

Production and Fortification of Some Products with Date Palm Pollen for Prevention of Some Aging Diseases

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Abstract

Prevention of premature chronic diseases is an important component of healthy aging. Nutrition can help to reduce the risk of premature chronic diseases in some older adults. Soups are generally consumed for health as well as nutritive benefits particularly in patients whose intake of solids is poor due to several obstructive or pathological reasons. Pollen grains, especially of date palm, have high nutritional and medicinal value. Date palm pollen contain 30.11% protein, 19.54% fat, 4.85% fiber and 5.06% ash. Date palm pollen grains constitute a rich source of mineral elements, iron, zinc, calcium and magnesium values are (230.87, 283.03, 215.15 and 129.46 mg/100gm respectively). It's also characterized by its ability to be stored for long periods without noticeable changes in its components.

Supplementation of dried soup with date pollen resulted in an increase in protein, fat, ash and fiber, on the other hand, carbohydrate and energy decreased. Red cabbage-tomato formula supplemented with date pollen recorded the highest iron content (29.5 mg/100gm) and zinc (30.74 mg/100gm) and highest rehydration ratio (4.72). The sensory quality of the soup samples was satisfactory and the highest acceptability was the red cabbage-tomato formula supplemented with date pollen.

Keywords: Dry soup, date pollen powder, healthy aging.

Introduction

Prevention of premature chronic diseases is an important component of healthy aging. Nutrition can help to reduce the risk of premature chronic diseases in some older adults. Soups are generally consumed for health as well as nutritive benefits particularly in patients whose intake of solids is poor due to several obstructive or pathological reasons. Under those circumstances, soups are the best source to supply health protective compounds and to circumvent the nutritive deficiency. Incorporation of antioxidant-rich ingredients into soup will further boost the product market as the present trend is focused on marketing of processed food products providing health benefits (**Sanchez-Moreno et al. 2004**).

Dry soup mixes, due to their long storage life at ordinary temperatures, protection from enzymatic and oxidative spoilage. Moreover, it has light weight for shipping and availability at all time of the year, their low unit volume, are well adapted to institutional use as well as to military rations. In addition, it is ready for reconstitution in a short time with a high nutritive value. They are prepared by blending dried ingredients with thickening agents or by spray drying the formulated slurry (**Singh et al., 2003**). **Axtell, 1992** reported that the good quality and reasonable ratio of dehydrated soup depend on variety and functional properties of supplemented individuals. A balance of nutrients may be obtained by including whole cereals, vegetables, pulses and milk products, etc. Such diets supply a large proportion of our energy needed, carbohydrate, protein, dietary fiber, amino acids and minerals (**Pandey et al, 2006**). **Ravindran and Matia-Merino (2009)** said that functional ingredients can be easily incorporated into soup powders to provide health benefits.

Food habits and nutrient intakes evolve with aging (**Gillette Guyonnet et al., 2007**). In older adults, an adequate diet depends on their ability to procure and prepare food and eat independently or the availability of dietary assistance when needed (**Bates et al., 2002**). Inadequate food intake and/or increased nutritional requirements lead to poor nutritional status, which is considered a

key determinant of morbidity, increased risk of infection, and mortality in elderly individuals (**Morley et al., 1986**). In a recent review, **Gillette Guyonnet et al., 2007** noted that food consumption is frequently decreased as seniors with Alzheimer Disease (AD) become less able to carry out activities of daily living, and this is a particularly critical issue for those living alone. Regulation of inflammation generally is reduced with ageing (**Franceschi et al., 2007**), and accelerated inflammation is implicated in neurodegenerative disorders such as Alzheimer's disease (**Giunta et al., 2008**). Polyphenols induce neuroprotective effects and influence neuronal signaling involved in memory function (**Ishige et al., 2001; Joseph et al., 2003; Olszanecki et al., 2002**). Diet and nutrition may affect the person's health and course of chronic inflammatory airway diseases. **Gupta et al., 2011** reported that dietary supplementation or adequate intake of antioxidant lycopene, vitamin A, vitamin D and vitamin C rich foods may be beneficial for asthma patients. **Steffen et al., 2005** stated that plant food intake (whole grains, refined grains, fruit, vegetables, nuts, or legumes) was inversely related to high blood pressure.

Pollen grains, especially of date palm, are subject of interest to many investigators in various fields of science for its high nutritional and medicinal value. Besides its content of steroidal hormones such as Oestrone hormone, it forms a complete food stuff consisting of high level of proteins, amino acids, carbohydrates, lipids, unsaturated fatty acids, minerals (Ca, Mn, K, Fe and Mg), vitamins (C, D, E and K,) and low level of nucleic acids. It's also characterized by its ability to be stored for long periods without noticeable changes in its components (**Hassan, 2011**). Date palm pollen grains contain relatively higher concentration of lysine which is too often the limiting amino acid in diets based on cereals. The high concentration of lysine in date palm pollen grains might be of great nutritional significance if these are included in cereal rich foods (**Hassan, 2011**). Pollen has been applied for centuries in traditional medicine, as well as in food diets and supplementary nutrition, due to its high nutrition

and physiological properties (Farag *et al.*, 2006). Al-Samarai *et al.*, 2016 conclude that the date palm pollen was as rich source of antioxidant, energy, and important minerals, so its suitability as a regular component in human diet. Abuowf, 2015 reported that date pollens had hepatoprotective effect against CCl₄ and this effect may be related to the antioxidant properties of date pollens.

AIM: The present study was therefore undertaken to develop a tasty dried soup mix which gives improved nutritional quality and long shelf-life, good physical, chemical and sensory properties. The soup is easy to prepare, especially for elderly people, and can prevent from some diseases as Alzheimer's disease, high blood pressure and inflammatory airway diseases.

Materials and Methods

Raw materials used for soup mix formulation were procured from the local market. The soup mix formulation was made according to Calbom and Keane, 2002, different ingredients are shown in table 1. The formulas AL and ALP were prepared for the prevention of Alzheimer's disease; PR and PRP were prepared for the prevention of Bronchitis. While HY and HYP were prepared for the prevention of Hypertension. Al, PR and HY were prepared for the comparison with samples with date pollen powder. The prepared product was finish-dried in a hot air drier to a moisture content of 8.5-13.5%.

Table 1: Formula of Dried Vegetarian Soup Mix

| | AL | ALP | PR | PRP | HY | HYP |
|--------------|------|------|------|------|------|------|
| Wheat | 50 | 50 | - | - | - | - |
| Cress | 100 | 100 | - | - | - | - |
| Parsley | 100 | 100 | - | - | - | - |
| Carrot | 100 | 100 | 100 | 100 | - | - |
| Broccoli | - | - | 100 | 100 | - | - |
| Sweet pepper | - | - | 100 | 100 | - | - |
| Red Cabbage | - | - | - | - | 100 | 100 |
| Tomato | - | - | - | - | 100 | 100 |
| Ginger | 10 | 10 | 10 | 10 | 10 | 10 |
| Celery | 100 | 100 | 100 | 100 | 100 | 100 |
| Potato | 100 | 100 | 100 | 100 | 100 | 100 |
| Garlic | - | - | 2.5 | 2.5 | 2.5 | 2.5 |
| Palm Pollen | - | 6.6 | - | 6.6 | - | 6.6 |
| Arabic Gum | 8.38 | 8.38 | 8.38 | 8.38 | 8.38 | 8.38 |

Rehydration Ratio (RR)

Rehydration ratio was performed according to **Krokida and Marinos-Kouris (2003)**. A given (2g) of the dried vegetarian soup mixtures were rehydrated in 20 ml distilled in a water bath at constant temperature, which was agitated at constant speed (100 rpm). The samples were taken from the bath after 10 minutes and were weighted after being blotted with tissue paper in order to remove the excess solution. Rehydration ratio was defined as the ratio of weight of rehydrated samples to the dry weight of the sample.

Proximate Analysis of the Dried Vegetarian Soup Mixtures

Moisture, protein, fat, crude fiber, ash, iron, zinc, calcium and magnesium contents of the dried vegetarian soup mixtures were determined according to the methods of **AOAC (2005)**.

Total Calories of the Dried Vegetarian Soup Mixtures

Total calories of the dried vegetarian soup mixtures were calculated by the formula of **James, 1995**.

Organoleptic Evaluation of the Resultant Soup Samples

The resultant soup samples were organoleptically evaluated after dissolving in hot water (10 g dried vegetarian soup mixtures/65 ml water) for its sensory characteristics, i.e., taste, flavor, color, thickness and appearance, dissolution rate and overall acceptability. The evaluation was carried out by ten panelists according to the method of **Wang et al., 2009**.

2.10. Statistical Analysis

The obtained data from chemical and rheological properties and sensory evaluation were exposed to analysis of variance. Duncan's multiple range tests at ($p \leq 0.05$) level was used to compare between means.

3. Results and Discussion

Date palm pollen contain 30.11% protein, 19.54% fat, 4.85% fiber and 5.06% ash. These results agree with work done by **Doweidar et al., 2011** and **Hassan, 2011**. Also, the data of mineral analysis indicated that date palm pollen have significantly high amounts of iron, zinc, calcium and magnesium which are important from the nutritional point. **Stanley and Linskens, 1974**

revealed that palm pollen grains constitute a rich source of mineral elements. Table 2 revealed that iron, zinc, calcium and magnesium (230.87, 283.03, 215.15 and 129.46 mg/100gm respectively) are in range of result by **Doweidar *et al.*, 2011** and **Hassan, 2011**.

Table -2- Chemical Analysis of Date Palm Pollen.

| | Value |
|----------------------|--------------|
| Moisture (%) | 28.80±0.10 |
| Protein (%) | 30.11±0.24 |
| Fat (%) | 19.54±0.05 |
| Ash (%) | 5.06±0.01 |
| Fiber | 4.85±0.20 |
| Carbohydrate (%) | 41.66±0.32 |
| Iron (mg/100gm) | 230.87±1.10 |
| Zinc (mg/100gm) | 283.03±1.25 |
| Calcium (mg/100gm) | 215.15±1.42 |
| Magnesium (mg/100gm) | 129.46±0.99 |
| Vit C (mg/100gm) | 89.09±0.70 |
| A (IU/100 g) | 7708.33±3.19 |
| E (IU/100 g) | 3030.92±2.35 |

Values are mean of ten replicates ± SD

According to **Hassan, 2011**; vitamin C or ascorbic acid occurs in relatively high levels in pine and palm pollens, which was indicated in our results (89.09 mg/100gm). Moreover date palm pollen have interesting physico-chemical characteristics according to **Kroyer and Hegedus, 2001** and **Doweidar *et al.*, 2011**

Chemical Composition of Dried Vegetable Soup

Table 3 shows the nutritional characteristics of the dried vegetarian soup mixtures on dry weight basis. As expected, supplementation with date pollen significantly increased fat and protein contents of the dried vegetarian soup mixtures. But, it significantly decreased total carbohydrates contents. And as a result, decreased the energy content. The results are in agreement with work by **Abd El-Magied *et al.*, 1987** who reported that supplementing potato snacks with date palm pollen increased the protein content and improved the biological value. Also, the supplementation resulted in an increase in fat, fiber and ash contents. These results agree with work by **Doweidar *et al.*, 2011**,

who reported an increase in the fat, fiber and ash contents with the increase in date palm pollen levels.

Table -3- Chemical Analysis of Dried Vegetable Soup Mix

| | Moisture | Protein | Fat | Carbohydrate | Fiber | Ash | Energy |
|------------|-------------------------|-------------------------|------------------------|-------------------------|-------------------------|------------------------|--------------------------|
| AL | 9.38±0.10 ^d | 14.31±0.15 ^b | 2.76±0.20 ^c | 67.22±0.15 ^b | 13.92±0.11 ^d | 6.82±0.20 | 375.81±0.10 ^a |
| ALP | 9.78±0.15 ^b | 15.41±0.13 ^a | 3.72±0.10 ^b | 65.67±0.12 ^c | 14.33±0.15 ^c | 7.35±0.15 ^d | 357.80±0.16 ^b |
| HY | 9.42±0.20 | 10.85±0.10 ^e | 2.54±0.12 ^c | 71.30±0.16 ^a | 12.07±0.12 | 7.12±0.13 | 351.46±0.15 ^c |
| HYP | 13.41±0.13 ^a | 12.68±0.16 ^d | 4.35±0.15 ^a | 63.81±0.10 ^d | 13.63±0.13 ^d | 7.89±0.12 ^b | 345.11±0.12 ^d |
| PR | 9.55±0.12 ^c | 12.08±0.11 ^d | 2.17±0.10 ^d | 70.55±0.20 ^a | 15.33±0.10 ^b | 8.21±0.16 ^a | 350.05±0.13 ^c |
| PRP | 13.46±0.17 ^a | 13.31±0.20 ^c | 3.62±0.16 ^b | 64.09±0.13 ^d | 17.04±0.17 ^a | 8.87±0.10 ^a | 342.18±0.20 ^d |

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

An un-adequate intake of certain minerals can produce diseases and lead to abnormal development. **Salgueiro et al. (2002)** stated that zinc, is essential for normal growth, development of the immune response and participating as a cofactor for more than 300 enzymes. While **Yip, R. (2001)** said that iron serves metabolic and enzymatic functions.

Data in Table 4 indicated that supplementation with date palm pollen significantly enhanced Fe content in the dried vegetarian soup mixtures. Where, HYP recorded the highest iron content (29.5 mg/100gm) and zinc (30.74 mg/100gm). In addition, supplementation with date palm pollen significantly enhanced calcium and magnesium contents with ALP having the highest values (243.08 and 165.83 mg/100 gm).

Table -4- Mineral Content of Dried Vegetable Soup Mix

| | Fe | Zn | Ca | Mg |
|------------|-------------------------|-------------------------|--------------------------|--------------------------|
| AL | 9.16±0.13 ^d | 3.01±0.21 ^d | 240.04±0.17 ^b | 164.72±0.10 ^b |
| ALP | 21.09±0.17 ^c | 17.14±0.10 ^c | 243.08±0.21 ^a | 165.83±0.15 ^a |
| HY | 5.54±0.21 ^e | 2.28±0.15 ^e | 199.19±0.12 ^d | 130.19±0.17 ^c |
| HYP | 29.50±0.10 ^a | 30.74±0.12 ^a | 202.13±0.13 ^c | 131.67±0.12 ^c |
| PR | 5.44±0.12 ^e | 2.32±0.13 ^e | 190.08±0.15 ^f | 127.25±0.21 ^d |
| PRP | 24.38±0.15 ^b | 24.82±0.17 ^b | 193.16±0.10 ^e | 128.07±0.13 ^d |

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

Data in Table 5 indicated that supplementation with date palm pollen significantly enhanced all vitamin content in the dried vegetarian soup mixtures. Where, PRP recorded the highest vitamin C content (238.63ppm) and vitamin A (37670.49 IU/100gm). In addition, supplementation with date palm pollen significantly enhanced vitamin E content and, as a result, the antioxidant activity with HYP having the highest values (311.39 AE/100 gm and 88.92%).

Table -5- Vitamin Content and Anti-oxidant Value of Dried Vegetable Soup Mix

| | Vit C (ppm) | Vit A (IU/100gm) | Vit E (AE/100gm) | Antioxidant Activity % |
|------------|--------------------------|----------------------------|---------------------------|---------------------------|
| AL | 118.15±0.31 ^f | 30496.06±1.51 ^d | 3.27±0.23 ^c | 26.06±0.03 ^f |
| ALP | 126.66±0.11 ^e | 31137.38±1.33 ^c | 156.622±0.51 ^c | 27.81±0.13 ^e |
| HY | 140.66±0.23 ^d | 1362.28±1.27 ^f | 1.65±0.09 ^f | 71.92±0.09 ^b |
| HYP | 150.23±0.33 ^c | 1981.06±1.41 ^e | 311.39±1.21 ^a | 88.92±0.12 ^a |
| PR | 220.30±0.25 ^b | 34262.32±1.32 ^b | 4.48±0.13 ^d | 59.63±0.07 ^d |
| PRP | 238.63±0.19 ^a | 37670.49±1.52 ^a | 249.45±1.11 ^b | 65.64±0.09 ^c |

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

Rehydration Ratio (RR)

The rehydration properties, rehydration rate, and rehydration capacity are important characteristics of many products, related to their later preparation for consumption (**Jokić et al., 2009**). The rehydration capacity was used as a quality characteristic of the dried product (**Velić et al., 2004**) expressed in the rehydration rate—RR (**Lewicki, 1998**). When the dried foods reconstituted, it must show acceptable textural, visual, and sensory characteristics, while the rehydration time is minimized (**Sanjuan et al., 1999** and **García-Pascual et al., 2006**).

Data in table 6 proved that supplementation with date palm pollen significantly affected the RR. Where, supplementation with date palm pollen significantly increased the RR (4.72 and 4.34 for HYP and ALP respectively). While, PR and PRP recorded the lowest RR (3.19 and 3.8 respectively). **Jokić et al., 2009**

mentioned that the products with a high rehydration capacity are tastier and retain their fresh appearance.

Table -6- Rehydration Ratio of Dried Vegetable Soup Mix

| | RR |
|------------|------------------------|
| AL | 3.51±0.31 ^e |
| ALP | 4.32±0.31 ^b |
| HY | 3.94±0.31 ^c |
| HYP | 4.72±0.31 ^a |
| PR | 2.97±0.31 ^f |
| PRP | 3.80±0.31 ^d |

Values are mean of ten replicates \pm SD, number in the same column followed by the same letter are not significantly different at 0.05 level.

Sensory Evaluation of Soup

Sensory evaluation is considered to be a valuable tool in solving problems involving food acceptability. It is useful in product improvement, quality maintenance and more important in a new product development (**Kramer and Twigg 1974, Singh-Ackbarali and Maharaj, 2014**). Dry soup should possess desired quality, representing the dominant flavor and aroma of the ingredients used. It is desirable that the product be free from off flavor, off taste, unacceptable aroma and faulty texture **Abeyasinghe and Illepruma (2006)**.

Sensory quality attributes of the resultant soup supplemented with date palm pollen are presented in table 7. Data in table 7 revealed that supplementation with date palm pollen significantly ($p \leq 0.05$) affects taste, color, flavor attributes and overall acceptability of the resultant soup samples. But, it had no significant effect on thickness and appearance as well as dissolution rate. HYP recorded the highest score of the quality attributes, in turn, the overall acceptability.

Table -7- Sensory Evaluation of Dried Vegetable Soup Mix

| | Taste (10) | Color (10) | Flavor (10) | Thickness and Appearance (10) | Dissolution Rate(10) | Overall Acceptability (50) |
|------------|---------------------------|--------------------------|---------------------------|-------------------------------|--------------------------|----------------------------|
| AL | 8.30 ± 1.16 ^{ab} | 9.40 ± 0.84 ^a | 8.70 ± 0.95 ^{ab} | 8.55 ± 1.01 ^a | 8.40 ± 1.17 ^a | 43.35 ± 3.97 ^{ab} |
| ALP | 9.10 ± 0.91 ^a | 9.45 ± 0.50 ^a | 9.10 ± 0.84 ^a | 9.25 ± 0.72 ^a | 9.05 ± 0.76 ^a | 45.85 ± 2.71 ^a |
| HY | 8.70 ± 1.16 ^{ab} | 9.80 ± 0.84 ^a | 8.95 ± 0.95 ^{ab} | 8.85 ± 1.01 ^a | 8.70 ± 1.17 ^a | 44.45 ± 3.97 ^{ab} |
| HYP | 9.40 ± 0.91 ^a | 9.65 ± 0.50 ^a | 9.30 ± 0.84 ^a | 9.65 ± 0.72 ^a | 9.35 ± 0.76 ^a | 46.95 ± 2.71 ^a |
| PR | 7.90 ± 1.44 ^b | 8.50 ± 0.97 ^b | 7.80 ± 1.16 ^b | 8.40 ± 0.99 ^a | 9.05 ± 1.01 ^a | 41.65 ± 3.05 ^b |
| PRP | 8.20 ± 1.32 ^{ab} | 8.45 ± 1.12 ^b | 8.30 ± 1.15 ^{ab} | 8.55 ± 1.30 ^a | 8.80 ± 0.95 ^a | 42.30 ± 4.78 ^b |

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

Conclusions

It could be concluded that the results of this study clearly demonstrated the usefulness of supplementing dried vegetarian soup mixture with date palm pollen as a valuable food addition to enhance nutritional characteristics quality of the resultant soup. Where, they're a reasonable source of protein, minerals, vitamins and antioxidant. The sensory quality of the soup samples was satisfactory sensory properties. The highest acceptability was the red cabbage-tomato formula supplemented by date palm pollen.

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