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Utilization of the wholly Prickly pear fruit juice [*Opuntia ficus indica(L.)Mill*]: Peels source of functional components and its shelf life storage.

Nesreen.M.El-Said.Ali.

Food Technology Research Institute, Agric., Research Center, Giza. Egypt.

Abstract

This study was performed to investigate the possibility of more utilization of some wholly fruits such as prickly pear and their wastes remaining after consumption. Peels which posses great healthy benefits. Prickly pear fruits are considered as one of the most popular fruits grown in Egypt for owning sweet taste. Besides, having a high nutritional value, thus nearly, all quantities of prickly pear fruits are consumed as fresh. This study is an attempt to produce dried wholly prickly pear fruits to prolong shelf life storage and wholly prickly pear fruit fresh juice. It has been demonstrated that, produce new untraditional product not consumed before among different consumers plus utilization of excess cultivated quantities of that crop. It has been also, revealed through that prickly pear peels have no toxic effects. Functional components such as dietary fiber, natural colorants, and antioxidant vitamins are some of the nutrients which people need to have in their daily diet. Certain vegetables are promising as sources of such components. One of them is *Opuntia spp*. fruits including peels. The long lasting permanence on the plant the fruit is not available throughout most of the year. Unfortunately, cactus fruits have a short shelf life from 3–4 weeks, thus limiting long-term storage and worldwide distribution.

Since the period of availability in the market is very short (1-2 months) a year in summer-and with many diseases, particularly obesity. Therefore resorted to a way to remove thorns without the use of any chemicals. Also, to use the cheaper methods for preservation by drying which must be inexpensive allover the year, and keeps the treasure components for human health.

The obtained results reveal that, the high content of some chemical constituents, which can use wholly fruits of prickly pear which added value to this fruit on a nutritional and technological functionality basis. High levels of betalains, carotenes, and anthocynins as antioxidants are noteworthy. Sensory acceptance was highly palatable (very good) of wholly prickly pear for both of cases as fresh or dried fruit juice. It could be concluded that, the wholly fruit fresh /dried juice (with peel) are suitable and valuable for human consumption. Therefore, cactus fruit juice could contribute to the intake of antioxidant substances such as ascorbic acid and phenols which are used for energy and sports drinks to uphold the mineral pool during periods of physical exhaustion. The differences between reconstitution ratio of different samples were non-significant L.S.D at $p<0.05$, also the absorption of water decrease with increasing storage time(3M) compared with zero-time.

Finally, it could be concluded that, it is proper, successful economic and applicable to produce wholly fresh fruits juice and wholly dried fruits slices which are very suitable to be taken as a good natural food or natural-food additive with many categories ofhealthy foodstuffs.

Introduction

Prickly pear fruits are popular among nearly all consumers due to their high sweet, low acidic taste. Those fruits are nearly almost consumed in fresh form.

The prickly pear is the fruit of the genus *Opuntia*, which belongs to the Cactaceae family. It is a berry, consisting of a thick pericarp with a number of small prickles, the fruits could be reddish purple, yellow or white in color, with a sweet pulp intermixed with a number of small seeds. Cactus pear or prickly pear, a member of the *Cactaceae* family, is widely distributed in Mexico and in all American hemispheres and grows in many other parts of the world, such as Africa, Australia and the Mediterranean basin. The fairly high sugar content and low acidity of the fruit, (Munoz *et al*., 1995) make it very sweet and delicious.

The production of prickly pear fruits (*Opuntia ficus-indica*) exceeded 30 thousand ton of Egypt in 2005, for the local market in Egypt for fresh consumption without any industrial applications.

The fruit is a fleshy berry, varying in shape, size, and colour and has a great number of hard seeds. Fruit processing into purée and juice production are the most important technologies. Preservation of characteristic nutrients, taste, flavor as well as color, long shelf-life, easy handling, and convenience, make juice a valuable and attractive product for both customers and the food industry. Moreover, the

multiple functional properties of cactus pear fit well with the recently upcoming demand for health-promoting foods and natural ingredients (Piga, 2004).

However, studies on drying cactus pear fruit and its juice are very limited. Recently, convective solar drying of prickly pear fruit slices was proposed by (Lahsasni *et al.,*2004 a,b). Cut cactus pear fruits from Morocco were dried in an experimental solar dryer varying drying air temperatures from 50 to 60°C and flow rates from 0.0227 to 0.0833 m^3/s, relative humidities from 23 to 34%, and solar radiation intensities between 200 and 950 W/m^2, respectively. Drying temperature was found to be the decisive factor in controlling the drying rate. The cactus-pear fruit is an oval, elongated berry, with a thick pericarp and a juicy pulp and, in general, many hard seeds. The pericarp or peel of commercially ripe fruits of *Opuntia ficus-indica* (L.) Mill. accounts for 33% to 55%, while the pulp is 45% to 67%, the latter containing seeds (2% to 10%). The multiple functional properties of cactus pear fit well this trend. Recent data revealed the high content of some chemical constituents, which can give added value to this fruit on a nutritional and technological functionality basis, (Piga ,2004).

As regards chemical components, the pulp is the edible part of the fruit and consists of water (84% to 90%) and reducing sugars (10% to 15%). It has very low acidity (0.05% to 0.18% as citric acid) of the pulp, which strongly influences the processing operations, with glucose being the predominant sugar and fructose being the second sugar, thus the fruit pulp is

very sweet (Stintzing *et al*., 2003).

Concerning, significant amounts of ascorbic acid which may be present, within the broad range of 10 to 410 mg.kg^{-1} found in different *Opuntia* spp., (Kuti, 1992). *Opuntia ficus-indica* (L) Mill., shows a vitamin C content ranging from 180 to 300 mg.kg^{-1} (Piga *et al*., 1996[j]).· Cactus pear is higher in vitamin C than other common fruits, such as apple, pear, grape, and banana (Cheftel and Cheftel, 1983), while other vitamins, such as carotenoids, thiamin, riboflavin, and niacin are in trace amounts (Sepúlveda and Sáenz, 1990). The pericarp or peel, which is a by-product, gives a oil with appreciable amounts of polyunsaturated fatty acids, mainly linoleic acid,□□ά-tocopherol, sterols, β-carotene and vitamin K1(Ramadan and Mörsel, 2003).The mineral pattern is characterised by high amounts of calcium (up to 59 mg.100 g^{-1}) and magnesium (98.4 mg.100 g^{-1}), while other minerals are in the normal range for fruits (Dominguez-Lopez, 1995). The literature reports also that cactus-pear fruit is a good source of fibre, which gives thejuice a favourable mouth feel and helps to reduce blood sugar and plasma cholesterol levels, (Munoz de Chavez *et al*., 1995; Trejo *et al*., 1995).

Recently, an increased interest in antioxidant activity and health-improving capacity of cactus pear has been registered. The antioxidant capacity of cactus-pear fruits has been recently assessed. (Butera *et al*. 2002) determined the antioxidant activity of methanolic extracts of yellow, red, and white fruits, as well as of betalains pigments.

As noted previously, cactus-pear fruits have a similar composition to other fruits, (Rodriguez *et al*., 1996), but technological parameters play an important role and are a great challenge during processing.

The pH values (5.3 to 7.1) are in the range of nonacid foods,(Piga *et al*., 1997), thus sterilisation treatment is required to avoid growth of pathogenic microorganisms. Moreover, the high content of soluble solids makes cactus pear very susceptible to microbial invasion. The stabilisation procedure may have detrimental effects on some sensory parameters of fresh fruits, such as colour and flavour

Cactus-pear fruits are consumed almost in the fresh form. Increased knowledge of their nutritional value, the possibility of using *Opuntia spp*. to colonies marginal lands, and the relatively limited shelf life, even in cold storage, have stimulated interest in obtaining processed items, which can satisfy the need for diversification, increased shelf life, and more convenience. However, the multiple-ingredient characteristics of cactus pear should encourage research to obtain different fruit products with emerging technologies. The increasing demand for natural rather than synthetic colorants for drinks and dairy products could benefit cactus pear, provided further studies on increased yield, extractability, and stability are carried out. This study has been initiated to utilize the very perishable, usage prickly pear (with peel) fruit, and handling in dried form to prolong its shelf life storage to its possess of functional components to be used as stuff food. Prickly pear peels have no toxic effect on liver and kidney of rats

and have significant nutritional value, however, the LDL-cholesterol level in the treated group was significantly decreased compared to the control, (Nesreen *et al*., 2011).

Since the peels of cactus pear fruits are normally not eaten and are difficult to separate from the pulp, low interest in cactus pear fruit peel processing is understandable. However, in a recent work two new products containing ground peels were elaborated (Cerezal and Duarte, 2005).

Whereas for the first, a mixtures of ground cactus pear skins, pulp, and sucrose were used to obtain a concentrated sweet product, the second consisted of ground peels, sucrose, and pectin and was addressed as "marmalade". It can be enriched bakery products, besides having good nutritive value, show new dimensions of health benefits by using flour mixed with prickly pear fruits or its components (whole fruits, peels, seeds and pulp) especially for patients of hypercholesterolemia and diabetic or anemic which confirmed by the data obtained by (Nesreen *et al*.,(2011) ;Doweidar and Nesreen (2011).

Materials and Methods

1-Materials:

The orange-yellow , pink and red prickly cactus pear fruits ([*Opuntin ficus indica* (L.)Mill]) were purchased from a local market in Cairo (Egypt) during summer season, 2012.

2- Methods:

2-1-Preparation of Dried Plant Material:

Wholly prickly pear fruits (with peels) were washed and blanched in boiling water containing 1% citric acid for 2mins., at 90°C, then deeper thoroughly in ice water to remove thorns then dried. Recently, convective warm air fans dried chamber drying of wholly prickly pear fruit slices was proposed. Cut wholly cactus pear fruits were dried in an experimental warm air fans chamber dryer varying drying air temperatures from 35 to 40°C and flow rates from 0.0227 to 0.0833 m^3/s, relative humidities from 23 to 30%, and warm air fans radiation intensities between 200 and 950 W/m^2, respectively for one weak. Drying temperature was found to be the decisive factor in controlling the drying rate. The dried samples were packed in solo fan bags and stored at – room temperature(25°C±2) in place (dry, darkly, and clean).

2-2-Drying Process – Chamber Dehydration:

All the aforementioned treatments including whole fruits as well as fruits pure were dehydrated as following;

The trays were put in an air ventilation drying chamber at 35- 40°C/ over night for weak. Air – drying was continued until the samples reach a constant weight in the end product. They were covered with a cloth net frame to protect them clearly. Relative humidity ranged from 57- 60%, and air velocity 1.7-1.9 meter/second during the drying period, Air drying period was calculated in hours(as the drying equal 10 hrs). The different dried samples were tightly packed in cellophane pouches and storage at room-temperature (25°C±2) for 8 moths according to Siham *et al*.,(2004).

2-3- Plant Material and Juice Preparation:

The sample was divided in to 3 groups as follows; fresh fruits peeler (control), wholly fresh fruits, and wholly dried fruits. All samples of prickly pear fresh fruits were sorted, washed with tap water, some of them manually peeled, other wholly fresh fruits and soaking of wholly dried fruits, then the juice was extracted from the whole edible pulp using a food processor (Moulinex, 750 W, type5000, France) with addition of some water for 3 mins., and strained through cheesecloth, then bottled in prix glass for every samples alone. Pasteurizing of prickly pear fruit juice at 80°C for 5min., then kept them at refrigerator degree (4°C ±2) to evaluate the both organoleptic qualities and shelf life storage samples, according to Abd El-razzck and Hassan., (2011).

3- Wholly Cacuts fruits juice(with peel) storage and its shelf life:

Wholly Prickly pear fruits [*Opuntin ficus indica* (L.)Mill], (with peels) samples, were preserved by using cheaper methods for drying storage. The obtained samples were stored after the following processing according to Nath,*et al.*,(2012) as follow; dehydration of samples of fruits full with peels into episodes before drying, then dried in drying chamber with air warm, by dried air fans its temperature ranged between (35-40°C)/ over night for one week. The dried fruits samples were packed in cellophane bags and storage at room-temperature (25°C±2), then prepare a juice after soaking over night compared to a fresh juice as control. Preparing 4 samples to be storage at refrigerator at 4°C for 15 days and following changes of non- reducing sugar as follow; fresh marketing juice, fresh with pasteurizing juice at 80°C for 5 min., drying's marketing juice and drying's pasteurized

juice, then analyzed to measured of non-reducing sugar for these 4 samples compared to control according by A.O.A.C.(2007).

4- Analytic Methods:

The following chemical analysis (4.1- 4.5.1) for all samples was carried out according to A.O.A.O (2007).

4-1-Determination of Total and Reducing Sugar:

All treatment were analyzed immediately after drying (zero- time of storage) and then periodically at 2 days intervals up to 15 days for, for chemical analysis(total sugars , reducing sugars, and non-reducing sugars).The total soluble sugar and reducing sugars content was determined colorimetrically according to A.O.C.A,(2007).

4-2-Non-reducing Sugars:

The non-reducing sugars were determined by the differences between the total soluble sugars and the reducing ones.

4-3- Determination of Moisture:

The moisture content in the sample was determined by drying the sample in an oven at 105°C until a constant weight was reached.

4-4- Determination of pH:

pH was measured for wholly prickly pear fruits juice at a controlled trmperature of 19.4 °C by a pH meter model 41150 , from USA., 1994 .

4-5-Derterminition of some Pigments:

4-5-1- Chlorophyll (A), Chlorophyll (B):

Chlorophyll A and B were determined according to the official methods of A.O.A.C,(2007).

4-5-2- Carotenoids:

Weight a representative sample gm containing 10 to 500µg of carotene, add 10-15ml peterlumether by diluting the acetone with water containing 5% Na_2

SO_4. Measure the colour at 452nm. According to Ranganna,S.(1977).

4-5-3- Anthocyanins:

Blend 100gm of the fruit with 100ml of ethanolic Hcl in a blender at full speed. Transfer to 500ml glass-stopped both using approx., 50ml of ethanolic Hcl for washing the blender jar. Store over night in refrigerator at 4°C. Filter on a Whatman No.,1 paper using a Bucher tunnel. Wash the bottle and the residue on the filter paper repeated by with ethanolic Hcl with approx., 450ml of extract is collected. Transfer the extract to a 500ml vol., flask and make to volume, to prepare the extract for spectrophotometer measurement, in ethanolic medium, the peak absorption of cranberry anthocyanins are as follows; 532, 535,.and 536 nm. According to Ranganna,S.(1977).

$$\text{Total OD Per 100 g of Berry} = \frac{\text{Abs. at 535nm} \times \text{vol made up of the extracts used For color measure,} \times \text{Total Volume} \times 100}{\text{ml of the extract used*} \times \text{wt., of sample taken.}}$$

4-5-4-Betaline:

Betaline pigments were extracted from red beet roots according to (Jackman & Smith, 1996; Strack *et al.*,2003).

4-6- drying ratio:

The drying ratio of prickly pear fruits products of all treatments was evaluated as reported by Van–Arsdel *et al*,(1973). They drying ratio was calculated from the ratio of weight of wet material to the weight of the same material after drying.

4-7-Reconstitution of wholly prickly pear dried fruits (with peels):

Reconstitution of wholly prickly pear dried fruits (with peels) was determined according to the method stated by Von Loesecke (1955) as following: 10 g the tested dry material samples were placed in 600 ml pyrex beaker, 80 to 150 ml distillated water were added, covered with a watch glass, placed on electric heater, as boiled for 5 min., removed from the heater and dumped into a 75 min., buchner funnel which was covered with a coarsely porous filter paper. Suction was gently applied and drained with careful stirring for one min., or until the drip from the funnel has almost stopped. Samples were removed from the funnel and a weighted calculation was made to expressed in terms of "Reconstitution ration".

$$\text{Reconstitution ratio} = \frac{\text{The drained weight of the reconstitution sample(WR).}}{\text{The origin weight of the dehydration sample(WD).}} \times 100$$

5-Sensory evaluations of product:

The quality attributes (color, taste, aroma, appearance, flavor, texture, and overall acceptability of the produced wholly prickly pear juice both of (fresh and dried) compared with pulp fruits peeler juice (control). Using suggested was evaluated for their sensory characteristics by ten panelists from the staff of the Processing Crops, Research Dep., Agric. Res. Center, Giza. Acceptability giving numerical scores to each of their attributes from 10 panelists. The produced was organoleptically judged by groups of panel testers. The quality were scored on a scale (1 to 10), according to Watts *et al*., (1989).

6-Statistical analysis:

The obtained results of Sensory evaluation were statistically analyzed by Snedecor and Cochran

(1984). The obtained data for rehydration ratio were statistically analyzed by the least significant difference value (L.S.D) at 0.05 levels probability by procedure of (SPSS for Windows 18.0, SPSS Inc. Chicago).

Results and Discussion

1- General and approximate chemical composition of prickly pear fruits:

Prickly Pear fruits are divided into three fractions that may be exploited by commercial processing, seeds, peel and pulp. The thick pericarp is covered with small barbed spines hosting a juicy pulp with 150-300 non-edible seeds. The latter account for 3-7% on weight basis, followed by the pericarp and mesocarp (36-48%) and edible pulp (39-64%) Mobhammer *et al*, (2006).The general composition in (Table 1) for prickly pear fruits was 56.88% pulp, 38.4% peels and 4.72% seeds, while the proximate chemical composition of prickly pear pulp was 89.75 ± 0.05, for moisture. Chemical composition of prickly pear pulp for acidity (as citric), pH value, total soluble solids ºBrix , total sugars, reducing sugars and non-reducing sugars were 0.055 ± 0.003; 6.16 ± 0.02; 14.67 ± 0.17; 12.65 ± 0.13; 7.33 ± 0.09 and 5.32 ± 0.05; respectively.,. as the physico-chemical characteristics of cactus fruit juice are presents in Table (1). Cactus fruit juice had bioactive substance content as total carotenoids (mg/100g fresh weight juice) 3.98 ± 0.14, Betacyanins (mg betanin/100g fresh weight juice) 7.55 ± 0.08, Betaxanthins (mg indicaxanthin/100g fresh weight juice) 2.09 ± 0.06, and Betalains (betacyanins+betaxanthins, mg/100g fresh weight juice) 9.65 ± 0.12, respectively.

2- Effect of Drying on Wholly Prickly Pear Fruit/ Juice:

Cactus pear is very particular for the presence of betalain, a widely used natural colorant in the food industry. Betalains are nitrogenous chromoalcaloids and their presence excludes that of anthocyanins Betalains are stable in a pH range of 4 to 7, thus they are particularly indicated as colorants of low-acidic foods. Betalains found in cactus pear are both betacyanins (red-violet colour) and betaxanthins (yellow colour), in amounts comparable to the most betalain rich red beet hybrids, taking the whole fruit into consideration. Nowadays, betalains for food use are extracted from red beet which contains up to 50mg/100g of betanin, a betacyanin. Jana, S (2012) detected 100 mg of betanin per 100 g of fresh weight of purple-cactus-pear juice, which was added as a colorant to a yogurt with promising results. Cactus-pear fruits could, therefore, be an even better source of betalains than red beet roots.

Some components were recorded in table(2) for prickly pear fruit dried juice such as moisture; acidity (as citric); pH value; Total Soluble solids %(juice); total sugars; reducing sugars and non-reducing sugars were 10.96, 1.08; (5.08 for dry sample, 3.753, 3.789.and 3.537 for fresh juice); (5.2, 8.5, and 9%)for juice; 37.20, 19.05,and 18.15 respectively.,.

Table (2) indicates the content of Chlorophyll(A), Chlorophyll(B), Carotenoids, Anthocyanins, and betalinine dyes in green, pink, and red wholly prickly pear fruits dried/fresh juice were 1.79%, 0.35% and as total equal 2.14% for dried sample but of fresh non; also 34.28 mg/100gm, for dried ,but for fresh

39.85mg/100gm; and 36.27 mg/100gm for dried, also for fresh juice 4.73mg/100gm; and dried 212.3 mg/100gm, but 121 mg/1oogm fresh products ,respectively.,.

3- Effect of Change Occurring in Non-reducing Sugars of (peeler/wholly) Prickly Pear Fruits(fresh/dried) Juice During Storage Time:

The polysaccharides of Hydrocolloids from cactus pear peel are characterized by sugar constituents typical of pectin with high and medium degrees of esterification of galacturonic acid residues (Habibi *et al*., 2005b; Majdoub *et al*., 2001).Total soluble solids of the pulp range between 12 and 17°Brix (Sáenz-Hernández, 1995), with glucose and fructose being the predominant carbohydrates in a ratio of about 1:1, depending on invertase activity (Kuti and Galloway, 1994; Sawaya *et al*., 1983). The polysaccharide fraction of cactus pear pulp was only recently reported to be composed of a complex mixture of polysaccharides of which less than 50% corresponded to a pectin-like polymer. The hydrocolloid fraction from the fruit pulp of *O.ficus-indica* fruits obtained by ethanol precipitation yielded 3.8% and contained 93.5% sugars. However, further studies are required to completely characterize the hydrocolloid fraction of cactus pear fruit pulp (Matsuhiro *et a*l., 2006).

These results from the both of tables (3and 4) for Effect of Storage at (4°C±2) of shelf Life on Non-Reducing Sugars(Wholly Cactus Fresh Juice as control, Wholly Cactus Fresh Juice Pasteurizer, wholly Cactus dried juice, and wholly Cactus dried juice Pasteurizer were noted that, the total sugars

,reducing and non-reducing sugars was less the longer storage, compared with the case control (wholly prickly pear fresh juice without pasteurization) , also, the total sugars and reducing sugars were the same results for sample wholly prickly pear fresh juice pasteurized and the both of wholly prickly pear dried juice pasteurized and non-pasteurized. Also, was noted that, were clearly differences results compared with the control for non-reducing sugars after a period of 15 days to sample (wholly prickly pear fresh juice pasteurization well as both of wholly prickly pear dried fruit juice non-pasteurized and pasteurized increase (1.31, 1.17, and 1.40 respectively.,).

4- Sensory evaluation of Wholly Prickly pear fruits juice:

Organoleptic tests are generally the final guide to the quality from the consumer's point of view. From the total score of the organoleptic evaluation for the three groups of prickly pear juice and from these results. From data presented in table (5) shows the organoleptic characteristics of peeler fruits fresh juice (control), and wholly Prickly pear fruit[fresh and dried (with peel)] juice samples (taste, color, flavor, appearance, texture, aroma, acceptability and overall) were evaluated by 10 individual of Egyptian consumers. As presented from the results, the total score was: 58.94, 55.69 and 52.36 for Prickly pear peeler fruit fresh juice (control), and wholly prickly pear fruit [both of fresh, dried (with peel)] juice respectively. The S_3 group decrease significant in all parameters compared with S_1 group (control), but no significant variance between S_2 group and S_1 groups (control). In general, it could be observed that, all

samples of wholly prickly pear for both of cases as fresh or dried fruit juice were highly accepted (very good). It could be concluded that, the wholly fruit fresh /dried juice (with peel) are suitable and valuable for human consumption.

These results which revealed that wholly cactus (with peels) fresh/dried fruit juice were organoleptically palatable consumers for almost like peeler cactus fresh fruit juice, specialty those who are suffering from diabetes which cactus fruit juice possesses antioxidant, hypoglycemic, hypocholesterolemic and antiatherogenic properties and also consequently positively affects the body's redox balance, decrease oxidative damage to lipid cited by [(Abd El-razek and Hassan *et al*.(,2011) ; Doweidar and Nesreen *et al*.,(2011).

5- Reconstitution ratio of Wholly Prickly pea rdried fruits juice:

Methods of drying (warm air dried at 35-40°C) as well as storage condition had been found to affect the degree of rehydration process. The rehydration ratio of wholly prickly pear dried fruits (with peel) samples showed that, the change in results storage at room temperature(25±2ºC) ranged between 1,46% for one month to 1.95% for 3moths per 15min. to 45min., compared with zero-time which observed that in (Table 6). From results in the table(6) represent rehydration for both of storage time (monthly) and rehydration time of wholly prickly pear dried fruits(with peel) tested every one subsequent month and continued for 3months. Results revealed that, water absorbed by the tested samples was the greatest for one month compared to zero-time. From these values, which proved that soaking of samples,

plus, the greater the storage period increased water absorption. It can be concluded that the differences between rehydration ratio of different samples were non-significant L.S.D at p<0.05, also the absorption of water decrease with increasing storage time compared with zero-time.

Table(1): Main Physical Parameters and Chemical Composition of Fresh Prickly Pear Fruit and their peels.

Technological Parameters	Range
Pulp (%).	43 - 57
Seeds (%).	2 - 10
Peels(%).	33 - 55
pH	6.16 ± 0.02
Acidity(% of citric acid).	0.055 ± 0.003
Moisture(%)	89.75 ± 0.05
Total Soluble solids ºBrix	14.67 ± 0.17
Total Sugars(%).	12.65 ± 0.13
. Reducing Sugar.	7.33 ± 0.09
Non-Reducing Sugars	5.32 ± 0.05

*Cited by; Jana, S.,(2012); Abd El-Razek. And Hassan (2011).

Table (2): Effect of Drying on Wholly Prickly Pear Fruit / Wholly Prickly Pear Fruit Fresh Juice Components.

Technological Parameters	Range		
Moisture (%). (Dry sample.)	10.96		
pH	Dry sample (5.08) Juice sample green(3.753). red(3.789). pink(3.537).		
Acidity (% of citric acid). (Dry sample).	1.08		
Total Soluble solids %. (juice).	Green (5.2%)	Red (8.5%)	Pink (9%).
*Total Sugars(%). (Dry sample).	37.20		
* Reducing Suga(%). (Dry sample).	19.05		
* Non-Reducing Sugars. (Dry sample).	18.15		
Pigments Wholly Fruits (Dried / Fresh) Juice.	Green%. Dry; *Chl.A 1.79 *Chl.B 0.35 Total = 2.14%. Juice; ND	Pink(carotenes) mg/100gm. Dry 34.28. Juice 39.85.	Red (anthocynins) mg/gm.. Dry 36.27. Juice 4.73. Red(Betaline)mg/100gm. Dry 212.3 juice 121

* On Dry Weight Basis. * Chl. A: Chlorophyll(A).
* Chl. B: Chlorophyll(B).

Table (3): Effect of Storage at (4°C±2) on Non-Reducing Sugars f or 15 days of (*W. C.F. F. J. and * W C.F. F. J. P.).

Parameters. / Storage's shelf life.	Total Sugar(%).	Reducing Sugar(%).	Non-Reducing Sugar(%).
***F.J.C.** (Control):			
zero time.	6.49	4.98	1.51
after 5 days.	6.41	4.72	1.69
after 10 days.	6.12	4.62	1.50
after 15 days.	4.45	4.22	0.22
***F.J.P.C.:**			
zero time.	5.92	4.78	1.14
after 5 days.	5.78	4.50	1.28
after 10 days.	5.75	4.36	1.39
after 15 days.	5.57	4.26	1.31

***W.C F. F.J. (Control) :Wholly Cactus Fresh Fruits Juice.**
***W.C. F.F. J.P.: Wholly Cactus Fresh Fruits Juice Pasteuriser.**

Table (4): Effect of Storage at (4°C±2) on Non-Reducing Sugars for 15 days of (*W.C.D. F.J. and *W.C. D. F. J.P.).

Parameters. / Storage's shelf life.	Total Sugar(%).	Reducing Sugar(%).	Non-Reducing Sugar(%).
***D.J..C.:**			
zero- time.			
After 5 days.	6.01	5.02	0.99
after 10 days	6.00	5.00	1.00
after 15 days	5.89	4.80	1.09
	5.62	4.45	1.17
*D.J.P.C.:			
zero- time.			
after 5 days.	6.01	4.65	1.36
after 10 days.	6.00	4.52	1.48
after 15 days.	5.82	4.50	1.32
	5.80	4.40	1.40

***W.C.D.F.J.: wholly Cactus Dried Fruits Juice.**
***W.C D. F.J.P.: wholly Cactus Dried Fruits Juice Pasteurizer.**

Table (5): Sensory Evaluation of Wholly (with peels) Prickly Cactus Pear Fruit (Fresh + Dried) Juice mean ±SD.

Characteristics / Samples	Color (10)	Aroma (10)	Taste (10)	Appearance (10)	Texture (10)	Flavor (10)	Overall Score (60)	Total Score (100)	Acceptance
* group S_1 (Control).	8.35 ±0.95	8.70 ±0.98	8.49 ±0.81	8.30 ±0.90	7.85 ±0.90	8.90 ±0.66	8.35 ±0.55	58.94	V
* group S_2	8.40 ±0.80	8.00 ±0.77	7.40 ±1.20	7.85 ±0.90	8.11 ±1.10	7.83 ±0.82	8.10 ±0.70	55.69	V
* group S_3	7.39 ±0.87	7.56 ±0.68	7.50 ±0.75	7.56 ±0.83	7.85 ±0.96	7.50 ±0.50	7.0 ±1.27	52.36	V

*Data are means ± standard error (n=10).
*Acceptability was carried out according to score of overall quality as following; >30 acceptability , < 30 un- acceptability.
*S_1 (Control):Fresh fruit juice of prickly cactus pear peeler.
*S_2 :Fresh fruit juice of wholly prickly cactus pear(with peel).
*S_3 :Dried fruit juice of wholly prickly cactus pear(with peel).

Table (6): Rehydration ratio Samples of Wholly Prickly Pear Dried Fruits after being storage at ambient temp.,(25±2ºC) for 3 moths.

Storage Time/ (monthly) / Rehyd./Time.	Zero-time. 0M		1-month 1M.		2-months. 2M		3-months. 3M	
	RH%	± SD	RH%	±SD	RH%	±SD	RH%	±SD
15min.	1.39	1.4333 ^{f} ± 0.1115	1.46	1.4667 ^{e} 0.1102 ±	1.33	1.3333 ±0.0651	1.32	1.3267 ±0.0503
30min.	1.67	1.6600 ^{d} ±0.0656	1.75	1.7367 ^{c} 0.0321 ±	1.49	1.4733 ^{e} ±0.0473	1.51	1.4900^{e} ±0.0265
45min.	1.81	1.7967 ^{b} ±0.0321	1.95	1.9367 ^{a} ±0.0321	1.62	1.6100 ^{d} ±0.0458	1.67	1.6767^{d} ± 0.0306
* Total ± SD = [1.5783 ± 0.1906] **L.S.D= (0.0432).								

*Different letters on the each mean indicate arrangement that average and determine the mean arrangement between the averages in different time periods L.S.D= 0.0432.
* It is significant at the level of significantly P< 0.05.
* Values which no having the characters are not significant at 0.05 levels.

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الاستفادة من عصير ثمرة التين الشوكى بقشرها كمصدر للمكونات الوظيفية وإطالة فترة صلاحية تخزينه.

نسرين محمد السعيد علي

قسم بحوث تصنيع الحاصلات البستانية - معهد بحوث تكنولوجيا الأغذية - مركز البحوث الزراعية- الجيزة.

الملخص العربى

تعتبر ثمرة التين الشوكي واحدة من الفواكه الأكثر شعبية التى تنمو في مصر لحلو طعمها، الى جانب ذلك فهى تمتلك قيمة غذائية عالية، وبالتالي فغالبية الإستهلاك للكميات من ثمرة التين الشوكى تكون طازجة.

تتميز ثمار التين الشوكي وأجزائها المختلفة بإحتوائها علي نسبة عالية من المكونات الوظيفية مثل الألياف الغذائية، الملونات الطبيعية، المضادة للأكسدة والفيتامينات وهذه بعض من العناصر الغذائية التي يحتاجها الفرد في وجباته اليومية ، حيث أن بعض الخضروات تعد مصدر لهذه المكونات بما في ذلك الفواكه بقشورها وأحدها ثمرة كمثرى الصبار(التين الشوكى بالقشر).

كشفت نتائج دراسة حديثة منشورة دوليا قام بها بعض الباحثين بعام 2011م كانت على قشور مخلف ثمرة التين الشوكي ان القشور ليس لها أى تأثير سام على كلا من الكبد والكى . قصر فترة توافر ثمار الصبار طوال العام حيث مدته قصيرة جدا تتراوح مابين من 3-4 أسابيع، مما يحد من فترة صلاحية تخزين وانتشاره في جميع أنحاء العالم. حيث فترة توافر في السوق المحلى اقصاها من

2-1 أشهر في السنة صيفا- ومع انتشار العديد من الأمراض، وخاصة السمنة والسكر ما بين الأطفال وكبار السن أهمية الغذاء و ويتميز بالعديد من المكونات الوظيفية الصحة – الكامنة بقشور ثمرة التين الشوكى .

لذا فإن هذه الدراسة هي محاولة إنتاج منتجات غير تقليدية وهى ثمرة التين الشوكي المجففة بالقشر وذلك لإطالة فترة صلاحة تخزينها و أيضا إنتاج عصير طازج من ثمرة التين الشوكى بالقشر التى لا تتناول من قبل بين المستهلكين بالإضافة إلى الاستفادة من كل الكميات المزروعة التى قد تتجاوز حد الإنتاج للمحصول.

تم إجراء هذه الدراسة لبحث إمكانية الإستفادة القصوى من بعض ثمار الفواكه بالقشر مثل ثمرة التين الشوكى بغرض عدم إبقاء أى مخلفات بعد إستهلاكها وعلى سبيل المثال تناول ثمرة التين الشوكي بقشرها لما تمتلكه قشورها من فوائد صحية عظيمة حيث هى من الصبارات.

وقد نجح إستخدام أرخص طرق تكنولوجيا الحفظ وهى التجفيف بوسيلة غير مكلفة لإطالة فترة صلاحيته طوال العام ومع الحفاظ على كنز المكونات الوظفية الهامة لصحة الإنسان – حيث تجاوز إنتاج ثمار التين الشوكي (ثمرة كمثرى الصبار) 30 ألف طن من مصر حسب آخر إحصائية كانت عام 2005م، ولكن لا يزال إنتاجه منخفضة جدا لا كافية للإستهلاك المحلى في مصر طازجا دون إستخدام اى تطبيقات تكنولوجيا صناعية بالمقارنة مع إيطاليا والمكسيك وبلدان أمريكا اللاتينية التطبيقات الصناعية.

كشف النتائج التي تم الحصول عليها أن نسبة عالية من بعض المكونات الكيميائية، التي يمكن أن تساعد على استخدام ثمار التين الشوكي بالكامل بالقشر سيضيف قيمة إلى هذه الفاكهة لاحتوائه على المواد الوظيفية الغذائية والتكنولوجية. ايضا يحتوى على مستويات عالية من الصبغات البيتالين، الكاروتينات، الأنثوسياثين، كمواد مضادة للاكسدة كما جديرة بالملاحظة، تم القبول الحسيى بدرجة (جيد جدا) من قبل المستهلكين لثمرة التين الشوكي الكاملة بقشرها لكلا من عصير الفواكه الطازجة أو المجففة.

يمكن أن نخلص إلى أن عصير الفواكه الطازجة كاملة بقشرها طازجة / مجففة هي مناسبة وقيمة للاستهلاك الآدمى. لذلك يمكن أن عصير فواكه صبار التين الشوكى تسهم في تناول المواد المضادة للأكسدة مثل الفينولات وحمض الاسكوربيك. مما يجعلها تستخدم للحصول على المشروبات الطاقة والرياضيين لدعمهم بالعناصر المعدنية خلال فترات الارهاق البدني. هناك كانت اختلافات بين نسبة إعادة تشكيل عينات مختلفة غير هامة بفرق معنوى اقل من 0.05، أيضا انخفاض امتصاص الماء مع زيادة فترة التخزين 3 اشهر (3M) مقارنة مع الوقت صفرية.

وأخيرا، يمكن أن نخلص إلى إنه من الممكن اقتصاديا و بنجاح نزع شوك ثمرة التين الشوكى دون استخدام اى مواد كيميائية لإنتاج عصير طازج من ثمرة التين الشوكى كاملة بالقشر وكذلك شرائح مجففة من ثمار التين الشوكى بالقشر كغذاء صحي ، كما يمكن إيجاد صور للإستهلاك التين الشوكى غير الصورة التى تعتبر هى الغالبة او السائدة .