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Arab Univ.
J. Agric. Sci.,
Ain Shams Univ.,
Cairo, 17(1), 105-118, 2009

PRODUCTION OF LOW CALORIC DEHYDRATED VEGETABLE MIXTURES

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Keywords: Vegetable mixtures, Low calorie, Antioxidant Compounds, Nutritional value

ABSTRACT

Hot flow air currents were used in sheld dryers to dehydrate some vegetables (squash, peas, green beans, potatoes, yellow carrot, tomatoes, onion, green pepper, yellow pepper, red pepper, cauliflower and eggplant) which were used to prepare 8 recipes of dehydrated vegetable mixture (vegi-mix). Sensory evaluation indicated that, 4 recipes of vegi-mix's recorded the highest scores of sensory evaluation and considered the prefer recipes and stored at ambient temperature up to 3 months during which, the physicochemical composition, the antioxidants and microbiological examination were assessed. Results revealed that the recipe composed of yellow, green and red paper, cauliflower and eggplant to prepare the vegi-mix caused to increase of total phenolic compounds, total flavonoids and total carotenoids content. The moisture contents were in the range of (8.62-9.78%); ether extract (10.23-16.76%); total carbohydrate (51.6-53.6%); crude fiber (9.62-10.61%) and total calories (340.43-375.36 kcal/100g dry weight basis respectively) for the selected 4 recipes. On the other hand, the tested vegi-mix's being also as a good source of fibers, minerals and antioxidants. Changes in moisture, crude fibers, total solids, total carbohydrate, chlorophyll a and b and total carotenoids, flavonoids and phenolic compounds as well as total bacterial counts, yeast and mould counts, sporeforming bacterial counts content were also studied during 3 months of storage at ambient temperature. A little decremental was observed in total phenolic compounds, total flavonoids content through 3 months of storage for the tested vegi-mix's. Results also showed that all tested vegi-mix's. were microbiologically safe up to 3 months of storage and maintained original sensory properties. Therfore, dehydrated vegi-mix's composed of squash, peas, green beans, potatoes, carrot, tomatoes, onion, green, red and yellow pepper, cauliflower and eggplant without herbs considered as a good source of antioxidants, minerals, high nutritional value, good palatability and healthy safe through three months of storage at ambient temperature.

INTRODUCTION

Nowadays, consumers have increased for consuming high amounts of safe ready to use products but with high sensory attributes, nutritional and health qualities of foods. The food should be nutritious, attractive in flavor and appearance, to be eaten and enjoyed. A balance of nutrients may be obtained by including whole cereals, vegetables, pulses and milk products, etc. Such these diets provides a large proportion of our energy needed, carbohydrate, protein, dietary fiber, amino acids and minerals **(Pandey *et al* 2006).**

Dehydration or drying methods of food preservation in which water removal is used to control the growth of microorganisms and enzymatic activity that decompose foods in their natural state. Ideally, dehydrated foods are maintained in such a state that they can be reconstituted to approximately their original volume when contacted with sufficient water **(Fellows, 1990 and Coenders, 1992).**

Evidence the reason for high consumption of fruit and vegetables to support the protective effects on the risks of many cancers and age-related diseases is extensive and consistent. For example, high consumption of fruits and vegetables is related to protect human against the lung cancer **(Michaud *et al* 2000).**

(Received April 14, 2008)
(Accepted January 22, 2009)

Vegetables are mostly low in calories and high in water soluble vitamins and also contain minerals and fibers. Today, the world trends to use new technologies for drying without additives and to produce a good quality and promoted the nutritional values of the products. Tomato, beans, broccoli, beet, mushroom, corn, white cabbage, kale, cauliflower, spinach, garlic, onion, are typical vegetables containing antioxidants **(Sun *et al* 2002).** The dehydrated vegetables food such as soups, baby food mixtures are considered the most important point in the production of the convenient foods. Such foods are necessary for hotels, hospitals, military, restaurants and also home uses **(Osman *et al* 1991).**

The bioactive constitutes of food plants such as carotenoids, phenolics, flavonoids, antioxidants, vitamins (C, A and E) and other micronutrients are seeming to play an important role in the protection against oxidative stress **(Prior & Guohan, 2001; Sohal, 2002 and Liu, 2003)**.

Zobel *et al* (2006) revealed that, consumption of vegetables (such as tomatoes juice, carrot juice and spinach) containing different carotenoids and lycopene could protect against DNA damage and oxidative DNA damage.

The present study aimed to produce some items of low calorie mixtures of dehydrated vegetables, then selected the suitable recipes to examine same quality attributes and determination of proximate chemical composition and antioxidant contents. Also microbiological evaluation was undertaken.

MATERIALS AND METHODS

Materials

Vegetables namely squash, peas, green beans, potatoes, carrots, tomatoes, onions, (green, yellow and red pepper), cauliflower and eggplant, were obtained at season 2006 from local market in Giza, Egypt.

Methods

1- Preparation of vegetables for drying

The different vegetables namely carrot, tomatoes, onion, green, yellow and red pepper, eggplant were sorted, washed and prepared according the suitable form of each, where, the eggplant and squash cut into cubes (diameter 2x2x2 cm), potatoes cut into 1.5x1.5x8 cm, cauliflower, green beans and squash (cut to small pieces), then blanched at 95ºC/1 min, 3 min, 5 min for squash and potatoes, peas, green beans, respectively. Cubed eggplant were soaking in 1.5-2.0% acetic acid for 30 sec. Prepared vegetables were dehydrared in sheld dryer (Tray type, fisher scientific, ser. No. (253855) iso temp. oven). Hot air was supplier of heat and temperature was controlled by the thermostate controller at 64ºC in the first four hours and then reduced to 50ºC till completely drying.

2- Preparation of vegetable recipes (vegi-mix's)

Dehydrated vegetables were mixed to prepare 8 various recipes (vegi-mix's) with different ratios of dehydrated vegetables as shown in **Table (1).** The obtained recipes packed into four layer packaging and stored at room temperature till analysis.

3- Physical analysis of vegi-mix's

Rehydration ratio and water absorption were determined according to the method of **Ranganna (1979)** as follows:

$$\text{Rehydration ratio} = \frac{\text{Rehydrated sample}}{\text{Dehydrated sample}} = \text{A: 1}$$

(Where A = Rehydrated materials)

$$\text{Percent water in the rehydrated material} = \frac{\text{Drained wt of A} - \text{dry matter content in B}}{\text{Drained wt of rehydrated material}}$$

Where A = Rehydrated materials
B = Sample taken for rehydration

$$\text{Water absorption} = \text{Wt sample after rehydration} - \text{Wt sample before rehydration} \times 100$$

Total calories of vegi-mix's were calculated by the formula of James (1995) as follows

Total calories = Fat x 9 + Protein x 4 + Total carbohydrate x 4

5- Sensory evaluation

Sensory attributes (color, taste, odor, texture and general acceptability of dehydrated (vegi-mix's) after preparing different recipes 10 gm (vegi-mix's) : 100 ml water and/or soup were evaluated

directly after 10 min of cooking by 10 panelists in Food Tech. Res. Inst. Lab. According to the method reported by **Sidel and Stane (1976).**

6- Chemical analysis of vegi-mix's

Moisture, ash, crude fibers, ether extract and protein contents were determined according to the method of **A.O.A.C (2000).** Total carotenoids, phenolic compounds, total flavonoids and chlorophyll contents were determined using the methods described by **Swin and Hillis (1959)** and **Snell and Snell (1954).** Minerals content i.e. iron, magnesium, sodium, potassium, calcium, manganese, cupper, phosphorus, and zinc were determined using atomic absorption (Pye Unican spectrophotometer SP. England) as mentioned by **Kasai *et al* (1997)**

7- Microbiological evaluation

Total viable counts, yeast and mould counts and spore forming bacterial counts were carried out by the method of **Smith and Townsend (1999).**

8- Statistical analysis

Means of data obtained for sensory attributes of tested vegi-mix's were calculated with Dunkan's multiple range test to identify significant differences at 0.05probability ($P<0.05$) by using the statistical analysis system (**SAS Institute Inc., 1999).**

RESULTS AND DISCUSSION

Physical properties of dehydrated vegetables and vegi-mix's

Figs. (1, 2 and 3) illustrated the absorption% of water for various dehydrated vegetables either in hot water or cold water at different times. It could be shown that reconstituted of green beans, green pepper and cauliflower in hot water after 10 and 20 min had the highest percentages of absorbed water comparing with other dehydrated vegetables **Fig. (1)**. But the dehydrated squash, onion, eggplant and green pepper recorded the highest percentage of absorped cold water after 90 and 120 min as shown in **Fig. (2).** The recovery of dehydrated vegetables in hot and cold water are shown in **Fig. (3).** However, dehydrated onion and green pepper had recorded the highest% of water absorption to reconstitute after 20 and 120 min in hot and cold water, respectively. These results are in accordance with those reported by **Shirley and Margy (1994)** which they reported that smaller pieces for some vegetables may rehydrate more quickly, while along time of blanching may partially cooking of some vegetables which other wise require longer cooking.

Data in **Table (2)** shows the physical properties of tested vegi-mix's, it could be noticed that recipes for samples A1, B1 had the highest absorption percentage of water/100g and or soups than those for recipes A2 and B2. Meanwhile, the recipe of A2 had the lowest rehydration% (which composed of squash, peas, green beans, potatoes, carrot, tomatoes, onion and green pepper recorded 70.12%) followed by A1 (75.09%), B2 (77.44%) and B1 (78.82%), whereas, rehydrated recipe of B1 recoded the highest rehydration ratio compared with other tested recipes.

Sensory evaluation of vegi-mix's

Sensory evaluation could be considered the most important aspects in vegi-mix's since its reflects to the consumer preference. Sensory characteristics includes color, taste, odor, texture and general acceptability were evaluated and represented in **Table (3).** Analysis of variance showed that, vegetable mixtures which composed of red and yellow pepper, cauliflower and eggplant (B1) in addition to squash, peas, green beans, potatoes, carrot, tomatoes, onion and green pepper (B2) which are represented in **Table (1).** Results indicat that recipe B1 and B2 cooked in hot water and soup plus salt recorded the highest scores of color, taste, odor, texture and general acceptability followed by recipes A1 and A2 (which are composed of squash, peas, green beans, potatoes, carrot, tomatoes, onion, green pepper only which are represented in **Table (1)**, respectively compared to those in the other tested recipes. Meanwhile, the addition of herbal extracts to recipes led to obtain the lowest scores of general acceptability for recipes C1, C2, D1 and D2.

On the other hand, there were no significant differences for general acceptability for vegi-mix's of recipes A2, B1 and B2, whereas, there were a significant differences were noticed between all criterion for recipes A1, A2, B1 and B2 compared with other investigated recipes (C1, C2, D1 and D2, as shown in **Table (3)**.

It could be clearly observed that the accepted vegetable recipes (A1, A2, B1 and B2) because there were prefer and recorded the highest scores

Table 2. Physical properties of recovery dehydrated vegetable mixtures (vegi-mix's)

Recipes	Type of Recovery	Water absorption /100g sample (%)	Rehydration %	Rehydration ratio
A_1	Water	425	75.09	4.014 :1
A_2	Soup	333	70.12	3.35 :1
B_1	Water	425	78.82	4.72 : 1
B_2	Soup	325	77.44	4.43 :1

A1 : Recipe composed of squash, peas, beans, potatoes, carrot, tomatoes, onion and green pepper rehydrated in hot water.
A2 : Recipe composed of squash, peas, beans, potatoes, carrot, tomatoes, onion and green pepper rehydrated in soup.
B1 : Recipe composed of squash, peas, beans, potatoes, carrot, tomatoes, onion green pepper, red pepper, yellow pepper, cauliflower and eggplant rehydrated in hot water.
B2 : Recipe composed of squash, peas, beans, potatoes, carrot, tomatoes, onion green pepper, red pepper, yellow pepper, cauliflower and eggplant rehydrated in soup.

Table 3. Sensory evaluation of prepared dehydrated recipes of vegi-mix's

Recipes	Taste	Color	Odor	Texture	General acceptability
A_1	7.7±**1.25^{a}	6.58±1.31^{bc}	6.83±1.19^{b}	7.28±1.68^{a}	7.27±1.49^{a}
A_2	7.6±1.17^{a}	6.92±1.31^{ab}	6.67±1.30^{b}	7.08±1.38^{ab}	7.0±1.4^{ab}
B_1	6.9±1.45^{ab}	7.36±1.12^{a}	7.08±1.68^{a}	7.25±1.36^{a}	7.04±1.52^{ab}
B_2	6.8±1.55^{ab}	6.68±1.88^{bc}	6.73±1.74^{b}	6.0±1.41^{bc}	6.96±1.50^{ab}
*C_1	5.9±1.1^{bc}	6.81±1.4^{bc}	5.92±1.93^{c}	6.67±2.06^{b}	6.25±1.86^{b}
*C_2	6.9±1.45^{ab}	5.92±1.38^{c}	7.0±1.65^{a}	5.5±1.0^{c}	6.09±1.26^{bc}
*D_1	6.1±2.28^{b}	7.08±1.73^{ab}	6.17±1.99^{bc}	6.4±1.0 7^{bc}	6.0±1.26^{bc}
*D_2	6.2±1.75^{b}	6.7±1.49^{bc}	6.3±1.7^{bc}	6.0±1.56^{bc}	6.4±1.17^{b}

*** Rejected**

****(Means±SD)** For each treatment within a column, means not sharing the same alphabetical letter are significantly different at 0.05

than other tested vegi-mix's after storage up to 3 months in four layer packaging at ambient temperature as shown in **Table (4).** Generally, panelist scores indicated that tested vegi-mix's especially recipes A1, A2, B1 and B2 soaked either in hot water or soup plus salt had the highest scores and came in the first order compared with all other tested recipes. Therefore, these four recipes namely A1, A2, B1 and B2 of vegi-mix's were chosen to continue for other analysis through 3 months.

Proximate chemical composition

Table (5) illustrated the chemical composition of the selected dehydrated vegi-mix's. It could be noticed that, the moisture content for all selected dehydrated vegetables (vegi-mix's) ranged between 8.62-9.78%. Vegi-mix's for recipes A1 and A2 had approximately the same values for all chemical composition followed by recipes B1 and B2, respectively. Whereas, the recipe A1 had the highest ether extract (16.76%) followed by recipe A2 (16.36%) and recipe B1 and B2 (10.23-10.13%) (on dry weight basis), respectively. The corresponding values of total carbohydrate contents in recipes A1, A2, B1 and B2 were 39.13; 39.98; 46.36 and 47.28%, respectively. Crude fibers content for recipes A1, A2, B1 and B2 found to be 10.61; 10.52; 9.83 and 9.62% respectively.

Generally, the dehydrated recipes of B1 and B2 for tested vegi-mix's recorded the lowest calories contents 340.43 and 341.58 kcal/100g (on dry weight basis), respectively compared with those for other tested samples. This may be due to the decremental of crude protein and ether extract contents in these dehydrated vegi-mix's which composed of red pepper; yellow pepper; cauliflower and eggplant in recipe B1 and B2. These results are coincide with those obtained by **Pandey *et al* (2006)**, they noticed that green leafy vegetables (paratha) contain 359-374 kcal/100g. Therefore, it could be considered these recipes (prepared vegi-mix's) as low calorific mixtures.

Minerals content of the selected recipes for dehydrated vegi-mix's

Minerals content of the selected recipes for dehydrated vegi-mix's are represented in **Table (6).** The obtained results indicated that, magnesium, sodium, potassium and calcium were the major minerals in all selected samples (Recipes of A1, A2, B1 and B2) which lies in the range of 240.3 to 244.9; 3258.7 to 4880.4; 3001.9 to 4251.6 and 58.11-59.14 mg/100g dry basis, respectively. However, the lowest amounts of minerals in tested recipes were calcium, iron and cupper **(Table 6).** Results also indicated that, the recipe B1 and B2 had the highest content of Mg, Fe, Mn and Zn compared with those in the other tested recipes. These results may be due to the presence of carrot, red pepper, green pepper and cauliflower and eggplant in these recipes which are considered the rich sources of minerals especially for potassium, magnesium and iron **Johanna (1999)**. Therefore, it could be mentioned that the selected dehydrated vegi-mix's had adequate minerals content and considered as sufficient source of minerals for human nutrition.

Physico-chemical composition of selected dehydrated vegi-mix's during 3 months of storage

Table (7) illustrated the effect of storage at ambient temperature for 3 months on physico-chemical composition for selected dehydrated vegi-mix's Results indicated that, there were no differences in moisture, total solids, total carbohydrates and crude fibers for all selected samples during storage in four layer packaging at ambient temperature. Also, there were showed a little changes in total carbohydrate contents during storage up to 3 months.

Antioxidants and chlorophyll contents of selected dehydrated vegi-mix's during 3 months of storage

Antioxidant compounds of selected dehydrated recipes of vegi-mix's were also determined and the results are recorded in **Table (8)**. Results indicated some differences among four selected dehydrated vegi-mix's in total phenolic compounds, total flavonoids, chlorophyll A and B and total carotenoids contents at the initial time of storage and during storage up to 3 months at ambient temperature. Data appeared that recipes (B1 and B2) of dehydrated vegi-mix's (which composed of squash, peas, green beans, potatoes, carrot, tomatoes, onion, green pepper, red pepper, yellow pepper, cauliflower and eggplant) had the highest contents of total flavonoids, phenolic compounds and total carotenoids, compared with that with other investigated mixtures. These results may be due to the presence of yellow pepper, green pepper, red pepper, cauliflower and eggplant which containing a significant amount of antioxidants compounds in this recipes and also as mentioned by **(Kahkomen *et al* 1999)**.

Table 4. Sensory evaluation of prepared vegi-mix's after storage for 3 months at ambient temperature

	Recipes	Taste	Color	Odor	Texture	General acceptability
One month	A_1	7.65±*1.40[a]	7.75±1.80 [a]	8.0±1.30 [a]	8.0±1.20 [a]	8.4±1.20 [a]
	A_2	7.52±1.10[a]	6.33±1.00 [b]	6.60±1.20 [b]	7.0±1.60 [b]	7.0±1.10 [b]
	B_1	6.5±1.30 [b]	6.50±0.70 [b]	6.75±1.00 [b]	6.33±1.30 [bc]	6.6±1.10 [bc]
	B_2	6.6±1.70 [b]	6.31±1.60 [b]	6.26±1.30 [bc]	6.0±1.40 [c]	6.8±1.00 [bc]
Two month	A_1	6.31±1.21 [a]	6.82±1.02 [a]	5.95±1.37 [a]	6.31±1.44 [a]	6.85±1.35 [a]
	A_2	6.22±1.30 [a]	6.00±1.00 [b]	6.1±1.30 [a]	6.21±0.40 [ab]	6.31±1.30 [b]
	B_1	5.9±1.120 [b]	6.25±1.35 [b]	5.59±1.87 [ab]	5.94±1.69 [ab]	6.52±1.66 [ab]
	B_2	6.0±1.10 [b]	6.22±1.00 [b]	5.61±1.70 [ab]	5.81±1.10 [b]	6.6±1.00 [ab]
Three month	A_1	6.14±1.68 [a]	6.55±1.44 [a]	5.82±1.89 [a]	6.00±1.48 [a]	6.60±1.07 [a]
	A_2	6.0±1.00 [a]	5.83±1.10 [b]	5.72±1.60 [a]	5.83±0.90 [b]	6.23±1.70 [ab]
	B_1	5.63±2.39 [b]	6.20±1.48 [a]	5.27±1.90 [ab]	5.64±1.57 [ab]	6.33±1.50 [ab]
	B_2	5.3±2.10 [b]	6.0±1.30 [b]	5.51±1.80 [ab]	5.52±1.31 [ab]	6.25±1.01 [ab]

***(Means ±SD)** For each treatment within a column, means not sharing the same alphabetical letter are significantly different at 0.05

A1 : Recipe composed of squash, peas, beans, potatoes, carrot, tomatoes, onion and green pepper rehydrated in hot water.

A2 : Recipe composed of squash, peas, beans, potatoes, carrot, tomatoes, onion and green pepper rehydrated in soup.

B1 : Recipe composed of squash, peas, beans, potatoes, carrot, tomatoes, onion green pepper, red pepper, yellow pepper, cauliflower and eggplant rehydrated in hot water.

B2 : Recipe composed of squash, peas, beans, potatoes, carrot, tomatoes, onion green pepper, red pepper, yellow pepper, cauliflower and eggplant rehydrated in soup.

Table 5. Physico-chemical composition of dehydrated recepies of vegi-mix'. (% dry weight basis)

Recipes	Moisture	Total solids	Crude protein	Ether extract	Crude fibers	Total carbohydrate*	Ash	Calorific value Kcal/100gm
A_1	**8.73	91.27	17.00	16.76	10.61	39.13	7.77	375.36
A_2	8.62	91.38	16.89	16.36	10.52	39.98	7.63	374.72
B_1	9.78	90.22	15.73	10.23	9.83	46.36	8.07	340.43
B_2	9.71	90.29	15.21	10.18	9.62	47.28	8.00	341.58

* Calculated by difference ** Mean value of triplicate sample

A1 : Recipe composed of squash, peas, beans, potatoes, carrot, tomatoes, onion and green pepper rehydrated in hot water.

A2 : Recipe composed of squash, peas, beans, potatoes, carrot, tomatoes, onion and green pepper rehydrated in soup.

B1 : Recipe composed of squash, peas, beans, potatoes, carrot, tomatoes, onion green pepper, red pepper, yellow pepper, cauliflower and eggplant rehydrated in hot water.

B2 : Recipe composed of squash, peas, beans, potatoes, carrot, tomatoes, onion green pepper, red pepper, yellow pepper, cauliflower and eggplant rehydrated in soup.

Table 6. Minerals content of low calorie dehydrated vegi-mixtures (ppm dry matter)

Minerals		Vegi mixtures*				
		A_1	A_2	B_1	B_2	Recommended daily requirement (Adults)
(Magnessium)	Mg	241.22*	240.32	244.89	241.92	270-400
(Sodium)	Na	4880.4	4876.3	3262.81	3258.70	1600
(Potassium)	K	3011.69	3001.89	4240.80	4251.6	1650-1875
(Iron)	Fe	9.24	9.21	10.18	10.11	-
(Calcium)	Ca	58.14	58.11	59.14	58.16	1200
(Manganese)	Mn	0.842	0.822	0.931	0.911	350
(Copper)	Cu	8.54	8.43	1.24	1.21	1.7
(Phosphorus)	P	0.44	0.39	0.36	0.34	-
(Zinc)	Zn	2.75	2.71	3.35	3.30	12-15

*Mean value of triplicate samples

A1 : Recipe composed of squash, peas, beans, potatoes, carrot, tomatoes, onion and green pepper rehydrated in hot water.
A2 : Recipe composed of squash, peas, beans, potatoes, carrot, tomatoes, onion and green pepper rehydrated in soup.
B1 : Recipe composed of squash, peas, beans, potatoes, carrot, tomatoes, onion green pepper, red pepper, yellow pepper, cauliflower and eggplant rehydrated in hot water.
B2 : Recipe composed of squash, peas, beans, potatoes, carrot, tomatoes, onion green pepper, red pepper, yellow pepper, cauliflower and eggplant rehydrated in soup.

Table 7. Physico-chemical composition of vegi-mix's. during 3 months (on dry weight basis %) of storage at ambient temperature

	Vegi-mixtures	Moisture	Total solids	Total carbohydrate	Crude fibers
One month	A_1	*8.15	91.85	39.11	10.46
	A_2	8.13	91.87	39.90	10.32
	B_1	11.35	88.65	46.33	9.93
	B_2	11.21	88.79	47.22	9.86
Two months	A_1	8.31	91.69	39.12	10.41
	A_2	8.21	91.79	39.81	10.30
	B_1	11.83	88.17	46.30	9.90
	B_2	11.76	88.24	47.20	9.83
Three months	A_1	8.46	91.54	39.11	10.41
	A_2	8.40	91.60	39.80	10.26
	B_1	11.96	88.04	46.26	9.90
	B_2	11.91	88.09	47.30	9.82

*Mean values of triplicate samples

A1 : Recipe composed of squash, peas, beans, potatoes, carrot, tomatoes, onion and green pepper rehydrated in hot water.
A2 : Recipe composed of squash, peas, beans, potatoes, carrot, tomatoes, onion and green pepper rehydrated in soup.
B1 : Recipe composed of squash, peas, beans, potatoes, carrot, tomatoes, onion green pepper, red pepper, yellow pepper, cauliflower and eggplant rehydrated in hot water.
B2 : Recipe composed of squash, peas, beans, potatoes, carrot, tomatoes, onion green pepper, red pepper, yellow pepper, cauliflower and eggplant rehydrated in soup.

Table 8. Antioxidant compounds and chlorophyll contents for vegi-mix's (mg/100 g on dry weight basis) during 3 months storage at ambient temperature

Storage period	vegi-mixtures	Phenolic compounds (mg /g)	Total flavonoids (mg/g)	Chlorophyll			Total Carotenoids
				A	B	Total	
Zero	A_1	77.87*	8.32	159.89	60.22	220.1	158.03
	A_2	77.00	8.11	153..99	60.11	214.1	156.11
	B_1	82.83	9.32	155.59	49.69	205.3	188.50
	B_2	82.09	9.09	155.00	48.63	203.6	182.30
One month	A_1	76.98	7.73	156.9	58.31	215.2	152.9
	A_2	76.19	7.31	151.8	57.61	210.2	150.8
	B_1	81.57	8.92	152.6	46.91	199.51	181.5
	B_2	81.31	8.83	151.0	46.00	197.0	180.3
Two months	A_1	76.31	5.98	154.8	57.61	212.4	151.3
	A_2	76.00	5.82	153.3	57.00	210.3	150.1
	B_1	81.05	8.88	152.3	45.32	197.6	180.6
	B_2	80.92	8.77	152.0	45.00	197.0	179.2
Three months	A_1	75.52	5.89	152.2	57.63	209.8	151.6
	A_2	75.11	5.71	151.9	57.00	208.9	150.8
	B_1	78.16	8.82	150.0	45.0	195.0	180.2
	B_2	78.00	8.61	150.0	43.9	193.9	173.6

* values are means of three replicate samples.

A1 : Recipe composed of squash, peas, beans, potatoes, carrot, tomatoes, onion and green pepper rehydrated in hot water.

A2 : Recipe composed of squash, peas, beans, potatoes, carrot, tomatoes, onion and green pepper rehydrated in soup.

B1 : Recipe composed of squash, peas, beans, potatoes, carrot, tomatoes, onion green pepper, red pepper, yellow pepper, cauliflower and eggplant rehydrated in hot water.

B2 : Recipe composed of squash, peas, beans, potatoes, carrot, tomatoes, onion green pepper, red pepper, yellow pepper, cauliflower and eggplant rehydrated in soup.

However, the decremental of total chlorophyll was 4.68; 2.43; 5.02 and 4.76% in recipes of dehydrated vegi-mix's for A1, A2, B1 and B2 respectively after 3 months of storage. On the other hand, the decremental % of total carotenoids were 4.07; 3.40; 2.86 and 4.77, respectively **(Table 8)**. Whereas, a reduction of total phenolic compounds were 3.02; 2.45; 5.64 and 4.98% compared with that at initial period of storage, while the reduction% of flavonoids were 2.92; 2.96; 5.36 and 5.28 for A1, A2, B1 and B2 respectively after 3 months of storage.

Generally, the human diets should contain high proportion of carotenoids. No formal diet recommendation for carotenoids have yet been established but some experts suggested intakes of 5.0 to 6.0 mg/day of carotenoid **(Josepinillia *et al* 2005).**

Microbiological examination

The dehydrated vegetables were evaluated microbiologically (total bacterial count, yeast and mould counts and spore forming bacterial count) during storage at room temperature for 3 months as shown in **Table (9).** Results showed that low calorific dehydrated vegi mix's (B2) had a little decrease in total viable counts and also spore forming bacterial counts during storage for 3 months which was (4.52 and 3.60 log cfu/g, respectively). Meanwhile, recipe A2 recorded 2.81 log cfu/g of yeast and mould count after 3 months of storage, compared with other tested samples **(Table 9)**. The results showed also that all tested recipes were microbiologically safe up to 3 months of storage at ambient temperature. Also dehydrated mixtures maintained its original sensory properties.

Table 9. Microbiological examination of dehydrated vegi-mixtures during 3 month of storage at ambient temperature (Log cfu/g)

Recipes	Total bacterial count				Yeast and mould counts				Spore forming bacterial count			
	Storage period (months)											
	0	1	2	3	0	1	2	3	0	1	2	3
A_1	4.52*	4.65	4.79	4.84	2.60	2.75	2.81	2.85	3.26	3.56	3.69	3.79
A_2	4.48	4.61	4.72	4.81	2.52	2.71	2.80	2.81	3.22	3.51	3.60	3.71
B_1	4.62	4.23	4.45	4.59	2.72	2.79	2.85	2.92	2.00	3.34	3.54	3.68
B_2	4.23	4.25	4.41	4.52	2.68	2.74	2.80	2.91	2.00	3.30	3.51	3.60

* Values are means of three replicate samples

A1 : Recipe composed of squash, peas, beans, potatoes, carrot, tomatoes, onion and green pepper rehydrated in hot water.

A2 : Recipe composed of squash, peas, beans, potatoes, carrot, tomatoes, onion and green pepper rehydrated in soup.

A3 : Recipe composed of squash, peas, beans, potatoes, carrot, tomatoes, onion and green pepper, red pepper, yellow pepper, cauliflower and eggplant rehydrated in hot water.

A4 : Recipe composed of squash, peas, beans, potatoes, carrot, tomatoes, onion and green pepper, red pepper, yellow pepper, cauliflower and eggplant rehydrated in soup.

So, it may be concluded that low calorific dehydrated vegi mix's being a good source of antioxidants, minerals, high nutritional value, very good palatability and healthy safe up to three months of storage.

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