Preparation of High Nutritional Quality Soup for the Elderly

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Received: *21/1/2020*

Abstract: Healthy diet for elderly not only provided them with their needs from all nutrients but also helped preventing and treating age-related disorders. So, the present study was to evaluate physical, chemical and sensory characteristics of nine formulated functional soup mixtures for elderly. This study was designed to prepare some soups contained some of vegetables and fruit which cooked in one of three liquids (water, chicken broth and whey). Nine soup mixtures of vegetables and fruits were prepared. Proximate composition, vitamins, minerals, physical characteristics and antioxidant activity were determined, sensory properties were evaluated, as well as caloric values and RDA (Recommended Dietary Allowances) were calculated. The soup colors varied between red to orange yellow or yellow. The results of the sensory evaluation showed that all the different soup mixtures were acceptable with values ranging from 8.38 to 9.50 for overall acceptability. The results indicated that one serving of soup mixtures which contained oat, spinach, broccoli and bananas covered the RDA of protein, crude fiber, fat, carbohydrates and caloric values for elderly male and female by about 14.3-18.5%, 29.3-44.3%, 10-12.5%, 29.6-30.6% and 9.4-10.7 kcal/cup of soup, respectively. While, vitamins A, C, B_6 and B_{12} were covered by about 448%, 39%, 29% and 750%, respectively for male and 576%, 47%, 33% and 750%, respectively for female. In conclusion the formulated soup mixtures with high acceptability and antioxidant activity can provide elderly people with high percent of their requirements from nutrients.

***Keywords*:** Vegetables soup, physiochemical characteristics, antioxidant activity, sensory evaluation, vitamins and minerals, RDA

INTRODUCTION

In 2018, Egypt has experienced increase in the number of elderly people (ages 50-70 year). This increase reached 6.41 million, representing 6.7% of the total population, including about 3.42 million males and 2.99 million females. This percentage is expected to rise to 11.5% in 2031 (CAPMAS, 2018).

It is very important for elderly people to maintain a healthy diet. This will help them in staying fit and keeping them active during the day. Avoiding malnutrition is crucial especially in elderly people since it led to multiple health problems (Zahangir *et al.,* 2017). Usually elderly persons are less active and that basal metabolism is lower so they require less energy (Prakash, 2003). In old age, the elderly finds it difficult to chew and swallow food due to tooth loss and other pathological reasons. Not eating enough food and fluids has an impact on the health and quality of life of them, and emphasizes the importance of caring for the good nutrition of the elderly (from the age of 51 years). So, swapping gristly food with soft food makes chewing and swallowing much easier (Okamoto *et al.,* 2015). Food must be rich in its content of nutrients and quantified according to each case, enough to provide the body with its daily needs. Also, the elderly need sufficient amounts of mineral elements, especially calcium, iron and zinc for their importance to this age (Prakash, 2005).

One way of avoiding malnutrition and solving the swallowing problem in elderly is providing nutrients enriched foods that are easy to eat and to cook foods, for example dried soup powder which is playing an important role in fulfilling present and future social consumer requirements. Dried soup powders have many advantages like flavor stability across a long period of time at room temperature and protection from enzymatic and oxidative spoilage (Krejcova *et al*., 2007; Farzana *et al*., 2017). The nutritional quality can be improved by introducing macro- and micro- nutrient sources which is appropriate for the elderly. Several studies have established that soup is more satiating than some other types of food (Flood and Rolls, 2007).

Fruit and vegetables are generally appreciated by elderly people. However, few studies have investigated elderly peoples' fruit and vegetables liking, taking into account their dependency and countries' specificities (Mingioni *et al*., 2016).

Fruits and vegetables are source of dietary fiber which has shown beneficial effects in the prevention of several diseases such as cardiovascular diseases, diverticulitis, constipation, irritable colon, colon cancer and diabetes (Rodrigues *et al.,* 2006). They provide adequate amounts of vitamins and minerals for humans. They are rich sources of carbohydrates, carotene, ascorbic acid, retinol, riboflavin, folic acid and minerals like calcium, iron, zinc, magnesium, manganese and selenium depending on the vegetable consumed (Fasuyi, 2006; Achikanu *et al*., 2013).

For fulfilling elder social requirements, dried soups play a vital role (Krejcova *et al*., 2007). Dried soup powders have an advantage of protection from enzymatic and oxidative spoilage and flavor stability at room temperature over long periods of time (6-12 months). In addition, they are ready for reconstitution in a short time for elderly, working families, hotels, hospitals, restaurants, and institutional use as well as to military rations. Much of the previous studies have been done to prepare the dried vegetables soup before cooking. Commercially, instant soups were prepared as dried, canned and frozen. Dry soup mixes containing

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either vegetables (Rekha *et al*., 2010; Farzana *et al*., 2017), meat and chicken (Martínez-Tomé *et al*., 2015) or fish (Bamidele *et al*., 2015; Islam *et al*., 2018) in many forms are second in popularity only to frozen soup.

The present study aimed to prepare nine different soup mixtures containing vegetables and fruits which are cooked in three different solutions (water, chicken broth and whey) before drying to produce high nutritional and high quality soup for the elderly.

MATERIALS AND METHODS

Materials

Vegetables (beets, broccoli, carrot, garlic, onion, peas, potato, squash, spinach, tomato, yellow pepper and yellow sweet potato), fruits (apple, banana and orange), cereal (oat) and chicken were purchased from local market. Whey was obtained from the Dairy Department, Faculty of Agriculture, Cairo University.

Methods

Preparation of chicken broth

It was prepared by cooking the chicken in water. The broth was collected and used as chicken soup.

Formulation and preparation of other soup mixtures

All the used materials were mixed with three liquids (water, chicken broth and whey). So, nine different soup mixtures were prepared as follows (Table, 1): F1 (carrot, tomato, onions, garlic, potato, yellow peppers, beets and orange with water), F2 (carrot, tomato, onions, garlic, potato, yellow peppers, beets and orange with chicken broth), F3 (carrot, tomato, onions, garlic, potato, yellow peppers, beets and orange with whey), F4 (carrot, tomato, onions, garlic, yellow sweet potato, squash, peas and apples with water), F5 (carrot, tomato, onions, garlic, yellow sweet potato, squash, peas and apples with chicken broth), F6 (carrot, tomato, onions, garlic, yellow sweet potato, squash, peas and apples with whey), F7 (carrot, tomato, onions, garlic, oat, spinach, broccoli and bananas with water), F8 (carrot, tomato, onions, garlic, oat, spinach, broccoli and bananas with chicken broth), F9 (carrot, tomato, onions, garlic, oat, spinach, broccoli and bananas with whey). Each of the obtained soup formula was first cooked till all components became edible then blended using electric blender, and homogenized to obtain thick texture. Each homogenized soup formula was divided into two parts. The first part was cooled and kept in polyethylene bags at -18°C until analyses. The second part was dried at 50°C in electric oven overnight. After drying, the samples were grinded and kept in polyethylene bags at -18°C until analyses.

Analytical Methods

Chemical analysis of the soup mixtures

The proximate analysis of the prepared nine different soups including moisture, protein, ash, crude fibers and fat, vitamins (vitamin A in form of β-carotene), minerals (iron, zinc, calcium, potassium, sodium) were determined according to the methods outlined by AOAC (2012). Ascorbic acid (vitamin C) was determined according to the method described by Sadasivam and Manickam (1996). Vitamins B_6 and B_{12} were determined according to Moreno and Salvado (2000).

Table (1): Formulation of soup mixtures

Ingredients (g)	Formula								
	F1	F2	F3	F4	F5	F6	F7	F8	F9
Potatoes	500	500	500	---	---	---	---	---	---
Yellow peppers	250	250	250	---	---	---	---	---	---
Beets	250	250	250	---	---	---	---	---	---
Orange	250	250	250	---	---	---	---	---	---
Yellow sweet potato	---	---	---	500	500	500	---	---	---
Squash	---	---	---	250	250	250	---	---	---
Peas	---	---	---	250	250	250	---	---	---
Apples	---	---	---	250	250	250	---	---	---
Oat	---	---	---	---	---	---	250	250	250
Spinach	---	---	---	---	---	---	250	250	250
Broccoli	---	---	---	---	---	---	250	250	250
Bananas	---	---	---	---	---	---	250	250	250
Carrot	500	500	500	500	500	500	500	500	500
Tomato	500	500	500	500	500	500	500	500	500
Onion	500	500	500	500	500	500	500	500	500
Garlic	50	50	50	50	50	50	50	50	50
Water	1500	---	---	1500	---	---	1500	---	---
Chicken broth	---	1500	---	---	1500	---	---	1500	---
Whey	---	---	1500	---	---	1500	---	---	1500

Antioxidant activity: Total antioxidant activity was assayed using 1, 1-diphenyl-2-picrylhydrazyl (DPPH) free radical according to Rattanachitthawat *et al*. (2010).

Caloric value

Total calories of raw materials and the prepared nine different soups were calculated by the equation of James (1995) as follows: Total calories = Protein *4+Fat *9+Carbohydrates *4.

Physical characteristics

The pH value was determined according to AOAC (2012). **Viscosity** was determined according to Brookfield Manual (1998). **Color measurement:** External color of the prepared nine different soups was measured according to the method outlined by McGurie (1992) using a hand-held Chromameter (model CR-400, Konica Minolta, Japan).

Sensory evaluation

The prepared nine different soups either before drying or after rehydration were evaluated for their sensory characteristics. The sensory attributes including taste, color, odor, consistency and overall acceptability were evaluated by 10 trained members' panelist (ages more than 50) from the staff members Food Science Department, Faculty of Agriculture - Cairo University. Each panelist was provided with the sample in an unlabeled transparent cup under white lights and asked to cleanse the palate with water before tasting the second sample according to Idowu *et al*. (2013).

Statistical analysis

All the obtained data were expresses as mean ± stander error. The obtained results were subjected to statistical analyses using the standard analysis of variance as outlined by Snedecor and Cochran (1980).

RESULTS AND DISCUSSIONS

Chemical composition of different soup mixtures

The proximate composition of resultant soups is tabulated in Table (2). The results presented in Table (2) indicated that protein contents of F1, F2, F3, F4, F5 and F6 were approximately the same, since it ranged between 9.2% (F2) to 9.9% (F3). No significant differences were found between F1, F2 and F4, also between F5 and F6. However, F7, F9 and F8 showed that the highest protein contents (12.0, 11.7 and 11.3%, respectively). These results may be due to the fact that these mixtures included the most protein-containing components such as oats (15.35%), spinach (24.44%) and broccoli (29%) on dry weight basis. Crude fiber contents ranged between 10.6% (F3) to 14.0% (F5). The lowest value of fat content was that of F6 (1.3%), while the highest value was observed for F8 (3.5%). F1 contained the highest amount of carbohydrates (57.1%), while the lowest were observed for F6 (47.4%). F3, F4, F5 and F6 have the high contents of ash (22.5, 24.5, 25.4 and 28.6%, respectively). Other soup mixtures showed the ash contents varied between 16.0% (F7) to 19.7% (F2).

In this study, the energy value of the nine soups ranged from 240 (F6) to 299 kcal/100 g (F7), which confirmed that one produced soup mixtures with different composition to meet the wishes of the elderly and all contained reasonable amounts of energy per meal.

Generally, F1, F2 and F4; F4, F6 and F8; F2, F3 and F4; F2 and F7 and F1 and F2 were found to be not significantly different in its protein, crude fiber, fat, carbohydrates and ash, respectively (Table 2). F5 and F6; F1 and F7; F5 and F9; F3 and F9 and F8 and F9 showed no significant difference for the same components, respectively (Table 2).

The fiber content of nine soup mixtures is associated with the presence of vegetables. The same results also indicated that F2 and F9 were not significantly different in between for their crude fiber contents as well as F5 and F6 for their carbohydrates contents. Concerning caloric values, F1 and F3; F2 and F9; F4 and F5 and F7 and F8 were non-significant (Table 2).

Table (2): Chemical composition of different soup mixtures (on dry weight basis)

Formula	Protein (%)	Crude fiber (%)	Fat (%)	Carbohydrates * (%)	Ash (%)	Caloric value (Kcal/100g)
F1	9.3 ±0.03^{f}	12.9 ± 0.02^{c}	1.4 ± 0.02^{e}	57.1 ± 0.02^{a}	19.3 ± 0.02^{e}	278 ± 0.02^{c}
F2	9.2 ± 0.05^{f}	12.5 ± 0.02^{d}	2.0 ± 0.02^{d}	56.6 ± 0.02^{b}	19.7 ± 0.02^{e}	281 ± 0.01^{b}
F3	9.9 ± 0.01^{d}	10.6 ± 0.05^{e}	2.1 ± 0.02^{d}	54.9 ± 0.05^{d}	22.5 ± 0.02^{d}	278 ± 0.02^{c}
F4	9.3 ± 0.01^{f}	13.2 ± 0.02^{b}	2.0 ± 0.02^{d}	51.0 ± 0.02^{e}	24.5 ± 0.05^{c}	259 ± 0.02^{d}
F5	9.6 ± 0.01^{e}	14.0 ± 0.02^{a}	3.2 ± 0.02^{b}	47.8 ± 0.02^{f}	25.4 ± 0.02^{b}	258 ± 0.02^{d}
F6	9.7 ± 0.02^{e}	13.0 ± 0.02^{b}	1.3 ± 0.02^{f}	47.4 ± 0.05^{f}	28.6 ± 0.05^{a}	240 ± 0.02^{e}
F7	12.0 ± 0.05^{a}	12.8 ± 0.05^{c}	2.8 ± 0.02^{c}	56.4 ± 0.02^{b}	16.0 ± 0.05^{g}	299 ± 0.01^{a}
F8	11.3 ± 0.05^{c}	13.0 ± 0.02^{b}	3.5 ± 0.01^{a}	55.3 ± 0.02^{c}	16.9 ± 0.02^{f}	298 ± 0.02^{a}
F9	11.7 ± 0.01^{b}	12.5 ± 0.05^{d}	3.2 ± 0.05^{b}	54.8 ± 0.02^{d}	17.8 ± 0.02^{f}	295 ± 0.05^{b}

Values are mean of three replicates ± SD, number in the same column followed by the same letter is not significantly different at 0.05 level; *Carbohydrates: was calculated by difference

Vitamins and minerals contents of different soup mixture

Vitamins and minerals play an important role in maintaining proper function and good health in the human body. Minerals and vitamins deficiencies are not associated only with malnutrition but also with many age-related disorders such as Alzheimer's disease, hypertension and heart diseases (Hoffman, 2017). Inadequate intake of minerals in the diet is often associated with an increased susceptibility to infectious diseases due to the weakening of the immune system. Additionally, vitamins and minerals (such as potassium and sodium) played important roles in the biological system (Jayasinghe *et al*., 2016); also, zinc improved the mental health and immune function of elderly.

The results presented in Table (3) showed the vitamins and minerals contents of the different prepared soups. In the present study, the nine soup mixtures recorded high contents of minerals and vitamins which may be attributed to the ingredients of these mixtures. Only, F8 showed the lowest contents of vitamins A, C, B_6 and B_{12} compared to others, while F1 showed the highest contents of these vitamins except B_{12} which was found at highest level in F3 (Table 3). Concerning minerals, F7, F8 and F9 showed the highest contents of Fe and Zn, while F1, F2 and F3 showed the highest contents of Ca. F4, F5 and F6 contained the highest values of K. However, Na was found in amounts ranged between 0.09 g (F7) to 0.43 g (F2). However, the results indicated that in most cases the contents of vitamins and minerals of all the prepared soups were significantly different (Table 3).

The results were almost similar to the study of Abdel-Haleem and Omran (2014) reported that vegetables are excellent sources of minerals especially calcium, phosphorus, iron, zinc, magnesium, potassium and sodium. Moreover, Slavin and Lloyd (2012) reported that plant-based foods contain considerable amounts of antioxidant vitamins. Celery and outer layers of lettuce have antioxidant vitamins such as vitamin C (ascorbic acid) and vitamin E (tocopherols), which are associated with cognitive decline in the elderly (Heo and Lee, 2004; Zanotta *et al*., 2014). Also, parsley and dill contained vitamin C and vitamin E (Laribi *et al*., 2015). In general, approximately similar results were recorded by Farzana *et al*. (2017), Singh *et al*. (2003) and Upadhyay *et al*. (2017).

Physiochemical characteristics of different soup mixtures

Recipes of thick nutrient-rich soups for the elderly that contained antioxidants are often recommended for easy chewing and swallowing and for easy preparation (Kim *et. al.,* 2014). The results presented in Table (4) showed slight changes in pH values of the prepared soup mixtures, since it ranged between 6.01 (F3) to 6.80 (F9). F4, F5 and F9 were non-significant differences in between but were significantly different from other soup mixtures, since it recorded the highest values. F3, F2 and F7 recorded the lowest pH values and were not significantly different in between. Intermediate pH values were observed for F8, F6 and F1 which were not significantly different in between and were significantly different from other soup mixtures. These results are consistent with the results of Mohamed *et al.* (2020) found that there were non-significant changes in the pH value of vegetable soup processed with water or whey. Also, they found that the pH value of all treatment (that is consists of cauliflower, green pea and carrot in different ratios and boiled in different ratios of water and whey) ranged from 5 to 6.68. Niththiya *et al*. (2014) found that the pH value of the dehydrated instant vegetable soup mix and prawn added soup mix using 'odiyal' flour and a mix of vegetables (manioc, long bean, carrot, moringa leaves and onions), rice grits, spice (garlic), salt, chili powder, tamarind and prawn powder ranged between 5.56 and 6.52. While, Jayasinghe *et al*. (2016) found that the soup formulas (80% vegetables, 10% grain, 3.5% legumes, 2.5% dried *Ulva* powder with 3% agar or 2% carrageenan and preservatives) had pH values ranged between 6.3 and 6.9.

Viscosity is an important characteristic of liquid foods (Wendin *et al*., 2010; Senanayake *et al*., 2014). Table (4) indicated that F7, F8 and F9 showed the highest apparent viscosity values (143.5, 145.0 and 144.0 cP, respectively). The lowest apparent viscosity values were observed for F1, F4 and F3 soup mixtures (130.0, 132.72 and 133.5 cP, respectively). F5, F6 and F2 showed intermediate viscosity values, since it was 135.64, 136.17 and 137.5 cP, respectively. The highest viscosity values of F7, F8 and F9 may be due to that these soup mixtures contained oat which showed the highest carbohydrates content. Viscosity expresses the texture and thickening of soup. The thickened liquid was contained a starch-based thickener. Also, Wendin *et al*. (2010) reported that low viscosity fluids (soups) were lower degree of chewing resistance, firmness, porosity and wobbling compared to high- viscosity fluids, while high viscosity fluids (thickened soups) were more melting, easier to swallow and creamy compared to low- viscosity fluids.

The antioxidant activities of the nine soup mixtures can be attributed to the presence of antioxidant vitamins in addition to flavonoids and polyphenols which are abundant in fruits and vegetables. Antioxidant activities of different soup mixtures are shown in Table (4).

The results indicated that F5 and F9 were promised in radical scavenging activity than others. The results indicated that F5 and F9 samples showed the highest values for antioxidant activity, since it was 89.63 and 89.45%, respectively. F4 also showed high value (88.92%) followed by F2 (87.81%) then F8 (87.32%) and F6 (85.64%). However, the lowest values were recorded for F7 (83.56%) and F3 (83.92%). These results emphasized the previous results that found by Hung and Duy (2012) where they reported that vegetables are best source of antioxidants and other phytonutrients.

The elevated antioxidant activity of F5 and F9 may be due to the increase of banana and onion peels as well as lettuce and whey protein in the formulation especially that these ingredients have potent antioxidant activities as confirmed by Park *et al.* (2018) and Mohamed *et al*. (2019).

Table (3): Vitamins and minerals content of different soup mixtures (/100g soup on dry weight basis)

Formula	Vit. A (µg)	Vit. C (mg)	Vit. B_6 (mg)	Vit. B_{12} (µg)	Fe (mg)	Zn (mg)	Ca (mg)	K (g)	Na (g)
F1	10421±0.03^{a}	200 ±0.03^{a}	1.29 ±0.03^{a}	ND	2.86 ± 0.02^{f}	1.43 ±0.02^{d}	150 ± 0.03^{c}	1.74 ± 0.01^{c}	0.16 ± 0.03^{f}
F2	9599 ±0.03^{c}	178 ±0.03^{c}	1.18 ± 0.02^{c}	19.74 ±0.02^{d}	3.29 ±0.02^{c}	1.32 ± 0.02^{f}	151 ± 0.02^{b}	1.45 ± 0.01^{e}	0.43 ± 0.02^{a}
F3	10268±0.03^{b}	190 ±0.02^{b}	1.27 ±0.03^{b}	49.30 ±0.03^{a}	2.82 ±0.02^{g}	1.41 ±0.02^{e}	162 ± 0.01^{a}	1.65 ± 0.01^{d}	0.28 ± 0.01^{c}
F4	9132 ±0.03^{d}	53 ±0.04^{d}	0.86 ± 0.02^{e}	ND	3.11 ±0.02^{d}	1.32 ± 0.02^{f}	119 ± 0.01^{h}	2.29 ± 0.03^{b}	0.13 ± 0.02^{g}
F5	8758 ±0.03^{f}	51 ±0.03^{f}	0.83 ± 0.01^{f}	19.11 ±0.03^{e}	2.55 ± 0.03^{h}	1.27 ±0.03^{g}	108 ± 0.02^{i}	2.43 ± 0.02^{a}	0.37 ± 0.01^{b}
F6	8929 ±0.03^{e}	52 ±0.02^{e}	0.91 ± 0.02^{d}	45.45 ±0.03^{b}	3.05 ±0.03^{e}	1.30 ± 0.03^{f}	130 ± 0.02^{g}	2.42 ± 0.03^{a}	0.18 ± 0.02^{e}
F7	5723 ±0.03^{h}	50 ±0.03^{g}	0.71 ± 0.02^{g}	ND	5.32 ±0.02^{b}	2.48 ±0.02^{b}	142 ± 0.01^{e}	0.92 ± 0.02^{h}	0.09 ± 0.01^{i}
F8	5669 ±0.03^{i}	49 ±0.03^{h}	0.70 ± 0.03^{h}	10.56 ±0.04^{f}	5.63 ±0.01^{a}	2.46 ±0.04^{c}	141 ± 0.02^{f}	1.04 ± 0.01^{g}	0.24 ± 0.02^{d}
F9	5726 ±0.03^{g}	50 ±0.03^{g}	0.71 ± 0.02^{g}	24.91 ±0.02^{c}	5.62 ±0.02^{a}	2.49 ±0.02^{a}	149 ± 0.01^{d}	1.07 ± 0.01^{f}	0.10 ± 0.03^{h}

Values are mean of three replicates ± SD, number in the same column followed by the same letter is not significantly different at 0.05 level; ND: Not detected

Table (4): Physiochemical characteristics and antioxidant activity of different soup mixtures

Formula	pH	Viscosity (cP)	Antioxidant Activity (%)	Color attributes			
				*L**	*a**	*b**	color
F1	6.35 ± 0.03 ^{b}	130.00 ± 0.08 ^{g}	86.06 ± 0.03 ^{d}	70.56 ± 0.02^{g}	4.56 ± 0.04^{g}	44.52 ± 0.01^{a}	Red
F2	6.14 ± 0.07 ^{c}	137.50 ± 0.03 ^{d}	87.81 ± 0.13 ^{c}	75.98 ± 0.02^{f}	5.64 ± 0.04^{e}	40.56 ± 0.02^{b}	Red
F3	6.01 ± 0. 09 ^{c}	133.50 ± 0.05 ^{f}	83.92 ± 0.09 ^{e}	77.52 ± 0.01^{e}	5.33 ± 0.04^{f}	39.76 ± 0.01^{c}	Red
F4	6.40 ± 0.03 ^{a}	132.72 ± 0.01 ^{f}	88.92 ± 0.12 ^{b}	79.80 ± 0.01^{d}	6.41 ± 0.02^{d}	25.83 ± 0.04^{i}	Orange Yellow
F5	6.70 ± 0.05 ^{a}	135.64 ± 0.11 ^{e}	89.63 ± 0.07 ^{a}	83.99 ± 0.04^{b}	6.92 ± 0.01^{b}	32.38 ± 0.04^{f}	Orange Yellow
F6	6.20 ± 0.08 ^{b}	136.17 ± 0.02 ^{e}	85.64 ± 0.09 ^{c}	85.35 ± 0.04^{a}	7.19 ± 0.02^{a}	34.87 ± 0.01^{e}	Orange Yellow
F7	6.16 ± 0.06 ^{c}	143.50 ± 0.03 ^{c}	83.56 ± 0.03 ^{e}	82.44 ± 0.02^{c}	2.39 ± 0.01^{h}	30.55 ± 0.01^{g}	Yellow
F8	6.20 ± 0.08 ^{b}	145.0 ± 0.04 ^{a}	87.32 ± 0.01 ^{c}	83.65 ± 0.01^{c}	2.55 ± 0.04^{h}	29.9 ± 0.01^{h}	Yellow
F9	6.80 ± 0.08 ^{a}	144.0 ± 0.05 ^{b}	89.45 ± 0.03 ^{a}	84.75 ± 0.01^{b}	6.52 ± 0.01^{c}	35.87 ± 0.04^{d}	Orange Yellow

Values are mean of three replicates ±SD. Values number in the same column followed by the same letter are not significantly different at 0.05 level.; *L** (lightness with *L** = 100 for lightness, and *L** = zero for darkness), *a** [(chromaticity on *a** green (−) to red (+)], *b** [(chromaticity on a blue (−) to yell low (+)].

Color is one of the most important quality features of vegetable and fruit products, where it is the first thing consumers see (Sudha *et al*., 2015). Color parameters (*L**, *a**, and *b**) for all the prepared soup mixtures are shown in Table (4). The obtained results indicated that F5, F6, F7, F8 and F9 showed more lightness compared to other soup mixtures, since it showed *L** values ranged between 82.44 and 85.35. While, F1, F2, F3 and F4 showed *L** values ranged between 70.56 and 79.80. F6, F5, F9 and F4 showed more red color (+*a** values ranged between 6.41 and 7.19), followed by F2, F3 and F1 which showed +*a** values ranged between 4.56 and 5.64, while F7 and F8 showed the lowest red color values (2.39 and 2.55, respectively).

Concerning *b** parameter, the results indicated that F1, F2 and F3 showed the highest value which being 44.52, 40.56 and 39.76, respectively (highly yellow color). The other soup mixtures showed values varied between 25.83 (F4) and 35.87 (F9). There is a direct relationship between phenolic compounds and the levels of color pigments in fruits and vegetables (Pietta, 2000; Elham *et al*., 2006). The level of color pigments correlated with antioxidant activity (Halliwell *et al*., 2005).

The observed variation in color parameters of the prepared soup mixtures could be related to the original color of its constituents such as beet (red), yellow sweet potato (orange yellow) and carrot (yellow).

Sensory evaluation of different soup mixtures

The different soup mixtures were subjected to sensory evaluation for their taste, color, odor, consistency and overall acceptability are shown in Table **(**5**)**. The great acceptability of the prepared soup mixtures was due to their ingredients. No significant differences were found between F1, F2, F4, F5, F6, F7 and F8 for taste, while F3 and F9 were significantly different than the previous mentioned but not significantly differed in between. Color scores of F1, F2, F6 and F8 were not significantly different in between. Also, F4, F5, F7 and F9 were not significantly different for color in between. However, the lowest color score was recorded for F3 which was significantly different from all other soup mixtures. Concerning odor, the same results indicated that F1, F4 and F5 recorded the highest score and were not significantly different, while other soup mixtures (F2, F3, F6, F7, F8 and F9) recorded lowest scores and were not significantly different in between.

With respect to consistency, F1, F2, F4, F5, F6 and F8 were not significantly different. On the other hand, F1, F2, F4, F7 and F8 were also not significantly different. F3 and F9 recorded the lowest scores compared to other soup mixtures and were significantly different from them but not significantly different in between.

For overall acceptability, F1, F4, F5, F6 and F8 showed no significantly differences in between. The same trend was also observed for F1, F2, F4, F6, F7 and F8 were found to be more acceptable than others. However, F3 and F9 recorded the lowest scores and were significantly different from other soup mixtures.

Table (5): Sensory evaluation of different soup mixtures

Soup mixtures	Taste (10)	Color (10)	Odor (10)	Consistency (10)	Overall acceptability (10)
F1	8.75 ± 0.71^{ab}	9.25 ± 0.46^{a}	9.50 ± 0.53^{a}	8.88 ± 0.35^{ab}	9.38 ± 0.52^{ab}
F2	8.75 ± 0.46^{ab}	9.50 ± 0.53^{a}	8.63 ± 0.52^{b}	8.63 ± 0.52^{ab}	8.88 ± 0.64^{b}
F3	7.38 ± 0.52^{c}	7.38 ± 0.52^{c}	8.38 ± 0.52^{b}	7.25 ± 0.46^{c}	7.50 ± 0.53^{d}
F4	8.88 ± 0.64^{ab}	8.50 ± 0.53^{b}	9.38 ± 0.52^{a}	9.00 ± 0.76^{ab}	9.38 ± 0.52^{ab}
F5	8.88 ± 0.64^{ab}	8.75 ± 0.46^{b}	9.88 ± 0.64^{a}	9.63 ± 1.30^{a}	9.50 ± 0.53^{a}
F6	8.14 ± 0.38^{b}	9.43 ± 0.53^{a}	9.00 ± 0.82^{b}	9.43 ± 0.53^{a}	9.43 ± 0.53^{ab}
F7	8.55 ± 0.46^{b}	8.58 ± 0.74^{b}	8.63 ± 0.52^{b}	8.50 ± 0.53^{b}	8.38 ± 0.52^{b}
F8	8.50 ± 0.53^{b}	9.00 ± 0.93^{a}	8.88 ± 0.83^{b}	8.63 ± 0.92^{ab}	9.38 ± 0.35^{ab}
F9	7.57 ± 0.53^{c}	8.43 ± 0.53^{b}	8.29 ± 0.76^{b}	7.71 ± 0.76^{c}	8.53 ± 0.53^{c}

Values are mean of three replicates ± SD, number in the same column followed by the same letter is not significantly different at 0.05 level

The percentages of covering of the recommended daily allowances (RDA) by the different prepared soups for older male and female (age 51-70 year)

The obtained results of nutrients of the nine soup mixtures were compared to the nutritional requirements recommended by the Dietary Reference Intake (DRI) for elderly males. This gender was chosen as a recommendation of nutrients, the nine soup mixtures contained nutrients greater than those required for females; thus, they are able to cover the needs of both genders. The RDA percentages of serving (250 g) of each of prepared soups were calculated depending on its chemical composition comparing with the standard RDA which required for older male and female (age 51-70 year) and the obtained results are shown in Table (6).

Protein content of F1, F2, F3, F4, F5 and F6 soups covered approximately the same percentages of the required RDA. Regarding RDA of protein for males and female aged 51-70 years (56 and 46 g protein/day, respectively), 250 g of each soup mixtures provide 5.9% (F1) and 6.8% (F5 and F6) for older male and provide 7.2 % (F1) and 8.3% (F5 and F6) for older female. However, F7, F8 and F9 provide relatively higher percentages of RDA of protein, (14.3% - 15.2%) for older male and (17.4% - 18.5%) for older female of daily requirements. Regarding RDA of crude fiber for male and female aged 51-70 years (30 and 21g crude fiber/day, respectively), the covered percentages of RDA from crude fiber contents of F1 to F6 were found to be ranged from 12.7% (F3) to 18.3% (F5) for older male and ranged from 18.1% (F3) to 26.2% (F5) for older female. F7, F8 and F9 covered percentages of 30.0, 31.0 and 29.3%, respectively of the required RDA from crude fiber for older male, while the same soups covered 42.9, 44.3 and 41.9%, respectively for older female of daily requirements.

The fat contents of the soup mixtures were 0.5 (F1, F6) and 2.5 g (F8). Regarding RDA of fat, each 250 g of soup mixture provide 2.5 and 12.5%, respectively of daily requirements of fat.

Concerning carbohydrates contents it was found to be ranged from 18.3 g (F6) to 39.8 g (F7) and were covered 14.1% to 30.6% of RDA for older male or female. Finally, energy values of the prepared soups varied between 93 to 212 kcal/cup soup and the covering percentages of RDA ranged between 4.2-9.6% for older male and 4.7-10.7 % for older female. From these results it could be observed that F7, F8 and F9 showed the highest values of energy, which may be due to its composition especially presence of oat, spinach, broccoli and bananas (Table 1).

However, Table (6) showed that RDA values for protein which covered by F2, F3, F4, F5 and F6 for male were found to be not significantly different, while F1, F7, F8 and F9 were significantly different for female. RDA values (for male and female) for protein of F2, F3 and F4 were not significantly different. The same trend was observed for F5 and F6. F1, F7, F8 and F9 showed significantly different in between and with other treatment.

Concerning crude fiber, the RDA values for male of all treatment were significantly different in between except F4 and F6 which were not significantly different. Similar trend was found for female.

RDA values (for male and female) of fat of F2, F3 and F4 were not significantly different in between, while other treatments were significantly different in between, while other treatments were significantly different.

With respect to carbohydrates, RDA values of all treatments were found to be significantly different either for male or female.

Concerning energy, RDA values for male of F7 and F8 were not significantly different, while other treatments showed significantly differences in between.

Percentages of RDA per serving from vitamins of different prepared soups

Vitamin contents of the nine soup mixtures are presented in Table (7). Results showed that 250g of each tested soup mixtures contained suitable amounts of vitamins when compared with RDA. The different prepared soups contained vitamin A at levels varied between 3438 µg (F5 and F6) to 4035 µg (F7). The present amounts of vitamin A were found to cover RDA at percentages varied between 382 to 448 % for older males and 491 to 576 % for older females. Vitamin C contents of the prepared soups varied between 20 mg (F4, F5 and F6) to 70 mg (F1) and it were found to cover RDA at percentages ranged between 22 to 78% for older males and 27 to 93% for older females. The resultant soups contained vitamin B_6 at levels ranged from 0.33 mg (F4 and F5) to 0.50 mg (F7, F8 and F9) per serving. These amounts of vitamin B_6 covered 19-29% of the RDA for older males and 22-33% for older females. Vitamin B_{12} was also found in some resultant soups at levels of 8 µg (F2, F5 and F8) and 18 µg (F3, F6 and F9) and these amounts covered 333-750% of RDA for both older males and females.

The results presented in Table (7) showed also that no significantly different was observed for male RDA values of vitamin A which covered by F1, F2 and F3 and also by F5 and F6. The same trend was found for F8 and F9. Similar results were found for females. RDA values of vitamin C which covered by F2 and F3 were not significantly different; F4, F5 and F6 were also not significantly different as well as F7, F8 and F9 either for male or female. Concerning vitamin B_6, F1, F2 and F3; F4 and F5 and also F7, F8 and F9 showed no significantly different in between for their RDA values for male or female. Finally, the same results indicated that RDA values for vitamin B_{12} of F2, F5 and F8 were not significantly different and also F3, F6 and F9 showed the same trend either for male or female.

Percentages of RDA per serving from minerals of different prepared soups

As regards to the results presented in Table (8) showed that soup mixtures F1, F3 and F5 contained the lowest amount of Fe (1.0 mg), while F8 and F9 contained the highest amount (4.0 mg) per serving. The contents of Fe were able to cover 12.5-50.0% of the RDA for older male and female. Zn contents varied

Table (6): The amount (g) and RDA* covering percentages of protein, crude fiber, fat and carbohydrates ** and energy (kcal/cup of soup) per serving*** of different soup mixtures for older male and female (Age 51-70)

Formula	Protein (g)	RDA covering %		Crude fiber (g)	RDA covering %		Fat (g)	RDA covering %		Carbohydrates ** (g)	RDA covering %		Energy Kcal/cup soup	RDA covering %	
		male	female		Male	female		male	female		male	female		male	female
F1	3.3±0.01^{f}	5.9±0.01^{e}	7.2±0.02^{f}	4.5±0.01^{g}	15.0±0.01^{g}	21.4±0.02^{g}	0.5±0.01^{f}	2.5±0.01^{f}	2.5±0.04^{f}	20.0±0.01^{e}	15.4±0.01^{e}	15.4±0.01^{e}	98±0.01^{g}	4.4±0.02^{f}	5.0±0.02^{e}
F2	3.5±0.01^{e}	6.3±0.04^{d}	7.6±0.02^{e}	4.8±0.01^{f}	16.0±0.01^{f}	22.9±0.02^{f}	0.8±0.01^{e}	4.0±0.02^{e}	4.0±0.04^{e}	21.5±0.01^{d}	16.5±0.01^{d}	16.5±0.01^{d}	107±0.01^{d}	4.9±0.04^{c}	5.4±0.02^{c}
F3	3.5±0.02^{e}	6.3±0.01^{d}	7.6±0.01^{e}	3.8±0.02^{h}	12.7±0.01^{h}	18.1±0.02^{h}	0.8±0.01^{e}	4.0±0.02^{e}	4.0±0.01^{e}	19.5±0.02^{f}	15.0±0.01^{f}	15.0±0.01^{f}	99±0.01^{f}	4.5±0.02^{e}	5.0±0.02^{e}
F4	3.5±0.04^{e}	6.3±0.01^{d}	7.6±0.02^{e}	5.0±0.01^{e}	16.7±0.01^{e}	23.8±0.04^{e}	0.8±0.01^{e}	4.0±0.02^{e}	4.0±0.01^{e}	19.3±0.01^{g}	14.8±0.01^{g}	14.8±0.01^{g}	98±0.04^{g}	4.4±0.01^{f}	5.0±0.02^{e}
F5	3.8±0.02^{d}	6.8±0.04^{d}	8.3±0.01^{d}	5.5±0.01^{d}	18.3±0.01^{d}	26.2±0.02^{d}	1.3±0.01^{d}	6.5±0.02^{d}	6.5±0.04^{d}	18.8±0.02^{h}	14.5±0.01^{h}	14.5±0.04^{h}	102±0.02^{e}	4.6±0.02^{d}	5.2±0.02^{d}
F6	3.8±0.01^{d}	6.8±0.01^{d}	8.3±0.01^{d}	5.0±0.02^{e}	16.7±0.01^{e}	23.8±0.01^{e}	0.5±0.01^{f}	2.5±0.01^{f}	2.5±0.02^{f}	18.3±0.01^{i}	14.1±0.01^{i}	14.1±0.01^{i}	93±0.02^{h}	4.2±0.02^{g}	4.7±0.01^{f}
F7	8.5±0.04^{a}	15.2±0.01^{a}	18.5±0.01^{a}	9.0±0.01^{b}	30.0±0.01^{b}	42.9±0.01^{b}	2.0±0.01^{c}	10.0±0.03^{c}	10.0±0.04^{c}	39.8±0.01^{a}	30.6±0.02^{a}	30.6±0.04^{a}	211±0.04^{c}	9.6±0.04^{a}	10.7±0.04^{a}
F8	8.0±0.04^{c}	14.3±0.01^{c}	17.4±0.01^{c}	9.3±0.02^{a}	31.0±0.02^{a}	44.3±0.01^{a}	2.5±0.01^{a}	12.5±0.03^{a}	12.5±0.02^{a}	39.3±0.01^{b}	30.2±0.04^{b}	30.2±0.04^{b}	212±0.01^{b}	9.6±0.01^{a}	10.7±0.04^{a}
F9	8.3±0.04^{b}	14.8±0.01^{b}	18.0±0.02^{b}	8.8±0.07^{c}	29.3±0.02^{c}	41.9±0.01^{c}	2.3±0.01^{b}	11.5±0.02^{b}	11.5±0.02^{b}	38.5±0.01^{c}	29.6±0.02^{c}	29.6±0.02^{c}	208±0.02^{a}	9.4±0.01^{b}	10.5±0.01^{b}

Values are mean of three replicates ± SD, number in the same column followed by the same letter is not significantly different at 0.05 level.; *RDA: Recommended Dietary Allowances for older male and female (Age 51-70) of [protein (g) = 56 & 46, Crude fiber (g) = 30 & 21, Fat (%) = 20 & 20, Carbohydrates (g) = 130 & 130, Energy (Kcal) = 2204 & 1978, respectively], " national policy and resource center on nutrition and aging, Florida international university, (2004)." ** Carbohydrates: was calculated by difference; ***Serving: One cup of soup (250 g).

Table (7): The amount of vitamins and RDA* covering percentages per serving** of different soup mixtures for older male and female (Age 51-70)

Formula	Vit. A (µg)	RDA covering %		Vit. C (mg)	RDA covering %		Vit. B_6 (mg)	RDA covering %		Vit. B_{12} (µg)	RDA covering %	
		male	female		male	female		male	female		male	female
F1	3648±0.01[d]	405±0.03[c]	521±0.03[c]	70±0.23[a]	78±0.23[a]	93±0.33[a]	0.45±0.01[b]	26±0.55[b]	30±0.12[b]	ND	-----***	-----***
F2	3648±0.01[d]	405±0.03[c]	521±0.03[c]	68±0.12[b]	76±0.55[b]	91±0.79[b]	0.45±0.01[b]	26±0.55[b]	30±0.12[b]	8±0.23[b]	333±0.52[b]	333±0.52[b]
F3	3645±0.02[e]	405±0.03[c]	521±0.03[c]	68±0.12[b]	76±0.55[b]	91±0.79[b]	0.45±0.01[b]	26±0.55[b]	30±0.12[b]	18±0.56[a]	750±0.33[a]	750±0.33[a]
F4	3448±0.03[f]	383±0.07[d]	492±0.02[d]	20±0.34[d]	22±0.12[d]	27±0.70[d]	0.33±0.02[d]	19±0.93[d]	22±0.21[d]	ND	-----***	-----***
F5	3438±0.02[g]	382±0.07[e]	491±0.02[e]	20±0.34[d]	22±0.12[d]	27±0.70[d]	0.33±0.02[d]	19±0.93[d]	22±0.21[d]	8±0.23[b]	333±0.52[b]	333±0.52[b]
F6	3438±0.01[g]	382±0.07[e]	491±0.01[e]	20±0.34[d]	22±0.12[d]	27±0.70[d]	0.35±0.02[c]	21±0.34[c]	23±0.45[c]	18±0.56[a]	750±0.33[a]	750±0.33[a]
F7	4035±0.01[a]	448±0.08[a]	576±0.02[a]	35±0.33[c]	39±0.55[c]	47±0.47[c]	0.50±0.02[a]	29±0.57[a]	33±0.55[a]	ND	-----***	-----***
F8	4025±0.01[b]	447±0.06[b]	575±0.02[b]	35±0.33[c]	39±0.55[c]	47±0.47[c]	0.50±0.02[a]	29±0.57[a]	33±0.55[a]	8±0.23[b]	333±0.52[b]	333±0.52[b]
F9	4023±0.02[c]	447±0.06[b]	575±0.02[b]	35±0.33[c]	39±0.55[c]	47±0.47[c]	0.50±0.02[a]	29±0.57[a]	33±0.55[a]	18±0.23[a]	750±0.33[a]	750±0.33[a]

Values are mean of three replicates ± SD, number in the same column followed by the same letter is not significantly different at 0.05 level; *RDA: Recommended Dietary Allowances for older male and female (Age 51-70) of [vit.A (µg) = 900 & 700, Vit. C (mg) = 90 & 75, Vit. B_6 (mg) = 1.7 & 1.5, Vit. B_{12} (µg) = 2.4 & 2.4, respectively],"national policy and resource center on nutrition and aging, Florida international university, (2004).."; **Serving: One cup of soup (250g).
ND: Not detected , ***---: Not calculated

Table (8): The amount of minerals and RDA*covering percentages per serving** of different soup mixtures for older male and female (Age 51 - 70)

Formula	Fe (mg)	RDA covering %		Zn (mg)	RDA covering %		Ca (mg)	RDA covering %		K (g)	RDA covering %		Na (g)	RDA covering %	
		male	female		male	female		male	female		male	female		male	female
F1	1.0±0.03^{e}	12.5±0.45^{e}	12.5±0.25^{e}	0.5±0.01^{b}	4.5±0.33^{b}	6.3±0.02^{b}	52.5±0.43^{d}	4.4±0.06^{d}	4.4±0.03^{d}	0.61±0.01^{g}	13.0±0.01^{g}	13.0±0.04^{g}	0.06±0.01^{e}	4.6±0.03^{e}	4.6±0.04^{e}
F2	1.3±0.01^{c}	16.3±0.57^{c}	16.3±0.57^{c}	0.5±0.01^{b}	4.5±0.33^{b}	6.3±0.02^{b}	57.5±0.63^{c}	4.8±0.01^{c}	4.8±0.06^{c}	0.55±0.01^{h}	11.7±0.01^{h}	11.7±0.01^{h}	0.17±0.05^{a}	13.1±0.02^{a}	13.1±0.06^{a}
F3	1.0±0.03^{e}	12.5±0.45^{e}	12.5±0.25^{e}	0.5±0.01^{b}	4.5±0.33^{b}	6.3±0.02^{b}	57.5±0.63^{c}	4.8±0.01^{c}	4.8±0.06^{c}	0.59±0.03^{h}	12.6±0.01^{h}	12.6±0.01^{h}	0.10±0.01^{c}	7.7±0.02^{c}	7.7±0.03^{c}
F4	1.2±0.02^{d}	15.0±0.23^{d}	15.0±0.44^{d}	0.5±0.01^{b}	4.5±0.33^{b}	6.3±0.02^{b}	45.0±0.78^{e}	3.8±0.05^{f}	3.8±0.03^{f}	0.87±0.04^{c}	18.5±0.06^{c}	18.5±0.01^{c}	0.05±0.01^{f}	3.8±0.01^{f}	3.8±0.01^{f}
F5	1.0±0.03^{e}	12.5±0.45^{e}	12.5±0.25^{e}	0.5±0.01^{b}	4.5±0.33^{b}	6.3±0.02^{b}	42.5±0.41^{f}	3.5±0.01^{g}	3.5±0.06^{g}	0.96±0.04^{a}	20.4±0.06^{a}	20.4±0.02^{a}	0.15±0.01^{b}	11.5±0.05^{b}	11.5±0.05^{b}
F6	1.2±0.02^{d}	15.0±0.23^{d}	15.0±0.44^{d}	0.5±0.01^{b}	4.5±0.33^{b}	6.3±0.02^{b}	50.0±0.45^{d}	4.2±0.01^{e}	4.2±0.01^{e}	0.93±0.02^{b}	19.8±0.04^{b}	19.8±0.01^{b}	0.07±0.01^{d}	5.4±0.06^{d}	5.4±0.06^{d}
F7	3.8±0.02^{b}	47.5±0.44^{b}	47.5±0.55^{b}	1.8±0.02^{a}	16.4±0.52^{a}	22.5±0.012^{a}	100.0±0.33^{b}	8.3±0.04^{b}	8.3±0.01^{b}	0.65±0.01^{f}	13.8±0.01^{f}	13.8±0.04^{f}	0.06±0. 01^{e}	4.6±0.03^{e}	4.6±0.04^{e}
F8	4.0±0.02^{a}	50.0±0.23^{a}	50.0±0.23^{a}	1.8±0.02^{a}	16.4±0.52^{a}	22.5±0.012^{a}	100.0±0.33^{b}	8.3±0.04^{b}	8.3±0.01^{b}	0.74±0.02^{e}	15.7±0.01^{e}	15.7±0.10^{e}	0.17±0.05^{a}	13.1±0.02^{a}	13.1±0.02^{a}
F9	4.0±0.02^{a}	50.0±0.23^{a}	50.0±0.23^{a}	1.8±0.02^{a}	16.4±0.52^{a}	22.5±0.01^{a}	105.5±0.52^{a}	8.8±0.02^{a}	8.8±0.01^{a}	0.75±0.04^{d}	16.0±0.03^{d}	16.0±0.02^{d}	0.07±0.01^{d}	5.4±0.06^{d}	5.4±0.06^{d}

Values are mean of three replicates ± SD, number in the same column followed by the same letter is not significantly different at 0.05 level; *RDA: Recommended Dietary Allowances for older male and female (Age 51-70) of [Fe (mg)=8 & 8, Zn (mg)= 11 & 8, Ca (mg)=1200 & 1200, K (g)=4.7 & 4.7, Na (g)=1.3 & 1.3, respectively], "national policy and resource center on nutrition and aging, Florida international university, (2004)."; **Serving: One cup of soup (250g).

between 1.8 mg (F7, F8 and F9) and 0.5 mg other soups per serving and these contents were found to cover 16.4 to 4.5% for older male and 22.5 to 6.3% for older female. The amounts of Ca were ranged from 42.5 mg (F5) to 105.5 mg (F9) per serving. It covered RDA at percentages of 3.5-8.8% for older male and female. K contents of the different soups varied between 0.55 g (F2) to 0.96 g (F5) per serving. The covered percentages of RDA of K ranged between 11.7 to 20.4% for older male and female. Finally, Na contents of the different prepared soups were found to cover 3.8-13.1% for both of older male and female. For male and female, the RDA values for Fe of F1, F3 and F5 were not significantly different, F4 and F6 and also F8 and F9 showed the same trend. For Zn, the results indicated that RDA values of F1, F2, F3, F4, F5 and F6 were found to be not significantly different and F7, F8 and F9 showed the same trend all either for male or female. RDA values for Ca of F2 and F3 and F7 and F8 were not significantly different either for male or female. Concerning K, RDA values for male or female of F2 and F3 were found to be not significantly different, while other soup mixtures showed significantly differences in between. RDA values of Na of F2 and F8 were not significantly different as well as F1 and F7, while other soup mixtures were significantly different.

Sensory evaluation of rehydrated different soup mixtures

After rehydration of the dried resultant soups, the samples were subjected to sensory evaluation for its taste, color, odor, consistency and overall acceptability. The results are shown in Table **(9)**. These results indicated that taste scores varied from 8.13 (F6) to 9.43 (F8) with no significant differences between the samples of F1, F2, F4, F5, F7, F8 and F9. Color scores varied from 8.00 (F8) to 8.88 (F2) and these rehydrated soups were found to be not significantly different for its color. The lowest score for odor was observed for F6 (7.25), while the highest score was that of F8 (9.88). However, samples of F1, F3, F4, F7 and F8 were found to be not significantly different for their odor. Concerning consistency, F9 showed the lowest score (8.29), while the highest score was observed for F8 (9.43). Consistency scores of F1, F2, F4, F6, F7 and F8 were not significantly different. The scores of overall acceptability varied between 8.38 (F3 and F7) to 9.50 (F5) and samples of F1, F2, F4, F5, F6 and F8 showed no significantly differences in between.

Table (9): Sensory evaluation of re-hydrated* different soup mixtures

Soup mixtures	Taste (10)	Color (10)	Odor (10)	Consistency (10)	Overall acceptability (10)
F1	8.88 ± 0.35^{ab}	8.75 ± 0.71^{a}	9.25 ± 0.46^{ab}	8.88 ± 0.35^{ab}	9.38 ± 0.52^{ab}
F2	9.00 ± 0.76^{a}	8.88 ± 0.64^{a}	8.50 ± 0.53^{c}	9.00 ± 0.76^{a}	9.38 ± 0.64^{ab}
F3	8.50 ± 0.53^{b}	8.38 ± 0.46^{a}	9.38 ± 0.74^{ab}	8.50 ± 0.53^{c}	8.38 ± 0.53^{c}
F4	8.63 ± 0.64^{ab}	8.75 ± 0.53^{a}	9.50 ± 0.53^{a}	9.00 ± 0.76^{a}	9.38 ± 0.52^{ab}
F5	8.88 ± 0.64^{ab}	8.75 ± 0.46^{a}	8.88 ± 0.64^{c}	8.63 ± 1.30^{b}	9.50 ± 0.53^{a}
F6	8.13 ± 0.38^{b}	8.43 ± 0.53^{a}	7.25 ± 0.82^{d}	8.43 ± 0.53^{a}	9.43 ± 0.53^{a}
F7	9.25 ± 0.46^{a}	8.58 ± 0.74^{a}	9.43 ± 0.52^{a}	9.25 ± 0.46^{a}	8.38 ± 0.52^{b}
F8	9.43 ± 0.53^{a}	8.00 ± 0.93^{a}	9.88 ± 0.83^{a}	9.43 ± 0.53^{a}	9.38 ± 0.35^{ab}
F9	8.29 ± 0.53^{ab}	8.43 ± 0.53^{a}	8.29 ± 0.76^{b}	8.29 ± 0.76^{c}	8.53 ± 0.53^{c}

Values are mean of three replicates ± SD, number in the same column followed by the same letter is not significantly different at 0.05 level; * Dried soups were rehydrated by addition of hot water at ratio of 85 g water /15 g dry soup

CONCLUSION

In this study, nine different soup mixtures of vegetable soups were prepared, which contained one variety of fruit. The soups were cooked well in water, chicken broth and whey. These soup mixtures were multicolored, rich in vitamins and minerals A, C, B_6, B_{12}, iron and zinc. It was found that these soups had high antioxidant activity. It is worth mentioning that these soups are easy to prepare to control its thickness and to chew and economical (come from cheap plant sources), so these soups meet a large part of the daily requirements and meet the wishes of a large number of older people.

ACKNOWLEDGEMENT

We sincerely express indebtedness to Dr. Ghada Mohamed Youssef, Professor of Food Technology, Department of Special Food and Nutrition Research, Food Technology Research Institute, Agricultural Research Center, Giza, Egypt, for her appreciated advice and her kind help.

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إعداد حساء عالي الجودة الغذائية للمسنين

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يجب الاعتناء بتغذية كبار السن، خاصة وانه مع تقدم العمر تظهر بعض الصعوبات كصعوبة الحركة وفقدان الشهية ومشاكل المضغ، لذلك يحتاجون إلى طعام سهل التحضير وغني في محتواه من المكونات الغذائية مثل البروتينات والفيتامينات والمعادن. صممت هذه الدراسة لتحضير حساء يحتوي على بعض الخضروات والفواكه والتي تم طهيها في واحد من ثلاثة سوائل (الماء، مرق الدجاج والشرش). وقد تم إعداد تسع خلطات. تم تقدير التركيب الكيميائي لهذه الخلطات ومحتواها من الفيتامينات والمعادن وتقدير الخصائص الفيزيائية والكيميائية والنشاط المضاد للأكسدة، كما تم تقييم الخواص الحسية وكذلك الاحتياجات اليومية الموصى بها. تنوعت ألوان خلطات الحساء بين الأحمر إلى البرتقالي أو الأصفر. أظهرت نتائج التقييم الحسي أن جميع خلطات الحساء المختلفة كانت مقبولة وتراوحت قيم درجات القبول العام من ٨,٣٨ إلى ٩,٥٠ . أشارت النتائج إلى أن الحصة الواحدة (٢٥٠ جم) من بعض الخلطات قد غطت الاحتياجات اليومية المعتمدة للمسنين الذكور والإناث من البروتين والألياف الخام والدهون والكربوهيدرات وقيم السعرات الحرارية (١٤,٣ - ١٨,٥ ٪)، (٢٩,٣ – ٤٤,٣ ٪)، (١٠- ١٢,٥ ٪)، (٢٩,٦ - ٣٠,٦ ٪) و (٩,٤ - ١٠,٧ سعر حراري / كوب من الحساء) على الترتيب. بينما غطت قيم كل من فيتامين أ، ج، ب٦، ب١٢ الاحتياجات اليومية للمسنين الذكور بحوالي ٤٤٨ ٪ ، ٣٩ ٪ ، ٢٩ ٪ و ٧٥٠ ٪ على الترتيب، وبحوالي ٥٧٦ ٪ ، ٤٧ ٪ ، ٣٣ ٪ و ٧٥٠ ٪ للمسنين الإناث على الترتيب. ونستنتج من هذه الدراسة إمكانية إعداد مجموعة من الخلطات التي تصلح كحساء مستساغ معد من مخاليط متنوعة من الخضروات والفواكه ذو قابلية عالية و ذات نشاط مضاد الأكسدة ويوفر للمسنين نسبة عالية من احتياجاتهم اليومية من المكونات الغذائية.