58.25
9	0	50	50	0	11.2 ± 3.25^{de}	11.9 ± 2.33^{efg}	12.5 ± 3.47^{bcdef}	12.0 ± 2.31^{cde}	47.6 ± 10.25^{de}	59.50
10	0	80	0	20	11.1 ± 2.28^{e}	12.2 ± 3.19^{defg}	11.4 ± 2.95^{def}	11.5 ± 1.78^{e}	46.2 ± 8.48^{e}	57.75
11	0	60	0	40	11.5 ± 2.79^{cde}	12.6 ± 3.84^{bcdefg}	11.7 ± 3.27^{cdef}	12.5 ± 2.88^{bcde}	48.3 ± 11.34^{cde}	60.38
12	0	50	0	50	12.2 ± 2.82^{bcde}	13.0 ± 4.16^{bcdefg}	11.6 ± 3.34^{cdef}	12.8 ± 2.20^{bcde}	49.6 ± 11.48^{bcde}	62.00
13	50	0	25	25	13.7 ± 3.33^{abcd}	15.0 ± 3.50^{abcd}	14.7 ± 2.83^{ab}	14.1 ± 2.51^{abc}	57.5 ± 11.34^{ab}	71.38
14	0	50	25	25	12.4 ± 2.06^{bcde}	12.6 ± 3.20^{bcdefg}	13.1 ± 3.54^{bcdef}	12.8 ± 2.10^{bcde}	50.9 ± 9.49^{bcde}	63.63
15	40	40	20	0	13.9 ± 3.41^{abc}	11.6 ± 3.55^{fg}	13.6 ± 2.99^{bcde}	13.9 ± 2.64^{abcd}	53.0 ± 11.57^{bcde}	66.25
16	40	40	0	20	12.3 ± 3.06^{abcde}	10.8 ± 3.22^{g}	13.9 ± 3.18^{abcd}	13.2 ± 2.20^{bcde}	51.2 ± 9.99^{bcde}	64.00
17	40	40	10	10	12.5 ± 2.32^{bcde}	13.1 ± 3.45^{bcdefg}	13.0 ± 2.19^{bcdef}	13.0 ± 2.36^{bcde}	51.6 ± 9.74^{bcde}	64.50
18	30	30	20	20	12.3 ± 2.75^{bcde}	14.0 ± 4.11^{abcdef}	13.3 ± 1.95^{bcdef}	13.7 ± 3.13^{abcde}	52.7 ± 10.99^{bcde}	65.88
19	25	25	25	25	12.8 ± 3.79^{abcde}	12.5 ± 4.60^{cdefg}	14.2 ± 3.12^{abc}	13.6 ± 3.27^{abcde}	52.9 ± 13.98^{bcde}	66.13
20	35	35	15	15	12.4 ± 2.84^{bcde}	11.6 ± 4.08^{efg}	13.1 ± 3.28^{bcdef}	12.9 ± 2.33^{bcde}	50.2 ± 11.07^{bcde}	62.75
Mean					12.66	13.27	13.07	13.16	52.15	65.14
LSD at p = 0.05					2.53	2.88	2.60	2.21	9.00	---

From statical analysis of data in Table (3), taste mean of all juice blends was 12.66 while, color mean was 13.27, odor mean was 13.07, appearance mean was 13.16 and finally, overall mean was 52.15. There were significant differences at portability 5% between all juice blends.

As category (1), mango juice blend No. (1): (80% mango + 20% pumpkin) had the highest values of all sensory parameters followed by juice blend No. (4) contained 80% mango + 20% carrot but mango juice blend No. (6): (50% mango + 50% carrot) had the least ones.

For category (2), apricot juice blend No (12) contained 50% apricot + 50% carrot and No. (11): 60% apricot + 40% carrot had the highest values of overall percent which represented 62.00 and 60.38, respectively. But juice blend No. (7) contained 80% apricot + 20% pumpkin had the least value (57.50). Meanwhile, category (3), cocktail juice blends could be arranged for the highest values of overall as follow: blend No. (13): 50% mango + 25% pumpkin + 25% carrot > blend No. (15): 40% mango + 40% apricot + 20% pumpkin > blend No. (19): 25% mango + 25% apricot + 25% pumpkin + 25% carrot.

In conclusion, mango juice blends had the first order of sensory scores followed by cocktail juice blends and finally apricot juice blends. Table (3), also, showed that sensory evaluation scores of the best six fruit and vegetable juice blends according to statical analysis of panel taste data in a shadow form. Selected juice blends represented the best two blends in every category. Juice formula (80% mango + 20% pumpkin), juice formula (80% mango + 20% carrot), juice formula (60% apricot + 40% carrot), juice formula (50% apricot + 50% carrot), juice formula (40% mango + 40% apricot + 20% pumpkin) and juice formula (50% mango + 25% pumpkin + 25% carrot) showed the highest scores of total scores which were: 63.20 ± 7.67, 57.70 ± 8.88, 48.30 ± 11.34, 49.60 ± 11.48, 57.50 ± 11.34 and 53.00 ± 11.57, respectively.

Formula: 80% mango + 20% pumpkin; formula: 80% mango + 20% carrot; formula: 40% mango + 40% apricot + 20% pumpkin and formula: 50% mango + 25% pumpkin + 25% carrots showed the highest scores of taste: 15.20; 14.50; 13.90 and 13.7, respectively. While, Formula: 80% mango + 20% pumpkin; formula: 80% mango + 20% carrot; formula: 50% mango + 25% pumpkin + 25% carrot and formula: 50% apricot + 50% carrot showed the highest scores of color: 16.10; 15.10; 15.00 and 13.0, respectively.

Formula: 80% mango + 20% pumpkin had the highest score of odor (16.40) followed by formula: 50% mango + 25% pumpkin + 25% carrot (14.70) then, formula: 80% mango + 20% carrot (12.40) and formula: 40% mango + 40% apricot + 20% pumpkin (13.60). But in case of appearance, formula: 80% mango + 20% pumpkin showed the highest score (15.50) followed by formula: 50% mango + 25% pumpkins+ 25% carrot (14.10) ; formula: 40% mango + 40% apricot + 20% pumpkin (13.90) and formula: 80% mango + 20% carrot (13.70).

Finally from statical results, there were no significant differences between every two juice blends from the same category in all sensory parameters except in case of color of the third group where there was a significant difference at probability 0.05 where, formula: 40% mango + 40%

apricot + 20% pumpkin had the least score of colour which was 11.6 ± 3.55 and this notice will affect this juice blend consuming ability because of the importance of colour in human acceptability.

Least significant difference (LSD at p = 0.05) for taste, colour, odor, appearance and overall were 2.53, 2.88, 2.60, 2.21 and 9.00, respectively. This number means that if differences between juice blends more than every previous number, in its case, it will be significant differences at probability 0.05 between these two juice blends in this sensory parameter.

Different blends of fruit and vegetable juice may be rich in different components (β-carotene) compared with individual fruits and vegetables. Fruits and vegetables contain many different antioxidant components. The majority of the antioxidant capacity of a fruit or vegetable may be from compounds other than vitamin C, vitamin E or β- carotene. For example, some flavonoids (including flavones, isoflavones, anthocyanins, catechin and isocatechin) that are frequently components of the human diet demonstrated strong antioxidant activities *(Hanasaki et. al., 1994).*

Chemical composition of the best six fruit and vegetable juice blends:

Juice blend No. (1):(80% mango + 20% pumpkin):

Data tabulated in Table (4) showed that juice blend No.(1) contained 84.34% moisture, 0.58% ash, 15.97% total sugars, 4.60% reducing sugars, 11.37% non-reducing sugars, 15% total soluble solids, 15.66% total solids and 4.35 pH value while, it contained 250 µg/100ml β-carotene.

Data in Table (4) showed that, minerals content were: 1.20, 455, 5.00, and 0.23 mg/100g for calcium, potassium, magnesium and iron, respectively.

The low content of β-carotene of this blend sure was due to low mango content (445 µg/100g) and relative high pumpkin content (3100 µg/100g) of β-carotene *(USDA, 2002).*

On the other hand, this blend had high contents of different minerals (K, Mg, and Ca). This may be due to its content in mango and pumpkin where both of them are rich in one or more of those minerals.

These results go in parallel with those found by *Wafaa & Mohamed, 2004 and Nagib, 2005.*

Juice blend No. (4):(80% mango + 20% carrot):

From data in table (4), it could be noticed that juice blend No.(4) contained 83.97% moisture, 0.34 % ash, 16.00 % total sugars, 4.60 % reducing sugars, 11.40 % non-reducing sugars, 15.50% total soluble solids, 16.03 % total solids and 4.32 pH value .It could be further observed, this blend contained 675 µg/100ml β-carotene.

In this concept, results in table (4) showed that this juice blend contained 1.20 mg calcium, 454 mg potassium, 3.77mg magnesium and 0.06 mg iron /100g.

The high amounts of β-carotene and potassium in this blend may be due to its carrot high content of β-carotene (8285 µg/100g) and potassium (323mg/100g) *(USDA, 2002).* These findings agree with those found by *Rezk, 2003; Elbastawesey, et al., 2003 and Nagib, 2005.*

Table (4): chemical composition of the best six fruits and vegetables juice blends.

Juice blends					Components									
No.	Mango %	Apricot %	Pumpkin %	Carrot %	Moisture %	Ash %	Total sugar %	Reducing sugar %	Non-reducing sugar %	T.S.S. %	T.S. %	pH value	β-carotene (µg/100ml)	Energy (Kcal/100g)
1	80	0	20	0	84.34	0.58	15.97	4.60	11.37	15.00	15.66	4.35	250	65.48
4	80	0	0	20	83.97	0.34	16.00	4.60	11.40	15.50	16.03	4.32	675	65.60
11	0	60	0	40	85.17	0.38	15.97	3.67	12.30	15.00	15.10	4.06	625	65.47
12	0	50	0	50	84.80	0.37	15.68	4.28	11.40	15.00	15.20	4.06	1000	64.29
13	50	0	25	25	84.94	0.24	15.84	7.24	8.60	14.50	15.06	3.95	525	64.94
15	40	40	20	0	84.97	0.27	15.54	6.44	9.10	14.50	15.03	3.95	500	63.71

Juice blends					Minerals (mg/100g)			
					Fe	Ca	Mg	K
1	80	0	20	0	0.33	1.20	5.00	455
4	80	0	0	20	0.06	1.20	3.77	454
11	0	60	0	40	1.00	1.60	3.80	309
12	0	50	0	50	0.17	1.90	3.80	322
13	50	0	25	25	0.13	1.30	4.5	347
15	40	40	20	0	0.13	2.30	2.80	418

Juice blend No. (11):(60% apricot + 40% carrot):

Results in Table (4) showed that juice blend No.(11) contained 85.17% moisture, 0.38% ash, 15.97 % total sugars, 3.67 % reducing sugars, 12.30 % non-reducing sugars, 15.00 % total soluble solids, 15.10 % total solids and 4.06 pH value.

This juice blend contained 625 µg/100ml β-carotene, 1.60 mg calcium, 309 mg potassium, 3.80 mg magnesium and 1.00 mg iron /100g. Such high quantity of β-carotene and potassium in this blend may be due to its content of apricot and carrots which are rich in one or more of these components.

These findings agree with those reported by *USDA, 2002 ; Dokar, et al., 2004 and Akin, et al., 2008.*

Juice blend No. (12):(50% apricot + 50% carrot):

The chemical composition of juice blend No.(12) were given in Table (4). Results showed that, it contained 84.80% moisture, 0.37% ash, 15.68% total sugar, 4.26% reducing sugar, 11.40% non-reducing sugar, 15.00% total soluble solids, 15.20% total solids, 4.06 PH value and 1000 µg/100ml β-carotene. On the other hand, results in the same table showed that blend contained 1.90, 322, 3.80 and 0.17 mg/100g for calcium, potassium, magnesium and iron, respectively.

This juice blend had the highest amounts of β-carotene and potassium and this result may be due to high content of β-carotene and potassium in apricot and carrot where apricot contained 1094 µg β-carotene and 259 mg/100g potassium while carrot contained 8285 µg/100ml β-carotene and 323mg/100g potassium *(USDA, 2002).*

Juice blend No. (13):(50% mango+25% pumpkin+25% carrot):

In the same concept, results in table (4) showed that juice blend No.(13) contained 87.94 % moisture, 0.24% ash, 15.84 % total sugars, 7.24 % reducing sugars, 8.60 % non-reducing sugars, 14.50 % total soluble solids, 12.06 % total solids, 3.95 pH value and 525 µg/100ml β-carotene. While, this juice blend contained 1.30 mg calcium, 347mg potassium, 4.50 mg magnesium, and 0.13 mg iron /100g.

β-carotene content in this juice blend was not clear high because although carrot contained the highest value of β-carotene, it represented low percent in juice blend (25%).

Juice blend No. (15):(40% mango+40% apricot+20% pumpkin):

Results in table (4) showed that juice blend No. (15) contained 84.97% moisture, 0.27% ash, 15.54% total sugars, 6.44% reducing sugars, 9.10% non-reducing sugars, 14.50% total soluble solids, 15.03% total solids and 3.95 pH value. Also, data in the same table showed that this fresh juice blend contained 500 µg/100ml β-carotene, 2.30 mg calcium, 418 mg potassium, 2.80 mg magnesium, and 0.13 mg iron /100g.

From previous results, Table (4), it could be seen that, formula: 60% apricot + 40% carrot had the highest value of moisture and non-reducing sugar while, formula: 80% mango + 20% pumpkin had the highest value of ash and pH but, the least value of β-carotene.

Also, formula: 80% mango + 20% carrot had the highest value of total sugar, total soluble solids, total solids and energy but formula: 50% mango + 25% pumpkin + 25% carrot had the highest value of reducing sugar. β-carotene content of formula: 50% apricot + 50% carrot was 1000 µg/100ml and this content was the highest.

As minerals, formula: 80% mango + 20% carrot contained the highest value of magnesium (5.00mg/100g) and potassium (455mg/100g). Meanwhile, formula: 60% apricot + 40% carrot had 1.00 mg/100g iron and formula: 40% mango + 40% apricot + 20% pumpkin had the highest value of calcium (2.30 mg/100gm).

The FAO/WHO recommend a daily intake of 500 to 850 micrograms of vitamin A (Retinol Equivalent "RE") for adults (500 micrograms for females, 600 micrograms for males, 800 micrograms during pregnancy, and 850 micrograms during breast feeding) and a daily intake of 400 micrograms for a child between 1 to 3 years of age. This level of intake is set to prevent clinical signs of deficiency and to allow normal growth. Higher levels of vitamin A are needed during breast feeding, as the milk is the source of vitamin A for the baby *(FAO/WHO, 1988)*. Until recently, 6 micrograms of β-carotene was assumed to equate to 1 microgram of vitamin A (*FAO/WHO, 1967*) when converted in the human body.

Finally, it could be concluded that it is possible to produce high β-carotene content juice from common Egyptian fruits and vegetables like Mango, Apricot, pumpkin and carrot. The highest value of β-carotene was found in juice blend No.(12) which consisted of 50% Apricot + 50% Carrot which represented 1000 µg/100g.

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إمكانية إنتاج عصائر مرتفعة المحتوى من البيتا كاروتين من الفاكهة و الخضر المصرية الشائعة

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إن الهدف الرئيسي من هذه الدراسة هو إمكانية إنتاج عصائر مرتفعة في محتواها من البيتاكاروتين باستخدام الفاكهة و الخضر المصرية الشائعة. لذا تم تقدير التركيب الكيماوي لكلاً من المانجو ، المشمش ، القرع العسلي و الجزر كتوصيف للمادة الخام ثم تم تصنيع العديد من خلطات عصائر الفاكهة و الخضر حتى الوصول إلى عشرين خلطة لاختيار أحسن ست خلطات في الصفات الحسية لدراسة التركيب الكيماوي لهم خاصة محتواهم من البيتا كاروتين. و لقد احتلت خلطات المانجو المرتبة الأولى يليها خلطات الكوكتيل و أخيراً خلطات المشمش. و كان مخلوط العصير المكون من ٥٠% مشمش + ٥٠% جزر هو الأعلى في محتواه من البيتا كاروتين حيث احتوى على ١٠٠٠ ميكروجرام/١٠٠مل.