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PHYSIOCHEMICAL MICROBIOLOGICAL AND SENSORIAL ASPECTS OF FRUIT LEATHER BLENDS OF PROCESSED BUTTERNUT WINTER SQUASH, MANGO AND GUAVA

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ABSTRACT: ***Butternut winter squash (Cucurbita moschata), was used in combination of Mangofera indica (Alfonso variety) and Guava fruits Psidun guava L in different ratio to produce dried fruit leather of high nutritional values .The extracted pulps were subjected to microwave oven(90watt) for 2 min to inhibit oxidative enzymes before being dried in forced hot air oven at 60^{O}C for 8-10 hrs on average .Moreover Sodium meta bisulfate was used in 0.2% to inhibit chemical and enzymatic discoloration and the preservation of both vitamin C and carotene. The leather fruit blends were stored for 6 months at room temperature. Change that occurred during processing and storage were studied. Organoleptic properties and SO_2 residue were estimated color changes were determined through using both optical density at 240nm and Hunter color difference meter measurements. Both bacterial, yeast and mold count were determined for fresh dried and stored products. Chemical composition were also determined in the fresh, dried and stored fruit leathers for comparison.***

In all cases, blends could be arranged in descending order pertaining quality as follows blend No.3, blend No.1, blend No.2 and blend No. 4.

Key word: ***Fruit leather, Butternut winter squash, Mango and Guava.***

INTRODUCTION

Juice blend is a new concept in the manufacture of fruit juices .It gives a new aroma which could be favorable to the interesting consumer. Beside, many other nutritional and economical trends could be attained.

Butternut winter squash newly introduced in Egypt which arrive late in the growing season and has a long shelf life. Its flavor is sweet, moist and pleasantly nutty. Winter squash is also a source of potassium niacin, iron and beta carotene. The orange –flashed squash is also an excellent source of beta carotene. as general rule, the deeper the orange color, the higher the beta carotene content . Beta carotene is converted to vitamin A in the body. Vitamin A being essential for healthy skin, vision, bone development and maintenance as well as many other function B carotene is an antioxidant like selenium which can inhibited excess of, lipid peroxidation in the cell (Morton 1990). Beside, its high content of dietary fiber plays an important

role in reducing the incidence of colon cancer.(*Aguero et al 2008)* stated that members of cucurbitaceae family make significant contribution to our intake of vitamins and minerals. There has been interest in carotenoids for possible anti carcinogenic activity (Zhang *et al* 1992).

On the other hand, Mango is one of the most delicious tropical fruits mango is a good source of carotene and minerals(Naguib 2000). (Askar 1966) reported that Egyptian mango varieties contained 73.2-84.3% moisture 0.29-1.42% ash 0.1-1% total acidity 1.28- 3.36% reducing sugars 8.93- 11.18% non reducing sugars 7.27-15.15% total sugars 0.59-1.42% protein and 22-27 mg /100gm ascorbic acid. (Avena and luh 1983) indicated that fresh mango fruits *(Mangifera indica L. kant variety)* contained 23.8% fructose 7.2% glucose 69.0 sucrose 20.6 total solids 18.9 total soluble solids , 0.447 % titratable acidity and 45.6mg /100gm ascorbic acid on fresh wet basis (Askar 1966) reported that Egyptian mango varieties contained 73.2- 84.3 % moisture 0.29%-1.42 % ash 0. 1 -1.1 % total acidity 1.28- 3.36 % reducing sugar 8.43-11.18 % non reducing sugars 7.27- 15.65 % total sugars, 0.59- 1.42 % protein and 22-77mg/100gm ascorbic acid. (Abd EL -Fadeel 1981) mentioned that mango balady variety contained 16.27% total solids 15.80% total soluble solids 0.63% total acidity 11.20% total sugars 1.92% reducing sugars and 16.52 mg /100gm ascorbic acid whereas the corresponding values of Pairy variety were 17.67 %, 17.25, 0.56 % 12.57 % 1.05 % and 14.35 mg/100gm.

Beside, guava is an excellent source of ascorbic acid dietary fiber vitamin A and calcium Guava puree is used in juice ,cakes, pudding, ice cream jam and jelly (Nakason and Paul ,1998 & Yen and Lin 1999)Total acidities ,total sugars and ascorbic acid content ranged from 0.2 % to 1.7%, 45.86 to 70.6 and 428.98 to 507.8 respectively on dry weight basis (Amer 1960,Abd Allah 1966, *Heikal et al* 1972, Hussein 1983 and Nakasone and Paul 19٩8) .

The present work was carried out aiming to prepare new dried leather of juice blends which were higher in nutrients such as vitamins and minerals and in the same time acceptable to the consumer in respect to flavor and aroma with economical rate.

MATERIALS AND METHODS

Materials:

A: Mango Fruits (*mango fera indica, L*) Alfonso variety were obtained from special farm at Al harraim belong to the Agriculture Research Center in Giza Governorate in September 2007. Fruits were picked at the ripe stage of maturity .

B: Guava Fruits (*Psidun guava,L)* were brought from special farm at Helwan Fruits were picked at the ripe stage in September 2007.

C: Butternut winter squash (*Cucurbita moschata*) were brought from Kaha Agriculture Research Station Horticulture Research Institute in march 2007 Fig (1).

Fig 1

Methods:

Technological methods:

1: Mango fruits were washed hand peeled ,cut into halves and pulped with waring blender and screened .

2: Guava fruits were washed cut into quarters and pulped with the waring blender and screened.

3: Butternut winter squash was washed, cut in fourths and peeled. With a spoon the center were scooped out to remove seeds and fibers .The squash was cut into one inch cubes which were blanched by microwave to improve the color and prevent discoloration. After blanching the cubes were pulped in a blender packed in polyethylene bags frozen at -20C^{o} and stored at -18C^{o} till being used the extracted juices were mixed together to obtain blends at the ratio indicated in Table (1). .

Table (1) : The blends of tested extracted juices .

Minerals	Blend (1)	Blend (2)	Bland (3)	Bland (4)
Mango	1	----	2	----
Guava	----	1	------	1
Butternut squash	1	1	1	2

All blends were treated by adding sodium meta bisulphate 0.2 %. The prepared blends were poured at stainless steel trays oiled with paraffin oil. The electric forced air dryer was used to dry the sample for 8-10 on average hours its temperature was thermostatically controlled at 60 C^{o} while the circulating air speed was about 3m/sec.

The dried leather were packed in polyethylene bags then stored at room temperature for 6 months. Samples were drawn every two months for being analyzed and evaluation. All blends subjected to microwave for 2 min to inhibit the enzyme discoloration and to introduce a porous structures before being dried by the forced hot air dryer.

Physical properties:

Color were determined using hunter color difference meter. Minolta which defines the color in 3 dimensional space *L to indicate lightness and a*, b* are the chromaticity coordinates.

$$E\bar{\Delta} = \sqrt{\left[(\Delta l)^2 + (\Delta a)^2 + (\Delta b)^2\right]}^{\frac{1}{2}}$$

Color intensity :

Five gms of dried sample were crushed in a mortar by 40 ml of water alcohol mixture (1:1.v/v) solution . The mixture was filtered with aid of suction and water in alcohol volume was completed to 50ml .The absorbance of the clear solution was recorded using spectrophotometer at wave length of 420 nm as described by (Nury and Brekke 1963).

Chemical analysis:

Moisture content ,total soluble solids , total acidity(as citric acid) total reducing and reducing sugars ascorbic acid ,ash and fiber were determined according to the methods described in the (A.O.A.C. 1990) total carotenoids were estimated as stated by(Ranganna1977).

Microbiological methods:

Total viable counts (TS) in duplicate plates were incubated with 1 ml for each dilution and thoroughly mixed with 10-15 ml portions of nutrient agar (Difco Manual 1985). The solidified plates were incubated at 37C^{o} for 48 hr. The plate of the suitable dilution was recorded and the viable counts after the incubation period of were estimated.

Yeast and molds contents duplicate samples (ml) from the final dilution, were transferred to Petri dishes and the malt agar was poured (Merck 1982) the plates were incubated at 30C^{o} for 72 hr .The average counts yeast and molds colonies were estimated.

Reconstitution of dried leather blends .A volume of water necessary to reconstitute the dried leather blends to the total soluble solids contents of the single strength juice was used

Sensory evaluation :

Ten panelists evaluated the fruit blends after being rehydrated Organoleptic evaluation was carried out according to the procedure described by (Reitmeier and Nonnecke 1991).

Statistical methods:

Data were statistically analyzed to facilitate comparing the least significant differences (LSD) between means of different values according to (Snedecor and Cochran 1973).

Sulfur dioxide in the sulphured dried samples was estimated according to the methods described by (Pearson and Wong 1971).

RESULT AND DISCUSSION

Fresh juice blends were subjected to microwave treatments at (90watt) for 2min to inhibit the oxidative enzymes responsible for discoloration . The absorption of microwave energy by water molecules in the interior of the

juice resulting in rapid evaporation causing partial puffing improved the color of the final products .

Moreover, moisture content decreased obviously, percent decrement was about 10%. Thereafter leather blends were dried in the forced hot air dryer. Moisture diffusivity through the dried leather increased due to porosity of the leather formed by microwave treatment a similar effect was reported by *(Tulasidas et al 1993)* and (*Raghavans et al 1994).*

In this respect *(Nighuis et al 1998)* reported that water molecules are polar i.e. the center of charge is displaced . This means that they can rotate under the influence of the alternating electrical field. Fruit juices contained over 80% moisture .Thus juices are very well suitable for heating and drying with microwave energy. In hot air drying the product surface becomes dry first and the dried food layer is poor conductor of heat throughout the dehydration process. Microwave however is able to penetrate a dry surface layer and heat the juices through out all high moisture regions. This promotes water transport increases drying rate.

Results in Tables (2 and 3) represent the different constituents of prepared blends before and after being dried respectively . These results indicate that blend No.2 had the higher total solids 16.4% followed by blend No. 1 (15.9%), blend No. 3 (14.2%) and blend No. 4 (13.95%).These slight differences were mainly due to different moisture contents.

Total soluble solids coincided with total sugars contents . Whereas, crude fiber and ash fluctuated in a narrow range. Meanwhile blend No.3 had the highest ascorbic acid and carotene contents. As for protein contents it fluctuated but in a narrow range. These constituents differed in the dried leathers since it had less ascorbic acid and carotene being decreased due to the dehydration process.

Total sugars slightly decrease percent decrement was 7.21% on average these decrements could be ascribed to Maillard reaction product which was taking place during drying process between reducing sugars and basic amino acids (Lysine) .

The slight decrement in protein content emphasized the previous reaction. These results are agreement with (Labuza 1982) and (Waller and Feather 1983). Who obtained similar results.

Other constituents like that of fiber and ash were almost always the same from the above discussion it could be understood that the use of butternut winter squash increase both carotenoids and dietary fibers . The latters are healthy nutrient and have an excellent functional effect in retarding many serious disease such as chronic heart diseases, cancer and age related mocular degeneration (Olson 1989, Dimascio 1989, *Edge et al 1997* and IARC 1998). Moreover, the product is cheap and available.

Table (2):The chemical constituents of dried leather of Mango, Guava and butternut winter squash blends before being dried.

Chemical contents	Blend 1		Blend 2		Blend 3		Blend 4	
	Fresh	Dry	Fresh	Dry	Fresh	Dry	Fresh	Dry
Moisture %	٨٤.١٠		٨٣.٦		٨٥.٨		٨٦.٠٥	
Total solids %	١٥.٩	١٠٠	١٦.٤٠	١٠٠	١٤.٢	١٠٠	١٣.٩٥	١٠٠
Total soluble solids%	١٣.٢٥	٨٣.٣	١٣.٦٩	٨٣.٤٧	١٠.٨١	٧٦.١٢	١٠.٩٢	٧٨.٢
Titra tatable acidity(as citric)%	٠.٢٤	١.٥	0.30	١.٨	0.28	١.٩٧	٠.٢١	١.٥١
Ascorbic acid mg /100gm	21.71	١٣٦.٤	٢٣.٧٨	١٤٥.٠	23.29	١٦٤.٠	٢٠.٢٥	١٤٥.١٦
Carotenoids mg /100gm	3.01	18.96	1.94	1.80	4.6	٣٢.٣٩	2.3	16.49
Total sugars%	١٢.٩٧	81.56	١٠.٥٢	٧٤.٠٨	13.35	81.40	١٠.٧١	٧٦.٧
Reducing sugar %	3.10	١٩.٤٩	4	٢٨.١٦	2.76	16.76	3.98	٢٨.٥
Non reducing sugar%	9.87	٦٢.٠٧	6.52	٤٥.92	10.59	64.64	٦.٧٣	٤٨.٢
Crude fiber%	٠.٧٩	٤.٩٦	0.81	٥.٩٠	0. 82	٥.٧٧	0.81	5.82
Ash%	٠.٦١	٣.٨	٠.٥٦	٤.٦٩	0.62	٤.٣٦	٠.61	4.38
Total nitrogen %	0.12	٠.٧٥	0.12	٠.٧٣	٠.١٣	٠.٩١	٠.١٣	٠.٩٣
Protein(N 6.25%)%	٠.٨٢	٥.١٥	٠.٧٣	٤.٤٥	٠.٨٤	٥.٩	٠.٨٢	٥.٨٧

1-1: 1 Mango and butternut winter squash.
2- 1:1 Guava and butternut winter squash.
3- 2:1 Mango and butternut winter squash.
4- 1:2 Guava and butternut winter squash

Table (3): The chemical constituents of dried leather of Mango, Guava and butternut winter squash blends after being dried.

Chemical contents	Blend 1		Blend 2		Blend 3		Blend 4	
	Fresh	Dry	Fresh	Dry	Fresh	Dry	Fresh	Dry
Moisture %	١٤.١٠	-	13.1	-	١٣.٨	-	14.2	-
Total solids%	٨٥.٩٠	١٠٠	86..9	100	٨٦.٢	١٠٠	85.8	١٠٠
Total soluble solids%	٧١.٥٨	٨٣.٣٣	71.87	83.18	٦٥.٦٢	٧٦.١٢	٦٧.١٦	٧٨.٢٧
Titra tatable acidity as citric%	١.٢٩	١.٥	1.57	1.81	١.٦٩	١.٩٦	١.٢٩	١.٥٠
Ascorbic acid mg /100gm	٨٠.٢٩	93.46	82.31	95.26	٩٠.٣٢	١٠٤.٧	٨٥.٥	٩٩.٦
Carotenoids mg /100gm	11.72	13.69	8.05	9.43	27.8	٣٢.٢	14.1	16.4
Total sugars%	68.03	79.19	٦٠.٨٥	٧٠.٥٩	68.08	٧٨.٥٢	٦١.٨٧	٧٢.١٨
Reducing sugar %	15.70	18.27	24.35	28.24	13.03	15.02	٢٤.٤٧	٢٧.٥١
Non reducing %	52.33	٦٠.٩٢	٣٦.٥٠	٤٢.٣٥	55.05	63.50	٣٧.٤٠	٤٤.٦٧
Crude fiber %	4.26	٤.٩٦	4.15	4.91	٣.٤٣	٣.٩٧	3.95	4.63
Ash%	3.29	٣.٨٣	٢.٩٤	٣.٤٠	٣.٣٧	٣.٩٠	3.37	3.9
Total nitrogen %	0.62	٠.٧٢	٠.٦١	٠.٧٠	٠.٧١	٠.٨٢	٠.٧٢	٠.٨٤
Protein(N 6.25%)	٣.٨٧	٤.٥	٣.٨١	٤.٣٧	٤.٤	5.12	٤.٥	٥.٢٥

1-1: 1 Mango and butternut winter squash.
2- 1:1 Guava and butternut winter squash.
3- 2:1 Mango and butternut winter squash.
4- 1:2 Guava and butternut winter squash.

The bacterial, yeast and mold counts of different leather blends before being dried, after being dried and after being stored for 6 months at room temperature were determined. The obtained data are presented in Table (4) it could be observed that the bacterial counts ranged from 5.2 to 4.1 X 10^3 before being dried . However the bacterial counts were decreased being in a range of 1.9 to 0.92 X 10^3 after being dried . However after 6 months of storage the range dropped to 0.48 to 0.24 X 10^3 .The corresponding values of yeast and molds were 8.8 to 6.3 X 10^2, 1.92 to 1.2 X10^2 and 0.82 to 0.52 X10^2.

Therefore, the microbiological examination of stored leathers blends showed decrements in all microbial counts including bacteria, yeast and molds counts during both dehydration as well as storage at ambient temperature for 6 months .

Table (4): Changes in total Bacterial Yeast and molds, counts in fresh, dried and stored leather blends.

Treatments	Total bacterial countsx10^3/gm In different blends				Yeast & molds counts X 10^2 /gm in different blends			
	١	٢	٣	٤	1	2	٣	٤
Before being dried	٥.٢	4.9	4.1	4.6	8.1	6.3	7.6	.8٨
After being dried	١.٩	١.٤	٠.٩٢	٠.٩٨	١.٦	١.٢	١.٥	١.٩٢
After being stored								
٢ Months	٠.٩٥	٠.٨٩	٠.٧٢	٠.٧٨	١.٢	١.٠	٠.٩	٠.٨٥
4 Months	٠.٦١	٠.٣٢	٠.٦٨	٠.٦١	٠٩	٠.٩٥	0.79	٠.٦٩
6 Months	٠.٢٤	٠.٢٥	٠.٣٦	٠.٤٨	٠.٨١	٠.٨٢	٠.٦٩	٠.٥٢

1-1: 1 Mango and butternut winter squash.
2- 1:1 Guava and butternut winter squash.
3- 2:1 Mango and butternut winter squash.
4- 1:2 Guava and butternut winter squash.

Results in Table (5) represent the effect of storage period on color as optical density at 420nm of fresh dried and stored leather blends. These results indicate that there were a definite increments for color values due to both drying and storage process in all the dried leather blends. These could be referred to two types of reaction: (1): Carbonyl- amino reaction such as reducing sugar and amino acids (Maillard reaction) and (2): oxidation reaction such as conversion of poly phenols into polycarbonyls (Labuza 1982) (Waller and Feather 1983). The oxidation type of browning reaction could be inhibited by anaerobic storage. Also Sulfite compounds have been shown to exhibit non- enzymatic browning protection in a varieties of products. Cysteine can retard browning in pear concentrate (Montgomery 1983) and also in other products *(Yu et al 1974*) (Baltes 1982) (Feeney and Whitaker 1982).

However, color values in fresh dried and stored leather blends ranged from 0.18 to 0.16 but it increased to reach a range from 0.231 to 0.212 after being dried but the corresponding values ranged from 0.481 to 0.447 after 6 months of storage at ambient temperature .

Conclusively , color density was increased with increasing the drying time and temperature. Also the length of storage period affect discoloration specially when moisture contents of the stored dried products were high.

Table (5) : Effect of storage period on color as optical density at 420 nm of fresh dried and stored leather blend .

Treatments	Blends			
	١	٢	٣	٤
Before being dried	0.0161	٠.٠١٨	٠.٠١٧	٠.٠١٦
After being dried	٠.٢١٢	٠.٢٣١	٠.٢٢٦	٠.٢١٤
After being stored				
٢ Months	٠.٣٦٥	٠.٣٢١	٠.٣٠١	٠.٣٢٤
4 Months	٠.٤١٦	٠.٣٩٤	٠.٣٩٥	٠.٤١٢
6 Months	٠.٤٧٧	٠.٤٦٢	٠.٤٥٧	٠.٤٨١

1-1: 1 Mango and butternut winter squash.
2- 1:1 Guava and butternut winter squash.
3- 2:1 Mango and butternut winter squash.
4- 1:2 Guava and butternut winter squash.

Results in Tables (6 and 7) represent the color values measured by Hunter color, color difference meter . The values indicate that there were a slight darkening in color due to both drying and storage processes .These discolorations could be referred to both chemical and enzymatic reactions.

However , the use of sulfites is not only inhibits enzymatic browning from occurring during drying operation but also provide some protection from the occurrence of non enzymatic reaction during storage (*Taylor et al 1986)*.

Sulfur dioxide treatment reduces destruction of carotene and ascorbic acid preserves natural color but the amount should not be as large that it could adversely affect the flavor and the human health.

Sodium meta bi sulfite was added to fruit juices in proportion of 0.2- % as a sulfuring agent to prevent either discoloration or quality deterioration in dried sheets and to improve the storage stability (Elewa 1982) and (Ibrahim 1990).

Table (6): The color of fresh ,dried and stored leather blends using Hunter color difference meter.

Treatments	Blend 1			Blend 2			Blend 3			Blend 4		
	L	a	b	L	a	b	L	a	b	L	a	b
Before being dried	50.3	27.0	53.3	54.0	15.6	54	51.3	30	56.7	54.1	20.3	58.9
After being dried	36.8	17.3	39.2	30.0	14.9	27.6	30.7	28.0	32.3	36.9	16.9	39.0
After being stored												
2 Months	36.7	18.1	37.1	30.0	14.3	27.7	30.9	22.0	37.3	36.8	19.5	38.0
4 Months	36.1	18.0	35.6	29.3	13.6	22.9	30.6	26.0	31.3	36.6	13.2	33.0
6 Months	30.9	20.0	35.0	29.4	14.3	21.7	30.1	20.0	32.0	36.3	12.3	32.0

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3- 2:1 Mango and butternut winter squash.
4- 1:2 Guava and butternut winter squash.

Table (7): Differences in color due to dehydration and storage when compared to fresh juice blends:

Treatments	Blend1	Blend2	Blend3	Blend4
After being dried E	21.79	35.68	20.93	26.07
After being stored 2m	22.94	37.19	30.21	27.25
After being stored 4m	24.41	39.76	32.87	31.75
After being stored 6m	27.57	40.62	33.04	32.91

Differences were calculated using the following equation:

$$E^{\frac{1}{2}} = \sqrt{\left[(\Delta l)^2 + (\Delta a)^2 + (\Delta b)^2\right]}$$

Result in Table (8) reveal SO_2 content in different dried leather samples were higher directly after blending since they ranged from 1982 to 1928 ppm . However after being dried the concentration of SO_2 in the dried leather dropped to reach a range of 1280 to 1259 SO_2 ppm. After being stored for 6 months the stored leathers had SO_2 ranged from 360 to 260 SO_2 ppm SO_2 in general inhibits both enzymatic and chemical discoloration Consequently it improves the color of the final product. These results are in agreement with results obtained by (Taylor *et al* 1986).

Table (8) : Effect of storage period on SO_2 (ppm) contents of fresh dried and stored leather blends.

Treatments	Blends			
	SO_2 ppm			
	Blend 1	Blend 2	Blend 3	Blend ٤
Before being dried	١٩٨٠	١٩٦٠	١٩٨٢	١٩٢٨
After being dried	١٢٦٠	١١٩٨	١٢٨٠	١٢٥٩
After being stored for : ٢ Months	٩٨٠	٩٥٠	٩٣٠	٩٦٠
4 Months	٦٣٠	٦٩٠	٦٤٠	٦٨٢
6 Months	٣٦٠	٢٩٠	٢٨٩	٢٦٠

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4- 1:2 Guava and butternut winter squash

Reconstitution process :

Dried leathers should be reconstituted before being consumed, water absorbed by dried material should be quantified. It is preferable to rehydrate the dried material to almost the state of fresh sample before being evaluated for their organoleptic properties .

Organoleptic evaluation of different leather blends:

Sensorial aspects are of great value to detect the consumer acceptance of the new product :Results in Table (9) reveal that the best color flavor and overall acceptability was that of blend (3) of mango and butternut winter squash in the ratio of 2:1 followed by blend (1) which consisted of mango and butternut winter squash in the ratio of 2:1 since its their color flavor and overall acceptability had the highest scores whereas blend 2 which consisted of Guava and butternut winter squash in the ratio of 1:1 had satisfactory scores pertaining color , taste and aroma and overall acceptability the forth blend consisted of Guava and butternut winter squash in the rates of 1:2 which had good color and satisfactory scores for both flavor and overall acceptability.

In all cases, the scores of all the organoleptic properties decreased due to dehydration and storage the least scores were given to blends after being stored for 6 months .Differences between Organoleptic properties scores were significant at 5% level From these results it could be shown that maximum storage period should not exceed 4 months where as the best blend was Blend No.3 according to the scores given by the panelists for different sensorial properties.

Table (9): Effect of storage period on organoleptic parameters of different leather blends .

Parameters / Treatments	Color scores				Taste and Aroma scores				Over all acceptability scores			
	Blends				Blends				Blends			
	1	٢	3	4	١	٢	٣	٤	1	٢	3	4
Before being dried	8	8	9	8	9	٨	9	8	9	8	9	٨
After being dried	7	٦	٨	٧	8	7	٩	7	٨	٨	9	7
After being stored												
2 Months	7	٦	7	7	8	6	8	7	8	٨	9	٦
4 Months	7	6	7	٦	7	6	٨	6	8	٨	٩	٦
٦ Months	٦	5	6	٥	7	5	٧	6	7	٧	8	٥
L.S.D: 0.05	0.79	0.55	0.74	0.84	0.42	0.45	0.57	0.45	0.57	0.57	0.57	0.57

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4- 1:2 Guava and butternut winter squash

Results in Table (10) represent the effect of storage on the properties of dried leathers of mango, guava and butternut winter squash : The main changes in the leather constituents of mango, guava and butternut winter squash were an increasing trend in moisture content during the storage periods.

On the other hand, there was a decreasing trend in the other constituents except ash and fiber which seemed to be constant. Sugar especially that of reducing one decreased obviously due to Maillard reaction as it was mentioned before . Other unstable components were ascorbic acid and carotenoids ascorbic acid was less stable during storage period when compared with content which suffered from oxidation process such as that of carotenoids. These results are in agreement with (Nogueira *et al* 1978) and (Mostafa 1996).

Total carotenoids decreased during prolonged storage of all blends packed in polyethylene pouches. The loss of carotenoids may be due to their conjugated double bond system which make them labile to oxidative decomposition when expose to air (Meyer 1982) and (Francis1985).

Table (10): Effect of storage at ambient temperature on the chemical constituents of dried blends of mango, guava and butternut winter squash .

Chemical content	Blend1				Blend2				Blend3				Blend4			
	Storage period				Storage period				Storage period				Storage period			
Months	0	2	4	6	0	2	4	6	0	2	4	6	0	2	4	6
Moisture %	14.1	14.3	14.6	14.9	13.1	13.2	13.4	13.8	13.8	13.9	15.6	15.9	14.2	12.4	12.8	12.9
Total solids%	85.9	85.7	85.4	85.1	86.9	86.8	86.6	86.2	86.2	86.1	84.4	84.1	85.8	87.6	87.2	87.1
Total acidity as citric acid%	1.29	1.26	1.23	1.22	1.57	1.54	1.53	1.53	1.69	1.64	1.63	1.63	1.27	1.26	1.24	1.22
Reducing Sugar %	15.70	15.5	15.3	15.2	24.35	24.1	23.9	23.8	13.03	12.9	12.60	12.5	24.47	24.2	24.1	23.9
Non reducing sugar %	52.33	52.57	52.7	52.7	36.50	39.3	36.7	36.6	55.05	55.1	55.30	55.3	37.4	37.4	37.3	37.2
Total sugar%	68.03	68.01	68.0	67.9	60.85	63.4	60.6	60.4	68.08	68.0	67.8	61.8	61.87	61.6	61.4	61.1
Ascorbic acid mg /100gm	80.29	80.0	79.1	77.3	82.31	79.1	73.2	70.1	90.32	90.0	89.1	86.5	85.5	74.3	71.1	69.2
Carotenoids%	11.72	11.3	11.3	11.0	8.15	8.05	7.9	7.0	27.8	21.2	18.3	16.1	14.1	12.1	9.3	7.6
Ash content%	3.29	3.29	3.27	3.21	2.94	2.94	2.91	2.9	3.37	3.31	3.3	3.3	3.37	3.32	3.31	3.31
Fiber content%	4.26	4.36	4.36	4.35	4.15	4.15	4.15	4.15	3.43	3.43	3.43	3.41	3.95	3.41	3.31	3.31

1-1: 1 Mango and butternut winter squash.
2- 1:1 Guava and butternut winter squash.
3- 2:1 Mango and butternut winter squash.
4- 1:2 Guava and butternut winter squash

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الصفات الطبيعية والكيماوية و الحسية والميكروبيولوجية للفائف الفاكهة المجففة والمصنعة من لب الكوسة الشتوي والمانجو والجوافة

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استعمل لب الكوسة الشتوي كمصدر للبيتا كاروتين مع لب المانجو والجوافة في إنتاج لفائف الفاكهة المجففة ذات القيمة الغذائية والاقتصادية العالية وعرض اللب المستخلص من الفاكهة إلي الموجات القصيرة ٩٠ وات لمدة ٢ دقيقة لتثبيط الإنزيمات المؤكسدة قبل عملية تجفيفها في فرن الهواء الساخن علي درجة ٦٠° م مدة ٨-١٠ ساعات في المتوسط بالإضافة فقد استعمل صوديوم ميتا باي سلفييت ٠.٢% لتثبيط التفاعلات الكيمائية والإنزيمية ولحفظ فيتامين سي والكاروتين كما خزنت لفائف مخاليط الفاكهة لمدة ٦ شهور علي درجة حرارة الغرفة كذلك فقد درست التغييرات الناتجة عن التصنيع والتجفيف والتخزين بالنسبة للخواص الحسية ومتبقيات ثاني أكسيد الكبريت والتغييرات اللونية بقياسها بواسطة الكثافة الضوئية علي طول موجي ٢٤٠ nm بالإضافة إلي استعمال قياسات جهاز Hunter color differences لمقارنة الألوان بالنسبة للب الطازج كما قدرت الإعداد البكتيرية والخمائر والفطريات في المنتجات الطازجة والمجففة والمخزنة والتركيب الكيماوي لهذه المنتجات قد تم تحليله علي مستويات مختلفة أي قبل التجفيف وبعد التجفيف وبعد التخزين وفي جميع الحالات كانت أفضل المخاليط من ناحية الجودة مرتبة تنازليا هي مخلوط ٣ ومخلوط ١ومخلوط ٢ثم مخلوط ٤.

Fig. (1): Butternut winter squash.