World Journal of Dairy & Food Sciences 16 (1): 19-27, 2021
ISSN 1817-308X

DOI: 10.5829/idosi.wjdfs.2021.19.27

Preparation of Functional Prickly Pear Juice Enriched with Sage or Mint Leaves Powder

[1]I.S. Badawi, [2]A.S. Ammar, [1]S.I. Ghoneim and [3]M.R. Shahein

[1]Food and Dairy Sciences and Technology Department,
Faculty of Environmental Agricultural Sciences, Arish University, Arish, Egypt
[2]Food Science Department, Faculty of Agriculture, Cairo University, Giza, Egypt
[3]Food Science and Technology Department, Faculty of Agriculture, Tanta University, Tanta, Egypt

Abstract: This study aimed to use natural sources of additives from medicinal plants to fortify therapeutic food with natural active substances at low economic cost. The following plants were chosen: (mint, sage) to support prickly pear. Prickly pear juice with the addition of mint or sage leaves powder in different concentrations (1.0, 1.5) and was stored at 5°C for 8 weeks. Chemical analysis, organoleptic properties, physiochemical characteristics and microbiological evaluation were carried out. Results indicated that the mint leaves had higher total phenolic compounds when compared to sage leaves. The mean values of phenolic compounds were 35.04 and 23.76 mg GA/g, respectively. The highest total flavonoid was recorded for sage leaves being 62.28 mg GA/g. While, the lowest one recorded for mint leaves was 43.184 mg GA/g. The prickly pear juice had total phenolic compounds and total flavonoids. The mean values were 228.5 and 26.95 mg GA/g, respectively. Addition of either Sage or mint leaves powder at level of 1.0 % and 1.5 increased the scores for color , odor, taste, consistency and total score of either fresh or stored juices. By increasing the level of the sage or mint leaves powder in prickly pear juice, the total score decreased. These additives enhanced the acidity development in prickly pear juice and increased total solids (TS) Also mint containing prickly pear juice had higher total bacterial counts than sage containing prickly pear juice.

Key words: Sage · Mint · Prickly Pear Juice · Phenolic Compounds · Flavonoids

INTRODUCTION

Prickly pear (*Opuntia ficus – indica*) a member of Cactaceae family, is widely distributed in Mexico, American and grows in many other parts of the world, such as Africa, Australia and the Mediterranean basin. The fruit is a fleshy berry, varying in shape, size and colour and has a consistent number of hard seeds and the fairly high sugar content and low acidity of the fruit [1, 2].

In Egypt, prickly pear trees are usually grown in sandy areas since the tree tolerates lack of water [3]. The prickly pear fruits are characterized by various colors due to the combination of two betalain pigments, the purple red betanin and the yellow-orange indicaxantin [4]. The prickly pears are considered to be a good source of minerals and other nutrients on the basis of compositional analysis [5]. The amount of phytochemicals varies between genus *Opuntia*; for example, it has been demonstrated that red-skinned prickly pear fruits contain taurine (7.7-11.2 mg/100g fresh fruit) at the same level of Sicilian cultivars of *Opuntia ficus-indica* but at a lower concentration than that reported for American and African cultivars [6]. Prickly pears contain phenolic compounds like ferulic acid, feruloyl-sucrose and sinapoyl-diglucoside, fatty acids like palmitic acid, stearic acid, oleic acid, vaccenic acid and linoleic acid (seeds, peel and juicy pulp) [7]. The pulp of prickly pear could be processed into many different products such as marmalades, jellies, natural sweeteners, wines and other alcoholic beverages, candies, canned, frozen fruit [8, 9]. The presence of many bioactive constituents in cactus, which could be responsible for various nutritional, medicinal and pharmacological uses [10]. Prickly pear is an important source of phenols, in addition to having the

Corresponding Author: Ibrahim Saleh, Food and Dairy Sciences and Technology Department, Faculty of Environmental Agricultural Sciences, Arish University, Arish, Egypt.

most common antioxidant phytochemicals, such as betalains and ascorbic acid [11]. Recently compared between Cladodes and Fruits of Prickly Pears, they found that its phenolic compounds concentrations were 119.66 and 123.56 mg/100 g and antioxidant activity 40.38% and 39.18 %, respectively [12]. Prickly pear seed oil has a noticeable antimicrobial activity against *Salmonella*, *Escherichia coli*, *Bacillus subtilis* and *Bacillus cereus* spores [13]. Prickly pear exhibited anti-inflammatory, anti-oxidant, antimicrobial, hypoglycemic and neuro protective properties due to the presence of health prompting properties not only in fruit but also in its stem. Furthermore, prickly pear fruit contains vitamins, carotenoids, poly phenolic compounds, flavonoids, betalains and minerals [14]. Betanin has been reported to possess antioxidant activity [15]. The aqueous extracts of *Salvia officinalis* exhibited *in vitro* antioxidant activity because of its content (glycosides, tannins, saponins, proteins, various phenolic compounds, alkaloids, flavonoids, steroids and vitamin C) [16]. Mint leaves of Mentha species were found to possess strong antioxidant properties in vitro by displaying free radical scavenging activity [17]. The previous researches didn't reveal the production of Prickly Pear juice Enriched with Sage or Mint leaves Powder, Therefore, this study aimed to Preparation of Functional Prickly Pear juice enriched with Sage or Mint leaves Powder to improve the bioactivity and nutritional properties of the resultant product.

MATERIALS AND METHODS

Source of Prickly Pear: Prickly pear (*Opuntia ficus indica*) was purchased from El-Arish local market, North Sinai Governorate.

Source of Herbs: Mint (*Mentha peperita*) and Sage (*Salvia officinalis*) leaves were obtained from El-Arish local market, North Sinai Governorate.

Preparation of Sage or Mint Leaves Powder: The plant leaves of mint and sage were dried at 30-40°C by the hybrid solar convective drying system (C.C.P. Parma – Italy) then grind the leaves until it becomes a powder.

Preparation of Juice Blends: The fresh prickly pear fruits was washed properly by hand in fresh water and peeled then, blended in blender. The seeds were separated from the juice by filtration, then either Sage or mint leaves Powder was added to the filtered juice at levels of 1.0% and 1.5% W/V of each. After that, the mixture was well mixed for 2 minutes by using the blender. The juice temperature was raised up to 82°C for 20 minutes. The juice was then bottled in 100 ml glass bottles heated up to 90°C for another two minutes. Finally the juice cooled down by using tab water and stored at 5°C until use. Prickly pear juice without additives was used as a control.

Proximate Chemical Analysis: Juice samples were chemically analyzed for Moisture, protein, Fat, Ash and dietary fiber contents were determined according to the standard methods [18], Carbohydrate was calculated by difference.

Determination of Titratable Acidity, Ph Value and Total Solids: Juice samples were chemically analyzed for titratable acidity, pH and Total Solids according to the method [18].

Determination of Total Phenolic Content (TPC): Total phenolic content (TPC) of Juice samples was determined by using a Folin-Ciocalteu reagent [19].

Determination of Total Flavonoid Content (TFC): Total flavonoid content (TFC) of Juice samples was measured by a modified colorimetric assay [20].

Determination of Radical Scavenging Activity (DPPH): Radical Scavenging Activity (DPPH) of juice samples was determined by using a spectrophotometer [21, 22].

Microbiological Assay: Total bacterial count of prickly pear juice was determined as described [23].

Organoleptic Properties of Juice: Sensory evaluation of the prepared prickly pear juices was enriched with (0, 1.0, 1.5, 2.0 and 2.5%) of each Sage and Mint performed by Fifteen semi trained panelists from the staff members and students of the Food and Dairy Science and Technology Department, Faculty of Environmental Agricultural sciences, Arish Univ., Egypt. The quality attributes of prepared juices were measured according to the method described [24], prepared juices were evaluated for color (40) odor (20) taste (20) consistency (20) and over all acceptability is the total of these four parameters.

Statistical Analysis: Data were statistically analyzed using a completely randomized factorial design when a significant main effect was detected; the means were separated with the Student-Newman-Keuls Test.

Differences between treatments of ($P \leq 0.05$) were considered significant using Cost at Program. Biological results were analyzed by One Way ANOVA.

RESULTS AND DISCUSSION

Proximate Chemical Composition of Prickly Pear Juice Enriched with Sage or Mint Leaves Powder: Data presented in Table (1) showed the proximate chemical composition of Prickly pear juice enriched with Sage or Mint leaves powder. Results indicated that addition of either Sage or Mint leaves powder at level of 1.0% and 1.5% for Prickly pear juice led to slightly increasing in chemical composition values of the produced Prickly pear juice (protein, ash, carbohydrates, fiber and fats) and this increase was associated with the level of addition.

The cactus pear juice had high amounts of total solids, fat and ash and but decrease in protein compared to pomegranate juice [25, 26]. The proximate chemical composition of the raw prickly pear pulp for moisture, protein, fat, fiber, ash, total sugar, reducing sugar (%) non-reducing sugar (%) and vitamin C were 84.55, 0.72, 0.45, 0.54, 0.42, 10.75, 8.24 2.72% and 32, respectively [8, 27, 28]. Moreover Prickly pears exhibited outstanding levels of components such as dietary fiber, protein and minerals. Results obtained allow us to underline the health benefits from prickly pear consumption as well as components with a high nutraceutical value [29]. Prickly pear fruit juice had high values of protein, fat, total sugars, reducing sugars and non-reducing sugars also, bioactive compounds, such as fiber, vitamins, minerals and organic acids. In addition juice has the high palatability than other samples and control as it scored the highest value as well as it contains a high activity of antioxidants [30].

Total Phenolic Compounds, Total Flavonoids and Radical Scavenging Activity (DPPH) of Sage or Mint Leaves: Results presented in Table (2) show the Total phenolic compounds, total flavonoids and radical scavenging activity of sage or mint leaves Powder. Results indicated that the mint leaves had total phenolic compounds higher than sage leaves. The mean values were 35.04 and 23.76 mg GA/g, respectively.

Moreover results indicated that the highest total flavonoid was recorded for sage leaves being 62.28 mg GA/g. While, the lowest one was recorded for mint leaves being 43.184 mg GA/g.

Sage modulated antioxidant pathways to minimize stress by scavenging free radicals. This may be due to the active constitutes of sage polyphenols, especially, phenolic and rosmarinic acid in sage which has potent antioxidant effects, thus protecting membrane lipids of fatty acids and phospholipids from oxidative stress [31]. Peppermint juice contains a number of biologically active compounds able to modulate lipid and glucose metabolism, of which flavonoids and other antioxidant compounds play a central role for improving the lipid and hyperglycemic profile [32]. The aqueous extracts of *Salvia officinalis* possess *in vitro* antioxidant activity because of its content (glycosides, tannins, saponins, proteins, various phenolic compounds, alkaloids, flavonoids, steroids and vitamine C) [16]. *S. officinalis* L. is one of the most appreciated herbs for richness of the essential oil content and its numerous biologically active compounds. It is considered as one of the greatest forms of healing medicine. The leaves of the plant have a wide range of biological activities, such as anti-bacterial, fungistatic, virustatic, antidiabetic, anticancer, astringent, eupeptic and antihydrotic effects [33].

Results in the same Table (2) indicate the radical scavenging activity of sage or mint leaves Powder. Results presented that the Sage leaves had radical scavenging activity higher than Mint leaves. The mean values were 46.1 and 29.94 %, respectively.

Mentha piperita essential oil had considerable degrees of antibacterial and antioxidant activities, which it can be useful for food preservation and pharmaceutical treatment [34]. *Mentha piperita* had the highest total phenolic content and showed the strongest antioxidant effects in DPPH assay in comparison to other four *Mentha* species [35]. The ethanol extract of *S. officinalis* had higher DPPH activity compared to the synthetic antioxidants BHA and BHT [36]. It proved that *Salvia* species was a good source of polyphenolic compounds with high antioxidant activity [37]. The harvest period and drying methods of leaves should be considered where it effect on antioxidant and DPPH properties of sage leaves and also had a positive effect on the polyphenol content [38].

Total Phenolic Compounds, Total Flavonoids and Radical Scavenging Activity (DPPH) of Prickly Pear Juice Enriched with Sage or Mint Leaves Powder: Data presented in Table (3) show the total phenolic compounds, total flavonoids and radical scavenging activity of Prickly pear juice. Values presented in Table (3) show that addition of different concentrations of sage or mint leaves powder enhanced total phenolic compounds and total flavonoids of prickly pear juice of all treatments.

Table 1: Proximate chemical composition of Prickly pear Juice enriched with Sage or Mint leaves powder

Treatments		Protein	Moisture	Ash	Fiber	Fats	Carbohydrates
Prickly pear juice	___	1.67	87.40	0.65	4.33	0.01	5.94
Prickly pear juice with Sage leaves powder	1.0%	1.75	86.54	0.74	4.42	0.04	6.51
	1.5%	1.77	86.23	0.83	4.46	0.07	6.64
Prickly pear juice with Mint leaves powder	1.0%	1.77	86.29	0.71	4.59	0.12	6.52
	1.5%	1.80	86.02	0.74	4.61	0.16	6.67

Table 2: Total phenolic compounds and total flavonoids radical scavenging activity (DPPH) of sage or mint leaves powder:

Treatments	Total phenolics (mg of Gallic acid/g)	Total flavonoids (mg/100g.d.w)	2, 2-diphenyl-1-picrylhydrazyl radical (DPPH)%
Sage leaves powder	23.76 ± 0.531	62.28 ± 0.129	46.1 ± 0.41
Mint leaves powder	35.04 ± 0.264	43.184 ± 0.27	29.94 ± 0.36

Table 3: Total phenolic compounds, total flavonoids and radical scavenging activity (DPPH) of Prickly pear Juice enriched with Sage or Mint leaves powder

Treatments		Total phenolics (mg gallic acid equivalents/100g)	Total flavonoids (mg equivalents/100g)	2, 2-diphenyl-1-picrylhydrazyl radical (DPPH)%
Prickly pear juice	___	228.5^{c} ± 0.74	26.95^{a} ± 0.07	81.831^{d} ±1.33
Prickly pear juice with Sage leaves powder	1.0%	228.74^{b} ± 0.84	27.57^{b} ± 0.06	82.512^{b} ±1.39
	1.5%	228.96^{b} ± 0.89	27.89^{a} ± 0.07	82.953^{a} ±2.01
Prickly pear juice with Mint leaves powder	1.0%	228.85^{b} ± 0.84	27.38^{c} ± 0.04	82.259^{c} ±1.36
	1.5%	229.03^{a} ± 0.97	27.68^{b} ± 0.06	82.427^{b} ±1.39

Results indicated that the Prickly pear juice contained total phenolic compounds and total flavonoids being 228.5 and 26.95 mg GA/g, respectively. Data indicated that Prickly pear juice enriched with Mint leaves powder 1.5% recorded the highest value (229.03%) of total phenolic compounds when compared with other treated blends with no significant difference, while, the lowest value (228.5%) of total phenolic compounds was recorded for Prickly pear juice without additives with significant difference. Also, Results indicated that Prickly pear juice enriched with Sage leaves powder 1.5% recorded the highest value total flavonoids level (27.89%) when compared with other treated groups with no significant difference. While, the lowest value (26.95%) of total flavonoids was recorded for Prickly pear juice without additives with significant difference.

The bioactive compounds in prickly pear juice may prevent degenerative diseases such as cancer, diabetes or cardiovascular diseases [39]. Phenolic compounds content of dried prickly pear showed three compound catechien, caffiec and vanillic [40]. Mint leaf extract possesses high amount of phenolic content, flavonoids content and flavonols. They also observed that this plant has radio protective effects possibly because of the amount of phenolic compounds, flavonoids and flavones due to their antioxidant and radical scavenging activity [41]. Likewise, it reported that green prickly pear, red and purple varieties have high content of bioactive compounds, mainly ascorbic acid (AA) and phenolic compounds [42, 43]. Mint (*M. piperita*) leaves contain 19-23% of polyphenols, which include eriocitrin and rosmarinic acid (59-67%) luteolin 7- orutinoside (7-12%) and hesperidin (6-10%) [44, 45]. Furthermore, the concentration of bioactive compounds in Mentha depends on species and in *M. piperita* depends on the plant variety, its maturity, geographical region, climate and processing conditions. *M. piperita* contains menthyl acetate (2-11%) isomenthone (2-8%) 1.2-3.9% (v/w) essential oils composed of menthol (33-60%) menthone (15-32%) eucalyptol (5-13%) menthofuran (1-10%) and limonene (1-7%) [46]. Various Mentha species and their extracts or essential oils have been shown to possess antioxidant activity [47]. Also, found that *S. officinalis* L. leaves are characterized by antioxidant properties and the antioxidants are effective against blood sugar [48]. Likewise, Sage leaves are a considerable source of phenolic compounds, the total polyphenols and flavonoids [49]. Sage (*S. officinalis* L.) is rich in the biologically active constituents which are represented mainly by polyphenolic compounds. They added that these polyphenolic compounds can be classified into phenolic acids and flavonoids. Also, they concluded that the high polyphenol content in *S. officinalis* [50]. Sage Leaves extracts is responsible for the strong antioxidant activities. It is used in the food and beverage industries due to its powerful antimicrobial activity against several gram positive and negative bacteria. It is rich in the biologically active constituents which are represented mainly by poly phenolic compounds [51].

Table 4: Physiochemical characteristics of prickly pear juice enriched with sage or mint leaves powder during storage period up to 8 weeks at 4±1°C

Treatments		Storage periods	pH	Acidity %	Total solids %
Control	___	0	5.39^{a} ±0.02	0.048^{e} ±.0.001	12.70^{d} ±0.05
		4 weeks	5.38^{a} ±0.02	0.053^{d} ±0.002	13.02^{d} ±0.06
		8 weeks	5.36^{a} ±0.03	0.062^{d} ±0.002	13.44^{d} ±0.02
Sage leaves powder	1.0%	0	5.29^{b} ±0.01	0.054^{d} ±0.004	14.77^{c} ±0.04
		4 weeks	5.10^{c} ±0.02	0.071^{c} ±0.001	15.21^{b} ±0.04
		8 weeks	4.78^{d} ±0.02	0.087^{b} ±0.002	15.53^{b} ±0.02
	1.5%	0	5.03^{c} ±0.02	0.056^{d} ±0.002	15.02^{b} ±0.04
		4 weeks	4.99^{c} ±0.01	0.082^{b} ±0.001	15.87^{a} ±0.03
		8 weeks	4.68^{d} ±0.02	0.096^{a} ±0.002	16.21^{a} ±0.04
Mint leaves powder	1.0%	0	5.31^{a} ±0.03	0.051^{d} ±0.005	13.97^{c} ±0.02
		4 weeks	5.26^{b} ±0.01	0.069^{c} ±0.002	14.55^{c} ±0.03
		8 weeks	5.11^{c} ±0.02	0.089^{a} ±0.001	15.33^{b} ±0.04
	1.5%	0	5.23^{b} ±0.02	0.052^{d} ±0.002	14.88^{b} ±0.03
		4 weeks	4.92^{c} ±0.02	0.066^{c} ±0.001	15.51^{b} ±0.05
		8 weeks	4.90^{c} ±0.02	0.091^{a} ±0.004	16.21^{a} ±0.02

Values are expressed as mean ± SD, n=3, Mean ± SD followed by different superscripts within columns significantly different ($p<0.05$).

Data in the same Table (3) indicated that Prickly pear juice enriched with Sage leaves powder 1.5% recorded the highest value (82.953%) of radical scavenging activity when compared with other treated blends with no significant difference. While, the lowest value (81.831%) of radical scavenging activity was recorded for Prickly pear juice without additives with significant difference.

The antioxidant capacity of Sicilian *Opuntia ficus-indica* fruit juice attributed to ferulic acid, rutin and isorhamnetin flavonol glycosides [52]. Also, antioxidant activity of Prickly pear fruit methanol extract and Prickly pear fruit ethanol extract may be attributed to the presence of total phenolics, ascorbic acid and betalain contents [53]. Likewise, Cactus fruit juice high correlation between its antioxidant activity and concentration. The free-radical scavenging activity and the inhibition of linoleic acid oxidation of the cactus fruit juice may be related to its high contents of both phenols and flavonoids [54]. Prickly pear methanol extract has the highest effectiveness in DPPH and β-carotene methods which recorded 1.8 and 1.62 ìg/ml, respectively [30]. *Salvia offcinalis* (Sage) can be a valuable natural source of antioxidants that can be used both in the food industry and in medicine [55].

Physiochemical Characteristics of Prickly Pear Juice Enriched with Sage or Mint Leaves Powder: Values presented in Table (4) show that addition of different concentrations of sage and mint leaves powder affected the acidity, pH and total solids (T.S) of prickly pear juice during storage.

Results indicated that these additives enhanced the acidity of prickly pear juice. The most effective additives in this respect were sage which showed the highest acidity and lowest pH values. Moreover acidity content of juice of all treatments slightly increased with the advance of storage period and this was associated with a decrease in pH values.

Results indicated that prickly pear juice with different concentrations from sage or mint resulted in remarkable increase in TS of resultant juice and this increase was associated with the level of addition.

Moreover results indicated that TS of juice of all treatments slightly increased with the advance of storage period. This could be due to the loss of some moisture during storage.

Total solids and total soluble solids contents are important factors in the production of fruit juice. It is well established that the higher the total solids is the better quality of juice. They found that the pH value was 6.16 ± 0.02 and the titratable acidity was 0.055% (as citric acid) thus cactus juice characterized as a low acid food (pH > 4.5) [54].

Total Bacterial Counts: Values presented in Table (5) show the total bacterial counts of prickly pear juice during storage as affected by addition of different concentrations of sage and mint leaves powder.

Results indicated that total bacterial counts gradually increased during storage period in juice of all treatments. Moreover, the blends of 1.5% sage with prickly pear juice contained 3.33, 3.83 and 4.13 cfu×10^{6}/g at 0, 4 and 8 weeks of storage, respectively, while the blends of 1.5% mint with prickly pear juice had 3.76, 3.97 and 4.18 cfu×10^{6}/g under the same mentioned conditions. So, it could be noticed that mint containing prickly pear juice had higher total bacterial count than sage with prickly pear juice.

Table 5: Total bacterial counts (TBC) of control and prickly pear juice enriched with sage or mint leaves powder during storage period up to 8 weeks at 4±1°C

		TBC cfu×10^6/g		
		Storage Periods (day)		
Treatments	Addition %	0	4 weeks	8 weeks
Control	___	4.12	4.43	4.83
Sage leaves powder	1.0	3.82	4.11	4.33
	1.5	3.33	3.83	4.13
Mint leaves powder	1.0	4.01	4.11	4.32
	1.5	3.76	3.97	4.18

Table 6: Effect the addition of Sage or Mint leaves Powder on Organoleptic Properties of Prickly pear juice during storage

Treatments		Storage periods	Color (40)	Odor (20)	Taste (20)	Consistency (20)	Total (100)
Control	___	0	36.5	18.1	19.0	19.2	92.8
		4 weeks	33.1	16.0	16.1	18.1	83.3
		8 weeks	30.2	13.0	15.0	17.3	75.5
Sage leaves powder	1.0%	0	38.2	19.3	18.6	19.0	95.1
		4 weeks	37.0	17.1	16.4	18.3	88.8
		8 weeks	35.4	16.4	15.2	17.6	84.6
	1.5%	0	37.8	18.8	18.4	18.8	93.8
		4 weeks	34.2	17.3	16.2	17.9	85.6
		8 weeks	32.3	17.1	14.8	17.2	81.4
	2.0%	0	27.7	18.2	17.8	17.4	81.1
		4 weeks	23.3	15.4	14.2	14.8	70.7
		8 weeks	18.5	13.2	12.3	13.3	61.8
	2.5%	0	25.6	17.3	15.2	15.1	73.2
		4 weeks	20.0	15.4	14.5	14.5	64.4
		8 weeks	17.2	13.0	11.4	13.5	56.1
Mint leaves powder	1.0%	0	38.4	19.0	19.0	19.1	95.5
		4 weeks	35.5	17.5	16.7	18.2	87.9
		8 weeks	33.0	16.4	15.9	17.8	83.1
	1.5%	0	38.0	19.2	18.1	19.0	94.3
		4 weeks	35.2	17.6	16.9	18.3	88.0
		8 weeks	32.2	15.8	15.7	17.8	81.5
	2.0%	0	30.1	17.2	15.8	16.5	79.6
		4 weeks	27.3	15.1	13.1	14.9	70.4
		8 weeks	22.1	13.3	12.5	12.4	60.3
	2.5%	0	28.0	17.1	15.4	16.2	76.7
		4 weeks	25.9	14.8	13.0	13.9	67.6
		8 weeks	21.5	11.4	11.2	12.1	56.2

These results agree with the strict limits of microbiological standards for fruit juices [56] and indicated that produced cactus juices had good quality and could be microbiologically stable for long storage periods.

Organoleptic Properties of Prickly Pear Juice Enriched with Sage or Mint Leaves Powder: Data presented in Table (6) showed the organoleptic scoring of Prickly pear juice enriched with different concentrations of Sage and Mint during storage periods (0, 4 weeks & 8 weeks).

Results indicated that addition of Sage or Mint leaves powder at levels of 1.0% and 1.5% had the highest values of the total score of Prickly pear juice. Increasing the level of the addition resulted in decreasing the total score of resultant Prickly pear juice.

Results indicated that addition of either Sage or mint at level of 1.0 % and 1.5 resulted in the highest scores of resultant juice for color, odor, taste, consistency and total score for either fresh or during storage period.

It the organoleptic characteristics of fresh cactus fruit juice (taste, color, flavor, appearance and overall acceptability) were evaluated by 50 individual of Egyptian consumers suffering from diabetes mellitus type 2 [54]. The obtained results indicated that all tested attributes recorded scores above 7 from 10, which revealed that

fresh cactus juice was organoleptically accepted by people suffering from diabetes mellitus type 2. These results are in harmony with those of Essa [57]. Prepared yoghurt concentrate supplemented with crushed leaves mint at ratios 2, 4 and 6%. They found that the addition of 2% mint level to yoghurt was established to be optimal in all the sensory qualities. Also, the yoghurt spread shelf life was 10 days at 5°C. The mint flavored yoghurt was suggested for use in different stuffs [58].

CONCLUSION

From the above results it could be concluded that fortifying prickly pear juice with different concentrations of sage or mint leaves powder led to improvement of bioactivity and the organoleptic properties of the product. In addition, these additions led to increase the total solids and acidity percentages as well as improve the microbiological quality of the prickly pear juice.

REFERENCES

1. Sepúlveda, E., C. Sáenz and M. Alvarez, 1990. Physical, chemical and sensory characteristics of dried fruit sheets of cactus pear *Opuntia ficus-indica* (L.). (Mill). and quince (*Cydonia oblonga* Mill). Italian J. Food Sci., 1: 47-54.
2. Joubert, E., 1993. Processing of the fruit of five prickly pear cultivars grown in South Africa. International J. Food Sci. and Technol., 28: 377-387.
3. Abdel-Nabey, A.A., 2001. Chemical and technological studies on prickly pear (*Opuntia ficus-indica*). fruits-Alexandria – Journal of Agricultural Research, 46(3): 61-70.
4. Fernandez-Lopez, J.A. and L. Almela, 2001. Application of high performance liquid chromatography to the characterization of the batalain pigments in prickly pear fruits. J. Chromatogr., 913: 415-420.
5. Conn, M.C. and A. Nakata, 2004. Glycoprotein (90kCa). Isolated from *Opuntia ficus-indica* var. saboten Makino lowers plasma lipid level through scavenging of intracellular radicals in triton WR-1339-induced mice. Biol. Pharm Bukk, 29: 1391-1396.
6. Tesoriere, L., M. Fazzari, M. Allegra and M.A. Livrea, 2005. Biothiols, Taurine and Lipid-Soluble Antioxidants in the Edible Pulp of Sicilian Cactus Pear (*Opuntia ficus-indica*). Fruits and Changes of Bioactive Juice Components upon Industrial Processing. J. Agric. Food Chem., 53: 7851-7855.
7. Chougui, N., A. Tamendjari, W. Hamidj, S. Hallal and A. Barras, 2013. Oil composition and characterisation of phenolic compounds of *Opuntia ficus indica* seeds. Food Chem., 139: 796-803.
8. Moßhammer, M.R., F.C. Stintzing and R. Carle, 2006. Cactus pear fruits (*Opuntia* spp.). A review of processing technologies and current uses. J. Profess. Assoc. Cactus Dev., 8: 1-25.
9. Matter, A.A., E.A.M. Mahmoud and N.S. Zidan, 2016. Fruit flavored yoghurt: chemical, functional and rheological properties. Int. J. Environ. Agric. Res., 2(5): 57-66.
10. Tilahun, Y. and G. Welegerima, 2018. Pharmacological potential of cactus pear (*Opuntia ficus indica*). A review Journal of Pharmacognosy and Phytochemistry, 7(3): 1360-1363.
11. Zenteno-Ramirez, G., B.I. Juárez-Flores, J.R. Aguirre Rivera, M. Monreal-montes, J. |Merida Garcia, M. Perez Serratosa, M.Á. Varo Santos, M.D. Ortiz Perez and J.A. Rendon-Huerta, 2018. Juices of prickly pear fruits (*Opuntia* spp.), as functional foods Ital. J. Food Sci., 30: 614-627.
12. Elshehy, H.R., S.S. El-Sayed, E.M. Abdel-Mawla and N.F. Agamy, 2020. Nutritional Value of Cladodes and Fruits of Prickly Pears (*Opuntia ficus-indica*). Alex. J. Fd. Sci. & Technol., 17(1): 17-25.
13. Abdel Fattah, M.S., S.E.A. Badr and A.S. Elsaid, 2020. Nutritive value and chemical composition of prickly pear seeds (*Opuntia ficus indica* L.) growing in Egypt. Int. J. Agric. Pol. Res., 8(1): 1-10.
14. Sabtain, B., R. Farooq, B. Shafique, M.M.A.N. Ranjha, S. Mahmood, G. Mueen-Ud-Din, S. Irfan, K. Shehzadi, Q. Rubab, L. Asad and M. Ishfaq, 2021. A Narrative Review on the Phytochemistry, Nutritional Profile and Properties of Prickly Pear Fruit. Op. Acc. J. Bio. Sci. & Res., 7(2): DOI: 10.46718/JBGSR.2021.07.000164.
15. Kanner, J., S. Harel and R. Granit, 2001. Betalains -A New Class of Dietary Cationized Antioxidants Journal of Agricultural and Food Chemistry, 49: 5178-85.
16. Kadhim, S.M., M.T. Mohammed, O.M. Ahmed and M.N. Jassimand, Abd, 2016. Study of some *Salvia officinalis* L. (Sage). Components and effect of their aqueous extract on antioxidant. Int. J. Chem. Sci., 14(2): 711-719. ISSN 0972-768X.
17. Brown, N., J.A. John and F. Shahidi, 2019. Polyphenol composition and antioxidant potential of mint leaves. Food Prod Process and Nutr., 1: 1-14.

18. A.O.A.C., 2000. Official Methods of Analysis of AOAC International, 17th ed. by Horwitz, W. Suite 500, 481 North Fredric avenue Gaithersburg, Maryland, 20877-2417, USA.
19. Jayaprakasha, G.K., R.P. Singh and K.K. Sakariah, 2001. Antioxidant activity of grape seed (*Vitis vinifera*), extracts on peroxidation models *in vitro*. Food Chem., 73: 285-290.
20. Dowd, C., 1959. Effect of menthol on cold receptor activity and analysis of receptor processes. J. Gen. Physiol., 88: 757-776.
21. Li, W., C.V. Wei, P.J. White and T. Beta, 2007. High-amylase corn exhibits better antioxidant activity than typical and waxy genotypes. J. Agric. Food Chem., 55: 291-298.
22. Dehshahri, S., M. Wink, S. Afsharypuor, G. Asghari and A. Mohagheghzadeh, 2012. Antioxidant activity of methanolic leaf extract of *Moringa peregrine* (Forssk). Fiori. Research in Pharmaceutical Sciences, 7(2): 111-118.
23. Richardson, H.G., 1985. Standard methods for the examination of dairy products (5th ed., pp: 133-150). Washington D.C.: American Public Health Association.
24. Potter, N.N., 1986. Quality Factors and How they are Measured, Food Science (book). AVI Publishing Company, Inc., 4th Edition, pp: 113-139.
25. Hallim, A.M., A. Rabie, M.A. El-Shewey and A.S. Abdel-Ghany, 2019. Evaluation of the Physicochemical Properties and antioxidant activity of stirred yoghurt fortified with Pomegranate and Cactus Pear Juices. Zagazig J. Agric. Res., 46: (6A).
26. Roghelia, V. and J. Panchal, 2016. Physicochemical characteristics of cactus pear fruits. J. Pharm. Chem. Biol. Sci., 4(1): 119-125.
27. Stintzing, F.C., A. Schieber and R. Carle, 2001. Phytochemical and nutritional significance of cactus pear. Eur. Food Res. Technol., 212: 396-407.
28. Saenz, C., 2002. Cactus pear fruits and cladodes: A Source of functional components for foods. Acta Hort. (Proc. 4th IC on Cactus Pear and Cochineal), 581: 253-263.
29. Silos-Espino, H., L. Fabian-Morales, J.A. Osuna-Castro, M.E. Valverde, F. Guevara-Lara and O. Paredes-Lopez, 2003. Chemical and biochemical changes in prickly pears with different ripening behavior. Nahrung/Food, 47(5): 334-338.
30. Bareh, G.F., M.S. Shaheen and A.M.S. Hussein, 2012. Production of good quality products from Egyptian Prickly pear fruits. J. Appl. Sci. Res., 8(11): 5494-5503.
31. Frei, B. and J.V. Higdon, 2003. Antioxidant activity of tea polyphenols in vivo evidence from animal studies. J. Nutr., 133(10): 3275S-3284S.
32. Barbalho, S.M., F.M.V.F. Machado, M. Oshiiwa, M. Abreu, E.L. Guiger, P. Tomazela and R.A. Goulart, 2011. Investigation of the effects of peppermint (*Mentha piperita*) on the biochemical and anthropometric profile of university students. Food Science and Technology, 31(3): 584-588.
33. Hasanein, P., M. Sharifi and A. Emamjomeh, 2017. Recent Studies on the Neuropharmacological Effects of *Salvia officinalis* L.: A Promising Candidate for Alzheimer's Disease. Med. Chem., 7: 348-352.
34. Goudjil, M.B., S. Ladjel, S.E. Bencheikh, S. Zighmi and D. Hamada, 2015. Chemical Composition, Antibacterial and Antioxidant Activities of the Essential Oil Extracted from the *Mentha piperita* of Southern Algeria. Res. J. Phytochem., 9(2): 79-87.
35. Nickavar, B., A. Alinaghi and M. Kamalinejad, 2008. Evaluation of the antioxidant properties of five *Mentha* species. In: Iranian Journal of Pharmaceutical Research, 7: 203-209.
36. Duletić-Laušević, S., A. Alimpić, D. Pavlović, P.D. Marin and D. Lakušić, 2016. *Salvia officinalis* of different origin Antioxidant activity, phenolic and flavonoid content of extracts. Agro Food Industry Hi Tech., 27(1): 52-55.
37. Jasicka-Misiak, I., A. Poliwoda, M. Petecka, O. Buslovych, V.A. Shlyapnikov and P.P. Wieczorek, 2018. Antioxidant phenolic compounds in *Salvia officinalis* L. and *Salvia sclarea* L. Ecol Chem. Eng. S., 25(1): 133-142.
38. Francik, S., R. Francik, U. Sadowska, B. Bystrowska, A. Zawiœlak, A. Knapczyk and A. Nzeyimana, 2020. Identification of Phenolic Compounds and Determination of Antioxidant Activity in Extracts and Infusions of Salvia Leaves. Materials. J., 13(24): 5811.
39. Jacob, J.K., F. Hakimuddin, G. Paliyath and H. Fisher, 2008. Antioxidant and antiproliferative activity of polyphenols in novel high-polyphenol grape lines. Food Res. Int., 41: 419-428.
40. Chang, S.F., C.L. Hsieh and G.C. Yen, 2009. The protective effect of *Opuntia dillenii* Haw fruit against low-density lipoprotein peroxidation and its active compounds. Food Chem., 106: 569-575.
41. Samarth, R.M. and M. Samarth, 2009. Protection against radiation-induced testicular damage in Swiss Albino Mice by *Mentha piperita* (Linn.). Basic and Clinical Pharmacology and Toxicology; 104(4): 329-334.

42. Cansino, N.C., G.P. Carrera, Q.Z. Rojas, L.D. Olivares, E.A. Garc_Ia and E.R. Moreno, 2013. Ultrasound processing on green cactus pear (*Opuntia ficus indica*) juice Physical, microbiological and antioxidant properties. J. Food Process. Technol., 4: 267.
43. Zafra-Rojas, Q.Y., N. Cruz-Cansino, E. Ram_Irezmoreno, L. Delgado-Olivares, J. Villanuevas Anchez and E. Alan_Is-garc_Ia, 2013. Effects of ultrasound treatment in purple cactus pear (*Opuntia ficus indica*). juice. Ultrason. Sonochem., 20: 1283-1288.
44. Kamiloglu, S., G. Toydemir, D. Boyacioglu and E. Capanoglu, 2012. "Health Perspectives on Herbal Tea Infusions" in Phytotherapeutics, 43(1): 54-68.
45. Berdowska, I., B. Zieli_nski, I. Fecka, J. Kulbacka, J. Saczko and A. Gamian, 2013. Cytotoxic impact of phenolics from Lamiaceae species on human breast cancer cells. Food Chemistry, 141: 1313e1321.
46. Fatemi, F., S. Dini, M.B. Rezaei, A. Dadkhah, R. Dabbagh and S. Naij, 2014. "The Effect of γ-Irradiation on the Chemical Composition and Antioxidant Activities of Peppermint Essential Oil and Extract" in Journal of Essential Oil Research, 26(2): 97-104.
47. Kapp, K., 2015. Polyphenolic and essential oil composition of Mentha and their antimicrobial effect. Academic Dissertation. Faculty of Pharmacy of the University of Helsinki, pp: 90.
48. Nunthaboot, N., K. Lugsanangarm, S. Kokpol and I.S. Abd-Elazem, 2013. Binding mode prediction of biologically active compounds from plant Salvia Miltiorrhiza as integrase inhibitor. Bio-information, 9: 426-431.
49. Gird, C.E., I. Nencu, T. Costea, L.E. Duţu, M.L. Popescu and N.Ciupitu, 2014. Quantitative analysis of phenolic compounds from *Salvia officinalis* L. leaves. Farmacia, 62(4): 649-657.
50. Abdelkader, M., B. Ahcen, D. Rachid and H. Hakim, 2014. Phytochemical Study and Biological Activity of Sage (*Salvia officinalis* L.). International Journal of Biological, Biomolecular, Agricultural, Food and Biotechnological Engineering, 8(11): 1231-1235.
51. El-Feky, A. M. and W. M. Aboulthana, 2016. Phytochemical and Biochemical Studies of Sage (*Salvia officinalis* L.). UK Journal of Pharmaceutical and Biosciences, 4(5): 56-62.
52. Galati, E.M., M.R. Mondello, D. Giuffrida, G. Dugo, N. Miceli, S. Pergolizzi and M.F. Taviano, 2003. Chemical characterization and biological effects of Sicilian *Opuntia ficus-indica* (L.). Mill. Fruit juice: antioxidant and anti-ulcerogenic activity. J. Agric. Food Chem., 51(17): 4903-4908.
53. Florian, C.S., M.H. Kirsten, R.M. Markus, C. Reinhold, Y. Weiguang, S. Subramani, C.A. Casimir, B. Ron and F.Peter, 2005. Color, Betalain Pattern and Antioxidant Properties of Cactus Pear (*Opuntia* spp.). Clones, J. Agric. Food Chem., 53(2). 442-451.
54. Abd El-Razek, F.H. and A.A. Hassan, 2011. Nutritional Value and Hypoglycemic Effect of Prickly Cactus Pear (*Opuntia ficus- indica*). Fruit Juice in Alloxan-Induced Diabetic Rats. Aust. J. Basic & Appl. Sci., 5(10): 356-377.
55. Farhat, M.B., M.J. Jordán, R. Chaouech-Hamada, A. Landoulsi and J.A. Sotomayor, 2009.Variations in essential oil, phenolic compounds and antioxidant activity of tunisian cultivated Salvia officinalis L. J. Agric. Food Chem., 57: 10349–10356.
56. GCC Standardization Organization, 2015. Microbiological Criteria for Foodstuffs GSO-1016-2015. https://www.scribd.com/document/407885670/GSO-1016-2015-E.
57. Essa, R.Y., 2009. Chemical and technological studies on *Opuntia ficus-indica* and its effect on diabetics, pp: 53-57. M.Sc. Thesis, Food Tech. Dept. Fac. of Agric., Kafr El-Sheikh Univ., Egypt.
58. Kumar, S.T., P. Arvindakshan and A. Sangeetha, 2013. Development of mint flavoured yoghurt spread. Asian J. Dairy Food Res., 32(1): 19-24.