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# Production of New Untraditional Healthy Instant Cubes from Some Egyptian Vegetables Mixes

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**Abstract:** Commercial instant vegetables cubes in local market contained some of unhealthy ingredient such as monosodium glutamate, sulfur dioxide and allergen components as soybean. Therefore, natural healthy cubes were prepared by vegetables mixture (veggi cubes), then evaluated chemically and organoleptic properties. The contain of cube was dried celery leaves, parsley leaves, dill leaves, cilantro leaves, carrot, onion, garlic and sodium chloride, then added dried carrageen, xanthan, guar gum or taro (1% and 2%) in eight formulae. Protein content ranged from 16.10 to 19.70 g/100g formulae, also formula 8 which contained 2% taro was the highest protein formula content followed by formula 7 (19.70 and 19.42 g/100g). While, oil contents in all formulae (from 13.97 to 11.32 g/100g) was lower than oil contents in commercial formula (21.07 g/100g). In contrast, formula 7 and 8 were the lowest carbohydrate contents (50.89 and 52.12 g/100g) compared to other formula and commercial formula. Formula 7 which contained to 1% taro was highest content of polyphenols, flavonoids, carotenoids, vitamin C and volatile oil, except chlorophyll. Also, formula 8 which contained to 2% taro was highest content in flavonoids, vitamin C and volatile oil. It was observed also, volatile oil content was the highest in formula 7 and 8 (0.30 and 0.32 ml/100g, respectively) which contained 1% and 2% taro followed by formula 5 and 6 (0.28 and 0.25 ml/ 100g) which contained 1% and 2% guar gum. Although, commercial formula was the best formula in taste, texture and appearance, but formula 8 was the highest significant quality Number (8.36). Also, formula 5, 6, 7 were not significant quality number (7.25, 7.44 and 7.64, respectively) compared to commercial formula (7.52).Increase rehydration time by decreasing temperature degree (100, 90, 80, 70°C, respectively) was observed. Also, increase recovery time by increasing carrageenan, xanthan, guar gum and taro concentrations. Results observed the commercial formula recovery was slowly compared with other natural formulae also the smell after recovery was weakness than that in other formulae. The color and the smell in taro formulae (7 and 8) were stronger than other formulae; also formula 8 which contained 2% taro was better than formula 7 which contained 1% taro. It's may due to taro contained dietary fiber (as mucilage) as strongest capture or enhancing to volatile oil and pigments Conclusively, taro and guar gum formulae were better than carrageenan and xanthan formulae compared to commercial formula. Also, 70 °C was the best recovery temperature to maintain smell and color, although 100 °C was better recovery time than other temperatures (90, 80 and 70°C).

**Key words:** Celery Leaves · Parsley Leaves · Dill Leaves · Cilantro Leaves · Carrot- Onion · Garlic · Taro · Vegetables Mixes (Veggi) · Healthy Cubes

## INTRODUCTION

The important growth in the ready-to-use (RTU) food industry has mainly been attributed to the increasing demand for fresh, healthy and convenient foods [1]. The advantages of the dehydrated foods, particularly, dry soup mixes could be as a protection from enzymatic and oxidative spoilage and flavor stability at room temperature over long periods of time (6 - 12 months). Also, they do not need refrigerator and had quite nutritive value. In addition, they are ready for reconstitution in a short time for working families, hotels, hospitals and restaurants [2, 3].

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The major active ingredients in bouillon cubes are salt (NaCl) and monosodium glutamate (MSG). Other raw material used include soybeans, locust beans, onion, tomato, hydrogenated palm oil (HPO), caramel, hydrolyzed plant/ vegetable protein and natural spices [4].

Magi cubes are taste enhancers when added to foods. The major ingredient is salt (NaCl), monosodium glutamate (MSG), vegetable oil, starch and spices. MSG is a flavor enhancer, classified under general recognized as safe (GRAS) by the US food and Drug Administration [5].

Green leafy vegetables such parsley and dill are popularly used for food in many countries of the world, as a rich source of ß-carotene, chlorophyll, ascorbic acid, minerals and dietary fiber.

Dill (*Anethumgraveolens* L.) is an important aromatic herb, which is used as flavoring and seasoning of various foods, such as salads, sauces, soups, sea foods and especially pickled vegetables. Parsley (*Petroselinumcrispum*) and coriander (*Coriandrum sativum*) are two culinary herbs commonly used to enhance the flavor of many dishes of the cuisines of China, Mexico, South America, India and South East Asia and Mediterranean Countries [6].

Taro is especially useful to persons allergic to cereals and can be consumed by children who are sensitive to milk. Taro is also a tuber that is very rich in carbohydrates, ranging between 73 to 80% which is mainly starch at 77.9% and 1.4% crude fiber on dry weight basis [7].

Spices as natural food additives are widely used these days as flavor enhancers sweeteners, leavening agents, nutrients etc. In Nigeria different spices are formal/used by different tribes. These spices have nutritional relevance and healing potentials. Solomon [8] has reported in spices, they concluded that these spices give humans some level of stimulation in the activity of the digestive tract.

Fatima [9] substituted the animal protein and poor vegetable protein in Maggi cubes with high vegetarian protein from mushrooms.

This work aimed to produce natural and healthy vegetables mixture cubs (veggi cubes) without any synthetic additive. Also use carrageenan, xanthan, taro and guar gum as enhancing agents compared with these used in commercial cubes.

## MATERILAS AND METHODS

**Materials:** Samples (parsley, dill, celery, cilantro, carrot, onion, garlic and taro) were collected from Giza Governorate. Fresh sample, after removal of external material by washing with tap water, were air dried between filter papers. After that samples exposure to vapor water 1 min, then dried in an oven under vacuum at 40±5°C, except taro and carrot were dried at 60±5°C.

Carrageenan, xanthan and guar gum were purchased from El-Gamhoria Chemical Company-Egypt.

**Preparation of Veggi Cubes:** Vegetable cubes were mixed from dry sieving powders under 100 meshes. The contain of cube was dried celery leaves, parsley leaves, dill leaves, celery leaves, cilantro leaves, carrot, onion, garlic and salt (NaCl), then added dried carrageenan, xanthan, guar gum or taro (Table 1).

The ingredients were mixed well by distilled water and pressed by manual pressing machine, then dried in oven under vacuum at 40±5°C. The form of cubes coated with aluminum foil.

**Methods**

**Macro Components:** Moisture, ash, total protein, ether extract, crude fiber were determined according to A.O.A.C. [10], while total carbohydrate was calculated as 100% - (% crude fiber+ % ash+ % crude protein+ % fat) [11].

Total calories of the dried vegetarian soup mixtures were calculated by the formula of James [12] as follows:

$$\text{Total calories} = \text{Fat X } 9 + \text{Protein X } 4 + \text{Total carbohydrate X } 4$$

**Micro components:** Total polyphenolic contents were measured using Folin-Ciocalteu method described by Singleton *et al.* [13]. Also, total flavonoids content as rutin was determined by Pharmacopeia [14]. Total chlorophyll was measured in a UV spectrophotometer at 670 nm [15]. Total carotenoids as β-carotene was determined according to Nagata *et al.* [16]. Vitamin C of dried samples was determined by 2, 4 di chlorophenol indophenol dye method [17]. Volatile oil was determined by ISO method [18].

**Rehydration Ratio:** Rehydration Ratio of dried vegetable mixes veggi formulae was determined according to Krokida and Marinos-Kouris [19] methods. Ten grams from formula per 100 ml water at 100, 90, 80 and 70 °C in water bath, respectively.

**Organoleptic evaluation**: The sensorial evaluation was carried out by ten panelists according to the method of Wang *et al.* [20]. While quality number (QN) calculated according to the Nieβen and Th□lking [21] equation:

Table 1: Vegetables cubes formulae mixture (g/100g)

| | | Formulae | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Items | Commercial formula | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Parsley | $SO_2$, E 621, E627, E631, soybean | 20 | 19.75 | 20 | 19.75 | 20 | 19.75 | 20 | 19.75 |
| Celery | | 20 | 19.75 | 20 | 19.75 | 20 | 19.75 | 20 | 19.75 |
| Dill | | 20 | 19.75 | 20 | 19.75 | 20 | 19.75 | 20 | 19.75 |
| Cilantro | | 20 | 19.75 | 20 | 19.75 | 20 | 19.75 | 20 | 19.75 |
| Carrot | | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| onion | | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| Garlic | | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| Salt (NaCl) | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Carrageenan | | 1 | 2 | | | | | | |
| Xanthan | | | | 1 | 2 | | | | |
| Guar gum | | | | | | 1 | 2 | | |
| Taro | | | | | | | | 1 | 2 |

$SO_2$ sulfur dioxide, E 621 Monosodium glutamate, E 627 Disodium guanylate, E631 Disodium inocynate

$$QN = \frac{Appearance + Color + Aroma}{3}$$

Based on QN was classified as follows: 7.00-6.50- very good quality (performance of quality parameters); 6.40-5.50- good quality (inessential deviations); 5.49-4.00- average quality (pronounced deviations, insignificants defects); 3.99-2.90- satisfactory quality (significant defects) and 2.89-1.00- unsatisfactory quality (serious defects).

**Statistical Analysis:** The data obtained were analyzed by using SPSS statistical software (version 19 SPSS Inc., Chicago. USA). The results were expressed as mean ±SD. Tested for significance using one-way analysis of variance "ANOVA" [22].

## RESULTS AND DISCUSION

**Proximate composition in dried vegetables:** Results in Table 2 showed that dried leafy vegetables were the highest protein content (from 19.47 to 26.25 g/100g), while dried carrot and onion were the lowest protein content (8.22 and 9.02 g/100g, respectively). Dried onion and garlic were lower content oil and ash than other plants. On the other hand, crude fiber content was increase in dried carrot, parsley and celery (35.03, 20.42 and 19.47g/100g, respectively). Also, dried taro and carrot were high content of total carbohydrates (86.80 and 83.00 g/100g, respectively).

**Proximate Composition in Different Dried Vegetables Mixes Cubes:** Results in Table 3 indicated that macro components in different cubes formulae compared to commercial formulae. Protein content ranged from 16.10 to 19.70 g/100g in formulae, also formula 8 which had contained 2% taro the highest protein formula content followed by formula 7 was 19.70 and 19.42 g/100g. While, oil content in all formulae (from 13.97 to 11.32 g/100g) was lower than oil content in commercial formula (21.07 g/100g). In contrast, formula 7 and 8 were the lowest carbohydrate contents (50.89 and 52.12 g/100g) compared to other formulae and commercial formula. Crude fiber was higher content in formula which contained carrageenan and xanthan than formulae which contained guar gum and taro, these results may due to guar gum and taro were contained high contents of soluble dietary fiber as mucilage [23].

**Antioxidant contents in dried vegetables mixes cubes:** Dried dill is rich in polyphenols (4600.25 mg/100g) followed by parsley, celery and cilantro (3425.24, 1950.76 and1530.76 mg/100g, respectively). Dried taro was the lowest content of polyphenols and flavonoids (18.45 and 63.25 mg/100g, respectively). Cilantro was higher flavonoids and carotenoids contents (466.22 and 312.32 mg/100g, respectively) followed by dill (399.24 and 280.30 mg/100g, respectively). While, parsley and cilantro nearly carotenoids contents (31.11 and 312.32 mg/100g, respectively). Data in the same table (4) observed chlorophyll content was absent in taro, onion and garlic. Parsley was recorded the highest content from chlorophyll and vitamin C (18.50 and122.35 mg/g, respectively). Vitamin C contents was near in cilantro and dill (57.50 and 54.02 mg/g), while garlic taro and carrot was the lowest contents of vitamin C (18.32, 15.52 and 14.61 mg/g, respectively). Results indicated dried celery then garlic and onion were the highest content of volatile oil (0.44, 0.34 and 0.30, respectively), in contrast dried parsley

Table 2: Means proximate composition in dried vegetables (g/100 g)

| Items | Protein | Oil | Ash | Crude fiber | Carbohydrate |
|---|---|---|---|---|---|
| Parsley | 22.40$^{b}$± 2.04 | 4.43$^{b}$± 0.43 | 12.53$^{b}$± 1.43 | 20.42$^{b}$± 3.26 | 51.70$^{c}$± 3.42 |
| Dill | 20.25$^{b}$± 1.88 | 4.25$^{b}$± 0.50 | 12.64$^{b}$± 1.20 | 13.61$^{d}$± 1.35 | 55.28$^{c}$± 4.30 |
| Cilantro | 26.25$^{a}$± 2.15 | 6.25$^{a}$± 0.65 | 18.75$^{a}$± 1.64 | 15.00$^{d}$± 3.89 | 48.25$^{d}$± 3.88 |
| Celery | 19.47$^{b}$± 1.25 | 2.18$^{c}$± 0.72 | 20.98$^{a}$± 2.03 | 19.47$^{c}$± 2.20 | 56.86$^{c}$± 4.20 |
| Carrot | 8.22$^{d}$± 1.32 | 1.00$^{d}$± 0.30 | 6.85$^{c}$± 0.85 | 34.03$^{a}$± 2.65 | 83.00$^{a}$± 6.12 |
| Taro | 10.17$^{d}$± 0.88 | 2.25$^{c}$± 0.34 | 1.80$^{e}$± 0.65 | 14.14$^{d}$± 1.98 | 86.80$^{a}$± 7.22 |
| Onion | 9.02$^{d}$± 0.42 | 0.57$^{e}$± 0.09 | 3.49$^{d}$± 0.35 | 9.27$^{e}$± 0.88 | 80.38$^{a}$± 5.40 |
| Garlic | 16.85$^{c}$± 1.46 | 0.82$^{d}$± 0.23 | 3.32$^{d}$± 0.92 | 10.00$^{e}$± 1.02 | 72.76$^{b}$± 4.92 |

* Means having the same letter within column are not significantly different at p<0.05.Data were mean of three determinations (n=3)

Table 3: Means proximate composition in different dried vegetables mixes cubes formulae (g/100g)

| Formulae | Protein | Oil | Ash | Crude fiber | Carbohydrate | Caloric value/100g |
|---|---|---|---|---|---|---|
| Commercial | 6.60$^{c}$ | 21.07$^{a}$ | ND* | ND* | 21.73$^{d}$ | 229$^{c}$ |
| Formula 1 | 16.44$^{b}$± 1.90 | 13.42$^{b}$± 0.83 | 13.91$^{a}$± 1.00 | 18.65$^{a}$± 1.20 | 56.23$^{b}$± 2.52 | 411.46$^{b}$± 8.45 |
| Formula 2 | 16.10$^{b}$± 1.12 | 12.13$^{b}$± 0.95 | 14.53$^{a}$± 0.85 | 19.37$^{a}$± 0.98 | 57.24$^{b}$± 2.30 | 402.53$^{b}$± 7.90 |
| Formula 3 | 15.92$^{b}$± 1.33 | 11.00$^{b}$± 0.52 | 12.83$^{a}$± 0.43 | 19.53$^{a}$± 0.87 | 60.35$^{b}$± 3.02 | 404.53$^{b}$ ±11.43 |
| Formula 4 | 15.35$^{b}$± 1.52 | 10.74$^{b}$± 0.62 | 13.80$^{a}$± 0.60 | 20.54$^{a}$± 1.12 | 69.11$^{a}$± 2.91 | 434.50$^{a}$± 9.88 |
| Formula 5 | 17.70$^{ab}$± 2.02 | 12.38$^{b}$± 0.44 | 13.71$^{a}$± 0.91 | 16.23$^{b}$± 1.35 | 56.31$^{b}$± 2.11 | 407.46$^{b}$± 8.82 |
| Formula 6 | 17.22$^{ab}$± 1.76 | 11.32$^{b}$± 0.53 | 14.02$^{a}$± 1.02 | 17.50$^{b}$± 0.90 | 57.44$^{b}$± 1.98 | 400.52$^{b}$ ±13.22 |
| Formula 7 | 19.42$^{a}$± 1.20 | 13.61$^{b}$± 0.88 | 14.82$^{a}$±1.24 | 17.55$^{b}$± 0.79 | 52.15$^{c}$± 2.23 | 408.77$^{b}$ ± 10.45 |
| Formula 8 | 19.70$^{a}$± 2.11 | 13.97$^{b}$± 0.65 | 15.98$^{a}$±1.48 | 18.04$^{b}$± 1.11 | 50.89$^{c}$± 1.90 | 408.09$^{b}$ ± 13.20 |

ND = Not Determined

Means having the same letter within column are not significantly different at p<0.05. Data were mean of three determinations (n=3)

Table 4: Antioxidant contents in dried vegetables mixes cubes (veggi) formulae.

| Items | Total polyphenols (mg/100g) | Total flavonoids (mg/100g) | Total carotenoids (B-carotene) (mg/100g) | Total chlorophyll (mg/g) | Vitamin C (mg/g) | Volatile oil (ml/100g) |
|---|---|---|---|---|---|---|
| Parsley | 3425.24$^{b}$± 26.25 | 156.23$^{c}$± 6.32 | 310.11$^{a}$± 14.42 | 18.50$^{a}$± 1.23 | 122.35$^{a}$± 9.87 | 0.06$^{d}$±0.00 |
| Dill | 4600.25$^{a}$± 30.54 | 399.24$^{b}$± 10.25 | 280.30$^{b}$± 12.84 | 15.00$^{b}$± 0.98 | 54.02$^{c}$±4.24 | 0.13$^{c}$±0.03 |
| Cilantro | 1530.76$^{d}$± 20.32 | 466.22$^{a}$ ± 12.43 | 312.32$^{a}$± 18.43 | 7.22$^{d}$±0.54 | 57.50$^{c}$± 5.02 | 0.03$^{e}$±0.00 |
| Celery | 1953.55$^{c}$± 22.54 | 480.26$^{a}$ ± 17.20 | 248.98$^{c}$± 20.54 | 10.25$^{c}$± 1.00 | 71.92$^{b}$± 7.30 | 0.44$^{a}$±0.09 |
| Carrot | 533.10$^{e}$± 9.85 | 89.00$^{de}$± 9.85 | 9.25$^{d}$± 0.87 | 0.62$^{e}$± 0.12 | 14.61$^{e}$± 1.02 | 0.12$^{c}$±0.17 |
| Taro | 18.45$^{h}$± 2.12 | 63.25$^{f}$ ± 6.52 | 2.10$^{e}$± 0.25 | 0.00$^{f}$± 0.00 | 15.52$^{e}$± 1.65 | 0.02$^{e}$±0.00 |
| Onion | 1670.80$^{f}$± 11.47 | 96.03$^{d}$± 8.90 | 0.20$^{f}$± 0.04 | 0.00$^{f}$± 0.00 | 75.00$^{b}$± 3.70 | 0.30$^{b}$±0.04 |
| Garlic | 459.42$^{g}$± 8.48 | 85.88$^{e}$± 9.00 | 0.51$^{f}$± 0.09 | 0.00$^{f}$± 0.00 | 18.32$^{d}$± 0.85 | 0.34$^{b}$±0.06 |

Means having the same letter within column are not significantly different at p<0.05. Data were mean of three determinations (n=3)

cilantro and taro were the lowest content of volatile oil (0.06, 0.03 and 0.02 mg/g). These results were adapted by Hossain *et al.* [24], they found that leafy vegetables were rich in antioxidant contents. Also, It is important to know the best method of processing and cooking to retain the health beneficial constituents in the vegetables [25].

**Antioxidant Contents in Different Dried Vegetables Cubes:** Results in Table 5 indicated that the contents of total polyphenol ranged from 2424.25 to 2126.45 mg/100g dried formulae were significant increase in commercial formula (215.34 mg/100g). Formula 1, 4 and 7 were highest content of polyphenols, while formula 5 was the lowest content was observed. Also, total flavonoids content in different formulae (from 312.54 to 297.56 mg/100g) was higher than commercial formula (22.15 mg/100g). In parallel, total carotenoids, total chlorophyll and vitamin C were increase significant in different formulae (232.79 to 176.44 mg/100g, 12.25 to 9.52 mg/g and 65.49 to 48.20 mg/g, respectively) than those in commercial formula (13.20 mg/100g, 0.92 mg/g and 3.27 mg/g, respectively).It was observed also, volatile oil content were the highest in formula 7 and 8 (0.30 and 0.32 ml/100g, respectively) which contained 1% and 2% taro followed by formula 5 and 6 (0.28 and 0.25 ml/ 100g) which contained 1% and 2% guar gum.

Table 5: Antioxidant contents in different dried vegetables cubes (veggi) formulae

| Formulae | Total polyphenols (mg/100g) | Total flavonoids (mg/100g) | Total carotenoids (mg/100g) | Total chlorophyll (mg/g) | Vitamin C (mg/g) | Volatile oil (ml/100g) |
|---|---|---|---|---|---|---|
| Commercial | 215.34$^{e}$± 19.25 | 22.15$^{c}$± 2.43 | 13.20$^{f}$± 1.35 | 0.92$^{d}$± 0.14 | 3.27$^{d}$± 0.75 | 0.02$^{c}$ ± 0.00 |
| Formula 1 | 2424.25$^{a}$± 18.35 | 312.45$^{a}$± 12.50 | 205.20$^{c}$± 3.24 | 10.43$^{b}$± 1.84 | 50.42$^{bc}$± 4.30 | 0.19$^{b}$± 0.02 |
| Formula 2 | 2288.60$^{c}$± 22.00 | 299.21$^{b}$± 9.85 | 199.86$^{d}$± 5.38 | 9.88$^{c}$± 2.02 | 48.20$^{c}$± 5.11 | 0.21$^{b}$ ± 0.02 |
| Formula 3 | 2317.27$^{b}$± 14.14 | 310.55$^{a}$±14.25 | 225.63$^{ab}$± 9.25 | 11.04$^{a}$± 1.90 | 62.42$^{a}$± 7.83 | 0.20$^{b}$ ± 0.03 |
| Formula 4 | 2403.33$^{a}$± 24.25 | 302.58$^{b}$± 11.11 | 221.40$^{b}$± 7.98 | 10.83$^{b}$± 2.12 | 59.80$^{ab}$± 6.45 | 0.24$^{a}$ ± 0.08 |
| Formula 5 | 2290.12$^{c}$± 16.86 | 308.90$^{b}$± 9.22 | 218.43$^{b}$± 7.22 | 12.25$^{a}$± 2.81 | 58.42$^{ab}$± 9.00 | 0.25$^{a}$ ± 0.09 |
| Formula 6 | 2126.45$^{d}$± 21.39 | 297.56$^{b}$± 7.97 | 209.02$^{c}$± 4.85 | 11.60$^{a}$± 3.01 | 55.60$^{b}$± 6.92 | 0.28$^{a}$ ± 0.05 |
| Formula 7 | 2442.24$^{a}$± 24.52 | 319.20$^{a}$± 8.43 | 232.79$^{a}$± 7.54 | 9.60$^{c}$± 2.23 | 65.49$^{a}$± 6.30 | 0.30$^{a}$ ± 0.06 |
| Formula 8 | 2303.47$^{b}$± 19.88 | 315.71$^{a}$± 9.12 | 176.44$^{e}$± 9.32 | 9.52$^{c}$± 1.98 | 64.86$^{a}$± 7.53 | 0.32$^{a}$ ± 0.08 |

Generally, Formula 7which contained to 1% taro was highest content of polyphenols, flavonoids, carotenoids, vitamin C and volatile oil, except chlorophyll. Also, formula 8 which contained to 2% taro was highest content in flavonoids, vitamin C and volatile oil.

Table 6: Organoleptic evaluation of different dried vegetables cubes (veggi) formulae

| | Color | Aroma | Taste | Texture | Appearance | Quality Number |
|---|---|---|---|---|---|---|
| Commercial | 7.00$^{b}$± 0.58 | 6.67$^{d}$ ± 0.75 | 8.43$^{a}$± 0.45 | 8.83$^{a}$± 0.69 | 8.89$^{a}$ ± 0.69 | 7.52$^{b}$± 0.35 |
| Formula 1 | 7.33$^{b}$± 0.47 | 6.83$^{cd}$± 0.69 | 7.84$^{c}$ ± 0.81 | 6.83$^{e}$± 0.89 | 7.00$^{c}$ ± 0.50 | 7.05$^{bc}$± 0.61 |
| Formula 2 | 7.33$^{b}$± 0.48 | 6.83$^{cd}$ ± 0.37 | 7.73$^{c}$± 0.58 | 6.33$^{f}$± 0.47 | 7.33$^{b}$± 0.75 | 7.16$^{bc}$± 0.22 |
| Formula 3 | 7.34$^{b}$± 0.74 | 6.95$^{c}$ ± 0.50 | 7.25$^{cd}$± 0.55 | 7.00$^{d}$ ± 0.82 | 6.67$^{c}$ ± 0.94 | 6.99$^{c}$± 0.43 |
| Formula 4 | 7.34$^{b}$± 0.94 | 7.00$^{c}$ ± 0.65 | 7.08$^{d}$ ± 0.72 | 6.75$^{e}$ ± 0.48 | 7.00$^{c}$ ± 0. 82 | 7.11$^{bc}$± 0.30 |
| Formula 5 | 7.66$^{b}$± 0.75 | 7.08$^{c}$± 0.34 | 8.00$^{b}$ ± 0.60 | 7.17$^{cd}$± 0.69 | 7.00$^{c}$ ± 0.58 | 7.25$^{b}$± 0.27 |
| Formula 6 | 7.67$^{b}$± 0.47 | 7.16$^{ab}$ ± 0.47 | 8.00$^{b}$± 0.53 | 7.33$^{c}$± 0.47 | 7.50$^{bc}$± 0.50 | 7.44$^{b}$± 0.19 |
| Formula 7 | 7.92$^{b}$± 0.84 | 7.42$^{ab}$ ± 0.73 | 8.12$^{ab}$ ± 0.42 | 8.17$^{a}$ ± 0.90 | 7.58$^{bc}$ ± 0.45 | 7.64$^{b}$± 0.32 |
| Formula 8 | 8.33$^{a}$± 0.47 | 8.92$^{a}$± 1.11 | 8.80$^{a}$ ± 0.69 | 7.58$^{b}$± 0.45 | 7.83$^{b}$ ± 0.90 | 8.36$^{a}$± 0.37 |

**Organoleptic evaluation of different dried vegetables cubes:** The best color in formula 8 which contained taro 2%, followed by formula 7 (taro1%) then formula 6 (guar2%) compared to commercial formula and other formulae (Table 6). While Color results were not significant variance in formula from 1 to 5 which contained carrageenan, xanthan and commercial formula. In the same trend, aroma in formula 8 then formula 7 which contained taro (8.92 and7.42, respectively) followed by formulae 6 and 5 which contained guar gum (7.16 and 7.08, respectively) were significant increased compared to commercial formula (6.67). Taste results after the best rehydration (10g cubes weight/100g water) were significant in formulae contained different concentration of taro followed by guar gum then carrageenan and xanthan compared commercial formula in Egyptian local markets. In contrast, texture in formula 7 which contained taro 1% was better than formula 8 which contained taro2%. Also, its observed formulae which contained low concentrations (1%) of taro, guar gum, carrageenan and xanthan were better than formulae high concentrations (2%) contained to same materials.

Although commercial formula was the best formula in taste, texture and appearance, but formula 8 was the highest significant quality Number (8.36). Also, formulae 5, 6 and 7 were not significant quality number (7.25, 7.44 and 7.64, respectively) compared to commercial formula (7.52).

Rehydration rate is an important characteristic of many products, related to their later preparation for consumption. The rehydration capacity was used as a quality characteristic of the dried product expressed in the rehydration rate. When the dried foods reconstituted, it must show acceptable textural, visual and sensory characteristics, while the rehydration time is minimized [3].

Figure (1) showed gradually increase rehydration time by decreasing temperature degree. Also, increase recovery time by increasing enhancing agent concentration. Results observed the commercial formula recovery was slowly compared with other natural formulae also the smell after recovery was weakness than that in other formulae. The color and the smell in taro formulae (7 and 8) were stronger than other formulae; also formula 8 which contained 2% taro was better than formula 7 which contained 1% taro. May be it's due to taro contained dietary fiber (as mucilage) as strongest capture or enhancing to volatile oil and pigments. Also, to gain a good smell and flavor after recovery we can use water before boiling.

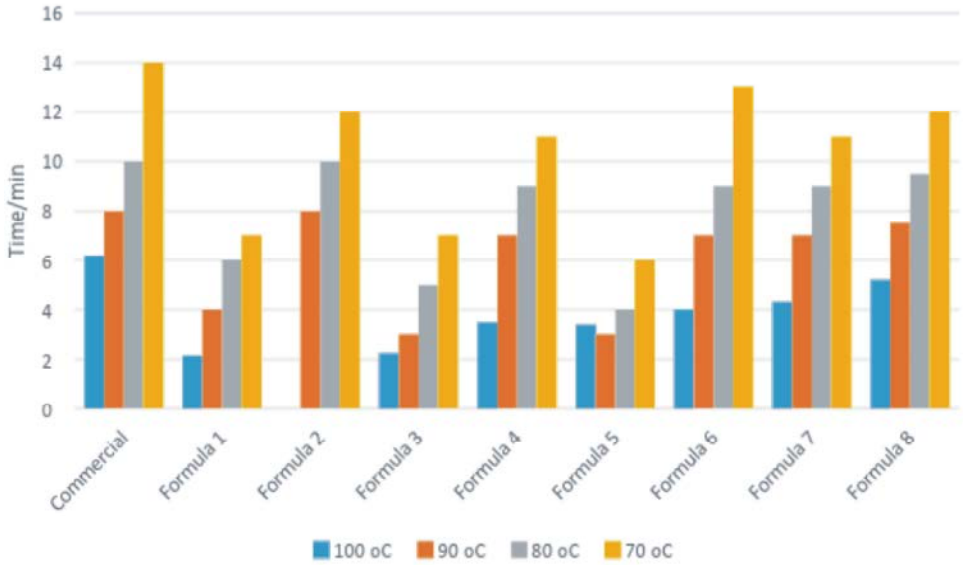


Fig 1: Effect of different temperature degree on recovery time in dried veggi formulae (10g/100ml)

## CONCLUSION

Taro and guar gum formulae were better than carrageenan and xanthan formulae compared to commercial formula. Also, 70 °C was the best recovery temperature to maintain smell and color, although 100 °C was better recovery time than other temperatures (90, 80 and 70 °C).

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