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Quality Analysis of Development Dried Vegetable Soup fortified with Purslane Leaves and Seeds powder

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Abstract

A purslane leaves and seeds powder enhanced vegetable soup was one of the aims of the research study. A conventional approach was used for the proximate analysis of purslane leaves and seeds powder. The energy of content in this study was 341.6–391.71 kcal/100 g, with moisture, ash, protein, fat, fiber, carbohydrate, and fiber content being 7.7% -8.34%, 13.75% 11.22%, 33.4% 24.54%, 6.32% 14.55%, 11.75% 9.04%, and 34.78% 40.65%, respectively. Highest content of Vitamin C, A, B total phenols, total antioxidants, and minerals (K, Ca, Mg, Cu and Mn) and lowest content of Fe, P and Zn were found in purslane seeds powder compared to purslane leaves powder. Purslane leaves and seeds powder significantly changed the physicochemical and sensory characteristics of soup samples. In the soup sample (10% purslane seeds powder), higher values for wettability, water solubility, and water activity were noted. 10% purslane leaves powder contained a high concentration of fiber, ash, and protein. All of the panellists approved of soup samples in all quantities

Keywords: Dried Vegetable Soup, Purslane powder, Antioxidant Activity, amino acids, Rheological properties.

Introduction

More people are utilizing herbal medicine in their daily lives, and the role of plants in traditional medicine has grown in recent years. Worldwide distribution may be seen for the vegetable and herb purslane *Portulaca oleracea* L **(Zhou *et al.* 2015)** According to **Hassan *et al.* (2014),** phenolic compounds, terpenoids, vitamins A, C, B1, B2, B3, B6, B9, and polyunsaturated fatty acids (PUFA) like omega-6 (linoleic acid; C18:2) and omega-3 (linolenic acid; C18:3) fatty acids are some of the beneficial compounds that give purslane its medicinal properties **(Azuka *et al.* 2014).** Phenolic compounds are a well-known group of secondary metabolites with a wide range of pharmacological activity, including anti-microbial, anti-carcinogenic **(Baâtour *et al.* 2012)** and anti-inflammatory effects, according to **(Ozcan *et al.* 2014).** The most significant classes of plant antioxidants, flavonoids, have anti-aging properties and lower cancer risk

Soups are considered to be a lightly processed, nutrient-rich food that is safe to eat. Since the creation of pots vessels, soups have been one of the oldest cuisines to be prepared and enjoyed. This covers dry mixes, instant soups, canned, refrigerated, frozen, dehydrated, and frozen foods. Soup sales are significantly influenced by convenience, nutrition quality and value, and organoleptic choice. Around the world, soups are extensively consumed and come in a variety of recipes and ingredients that vary by geography, culture, and the ingredients that are available, inspiring the creation of several creative recipes under various cuisines. Despite all these sources of variance, most soups share similar sensory characteristics and are primarily regarded as one of the most popular comfort foods **(Sugumar and Guha 2022)**.

This study focuses on vegetable soup that has been supplemented with powder made from purslane leaves and seeds. The created soup will be used for its nutritional and therapeutic benefits as a functional soup. The current study's objective is to recognize and comprehend the sensory characteristics of the developed soup in order to address quality loss throughout processing process and serve as a marker for quality degradation during the soup's shelf life (**Sugumar and Guha, 2020**).

Materials and methods

Materials

Purslane leaves (*Portulaca oleracea*)were obtained from the farm of Yousif Bader in Mahlet bisher, Shubrakhit at Beheira Governorate, Egypt, while purslane seeds were obtained from The Crops Research Institute, Agriculture Research Center, Giza, Egypt. In Egypt's Beheira Governorate's local market, Shubrakhit, we bought carrots and tomatoes. Cumin, paprika, chili, coriander, salt, onion and garlic were purchased from the local market, of Shubrakhit at Beheira Governorate, Egypt. All currently used chemicals were obtained from Republic Company of Tanta city at El Gharbia, Governorate, Egypt.

Methods

Preparation of purslane leaves

Purslane leaves have been cleaned, picked, damaged leaves removed, washed well with water and dried in a drying oven at 45^{oc} for three hours then milled in a laboratory hammer mill (Brabender–made in Germany) until they could pass through a 125 µm mesh. **(Yeh, 2004).**

Preparation of purslane seed

Purslane seeds have been cleaned, picked, damaged seeds removed then milled in a laboratory hammer mill (Brabender–made in Germany) until they could pass through a 125 µm mesh. **(Yeh, 2004).**

Preparation of dried vegetable soup

Tomatoes processing included washing, slicing, drying at 40 °C for 23 hours, and grinding. The carrots were washed, divided into small pieces, and blanched for two to three minutes in hot water. Pieces of boiled carrots were immediately chilled in cold water (16 oc), allowed to drain for a short while, dried at 50 oc for 23 hours, and then ground in a blender (tornado) until they could pass through a 125 m mesh. According to **Sivasanker (2007).**

Onion and garlic were cleaned, cut into slices, dried at 40 °c for 18 hr, then milled in a blender (tornado) until they could pass through a 125 µm mesh. The basic formula of dried vegetables soup mixture was presented in Table (1). As described by **Abeysinghe and Illeperuma (2006).**

Table 1. Control formula of dried vegetable soup mixture.

Ingredient	Weight (g / 100g)
Corn flour	20
Carrots	30
Tomatoes	30
Onions	4
Garlic	4
Capsicum	1
Coriander	2
Cumin	2
Paprika	3
Salt	4
Total	**100**

Proximate chemical composition

By drying the sample at 105°C in an air oven, moisture was measured. The total nitrogen was determined using the Micro-Kjeldahl technique to determine crude protein. Petroleum ether was used as the solvent in a Soxhlet apparatus to quantify the ether extract. By ashing in an electric muffle at 550°C until constant weight, the ash concentration was determined. Defatted material was digested with 1.25% H_2SO_4 flowing by 1.25% NaOH to identify crude fibers according to the method in **A.O.A.C (2010).** The equation used to calculate accessible carbohydrates is available carbohydrates = total carbohydrates–crude fiber. The caloric value was calculated as follows: caloric value (k Cal/100 g) =(carbohydrates×4) +(protein×4) +(fat×9). Using a pye Unicom SP 19,000 atomic absorption spectroscopy device, the amounts of the minerals calcium (Ca), sodium (Na), magnesium (Mg), iron (Fe), and zinc (Zn) were as described in **A.O.A.C. (2010).**

Determination of vitamins

Vitamin E

Quaife and Harris (1948) utilized calorimetry to measure Vitamin E, whereas **Batifoulier *et al.* (2005)** used HPLC to separate and quantify thiamine, folic acid, Pyridoxine, nicotinic acid, riboflavin, and B12 using a new reversed-phase chromatographic approach.

Vitamin C

Iodometry method was used according to **(Borquaye, *et al*., 2017)**

Amino acids

As previously mentioned, the SYKAM S433 Amino Acids Analyzer was used for amino acid extraction **(Knezevic *et al*., 2009).** The integrator's regions of standards were used to compute the amino acids composition, which was then expressed as a percentage.

Phytochemical analysis of purslane leaves and seeds

Determination of antioxidant activity

Antioxidant activity of the studied samples were determined as described in **Chen *et al*., (2008).**

Determination of total phenols

The Folin-Denis reagent was used to determine total phenols of the studied samples according to **Swain and Hillis (1959),**

Soup mixtures properties.

Rehydration ratio (RR) and bulk density (mass/volume) were determined by methods described in **Chitomarat (2002)** and **Krokida and Marinos-Kouris (2003),** respectively. According to prior research **(Malomo *et al*., 2013),** the weight of the crucible after drying was subtracted from the weight of the crucible while it was empty, multiplied by 100, and the result was used to calculate the water solubility index. The dispersibility was calculated as follows: % dispersibility = 100–the volume of the settled particle (**Malomo *et al*., 2013**). A glass funnel was positioned 10 cm above a beaker that contained 100 ml of distilled water at 25 °C in order to measure the wettability of the four samples. A tube was used to seal the funnel's small aperture, and a 1 g sample of powder was placed near to the tube. The stopwatch was started at the same time as the tube was raised. Finally, the amount of time it took for the powder to fully saturate was recorded. Using a Rotronic, water activity was measured (Hygrolab3, Switzerland). The plastic cups were filled to the brim with the ground sample (vegetable soup), and the Hygroplam probe was then inserted inside of them. The temperature and water activity reading were displayed on the display after roughly three to four minutes (**Piga *et al*.,2005**). Using a pH meter and 10 grams of soup powder, 100 milliliters of distilled water, and 30 seconds at room temperature, the pH value was calculated (JENCO 608, USA).

Rheological properties of instant dehydrated soup samples

Viscometer was used to test the rheological characteristics (viscosity and shear rate) of dried soup samples (Viscotech Myr VR 3000). 10% of the soup mix was mixed with boiling water to create the slurry. Spindle no. 2 was chosen for the measurement, the slurry was placed in a tiny sample beaker, and the desired temperature was maintained using an embedded temperature sensor. The viscometer was run at speeds ranging from 10 to 60 rpm. Data on viscosity and shear rate were immediately taken from the instrument. The resulting soup samples underwent rheological analysis, and the viscometer's temperature was maintained at room temperature (25 °C 1 °C).

Sensory evaluations of dried vegetable soup

Ten members of the Food Science and Technology Department, Faculty of Home Economics, Al-Azher University, Tanta, tested samples of dried vegetable soup. As stated below, **Wang *et al*. (2009)** methodology:

150 ml of slightly hot water was combined with 12 grams of dry soup mix, and the mixture was steadily swirled until it reached a boil. Equal portions of soup, together with an evaluation form, were presented to the panelists after 5 minutes of boiling. Six components of acceptability were evaluated for soup samples: taste (10), texture (10), odor (10), general appearance (10), color (10), and total acceptability (50).

Statistical analysis

The findings were statistically evaluated using SPSS's analysis of variances **(Coakes,1997).** Duncan's multiple range tests were used to examine differences between individual means that were statistically significant (Duncan**,1995**).

Results and discussions

Chemical Composition of Purslane leaves and seeds powder

Data in Table (2) showed that purslane leaves powder had high contents in protein (33.4%), ash (13.75%) and fiber (11.75%). The findings of **Petropoulos *et al*., 2020**, who stated that the amounts of protein, ash, and fiber were 27.58, 18.2, and 15.0%, respectively, concurred with these findings. While purslane seeds powder contains low levels of protein, ash and fiber. Purslane seeds powder contains high levels of fat (14.55%). At the same Table, purslane leaves and seeds powder contained high levels of total carbohydrate, 34.78 and 40.65 %, respectively. These findings are somewhat consistent with those of (**Ahmed *et al*, 2014 and Petropoulos, *et al*., 2020**), who discovered that the carbohydrate content of purslane leaves and seeds powder, respectively, was 36.94 and 53.43% (mg/g dry weight).

It is apparent that purslane leaves powder, is a good source of iron (2.22 mg/100g), phosphors (44.52 mg/100g) and zinc (3.95 mg/100g). Similar results are found by **Chugh *et al*. (2019**) who reported that purslane leaves powder had 1.99 mg/100g of iron and 44mg/100 of pb.

From the same Table, it could be seen that purslane seeds powder had high content of K, Ca and Mg where, were 521.50, 76.76 and 70.45 mg/100g compared to purslane leaves powder where, were 492.44, 65.75 and 65.82 mg/100g, respectively. These findings agree with those of **Azuka *et al.***

Table 2: Chemical composition (on dry weight bases) of purslane leaves and seeds powder.

Macronutrients (%)	Samples	
	Purslane Leaves powder	Purslane Seeds powder
Moisture	7.70	8.34
Protein	33.40	24.54
Fat	6.32	14.55
Ash	13.75	11.22
Fiber	11.75	9.04
Carbohydrate	34.78	40.65
Energy	341.60	391.71
Micronutrients (mg/100g)		
Fe	2.22	0.10
K	492.44	521.50
Ca	65.75	76.76
Mg	65.82	70.45
Cu	0.63	0.28
Mn	0.324	0.124
P	44.52	37.90
Zn	3.95	3.21
Total phenols (mg GAE*/100g)	8.66	12.08
Total antioxidants	1.81	3.46

(2014) who found that purslane leaf powder contained 494, 65, and 68 mg/100g of potassium, calcium, and magnesium, respectively. Due to their physiological effects on the human body, these minerals are essential. For example, calcium and phosphorus are needed for healthy bones, while iron is necessary for healthy blood and muscles. The information reveals a wide range in the concentration of specific minerals in purslane powder and, subsequently, in the physiological advantages it offers **(Badawy *et al.*, 2018)**. In comparison to purslane seeds powder (8.66 mg/100g), purslane seeds powder has a high phenols content (12.08 mg/100g). The outcomes are consistent with those of **Oliveira *et al.* (2009)** who discovered that there were significant differences in the total phenolic content of purslane stems and leaves among samples, ranging from 7.83 to 63.39 mg/g dry weight.

Purslane seeds powder also has a high level of total antioxidants (3.46). The current findings are less significant than those made by **Odhav *et al.* (2007),** who claimed that fresh leaves have an RSA of 95%. The variability may be brought on by the collection period and environmental factors. According to earlier studies, plants' levels of active chemicals rose when sunlight and temperature rose **(Lim and Quah, 2007).**

Vitamins content (mg/100gm) of purslane leaves and seeds powder.

One of the best sources of Vitamin A among green leafy vegetables is purslane **(Alam *et al.*, 2014).** Purslane seeds powder (1315 IU/100 g, 44% RDA): This result differs from that reported by **Chugh *et al.*, 2019**.

Vitamin A, a recognized natural antioxidant with powerful anti-inflammatory properties, is important for healthy mucous membranes, eyesight, and the prevention of lung and oral cavity cancers. It is also vital to maintain the health of the mucosa and skin. It has been demonstrated that natural foods like Vitamin A-rich fruits and vegetables can help prevent lung and oral cancer. **Chugh *et al.*, 2019,**

Purslane also includes Vitamin B (B1, B2, Niacin, B6, Folic Acid), which is necessary for healthy growth, for the heart, neurological system, eyes, and for the production of co-enzymes for cellular respiration (**Michael,2008**). Purslane seeds powder content of folic acid (12.5µg) was higher than purslane leaves powder (10.9 µg). These results are similar to the results of **Azuka *et al.*, 2014** who reported that

Table 3. Vitamins content of purslane leaves and seeds powder on dry weight basis.

Vitamins	Samples	
	(Purslane)leaves powder	(Purslane) seeds powder
Vitamin A (IU)	1298	1315
Thiamine (B1) mg/100g	0.039	0.049
Riboflavin (B2) mg/100g	0.10	0.116
Niacin mg/100g	0.52	0.45
Pyridoxine (B6) mg/100g	0.069	0.071
Folate (B9) µg/100g	10.90	12.50
Vitamin C mg/100g	19.00	22.4 0

purslane leaves powder content of folic acid was (12.00 µg).

Vitamin C helped in the health of lungs and bronchia, teeth and gums, bones and joints, and purifies the blood. Purslane seeds powder had high content of Vitamin C (22.4 mg) while, purslane leaves powder contained (19.00 mg). These results in agreement with **(Azuka *et al*., 2014 and Chugh *et al*., 2019)**.

Amino acids content (mg/100gm) of purslane leaves and seeds powder

Amino acid content is a crucial determinant of the nutritional value of meals. By comparing their respective amino acid contents, purslane leaves and seeds powder's estimated protein quality can be found (**Chen *et al.,* 1986**). Based on the retention period of the standard mixture, sixteen free amino acids were found in rice samples in the current study (Table 4. All of the rice samples examined contained nine of these necessary amino acids (except for tryptophan). The following amino acids among them: tyrosine, phenylalanine, histidine, thereonine, valine, methionine, lysine, isoleucine, leucine, and valine. Except for isoleusine and histidine, the powdered seeds of purslane provide a rich source of all the essential amino acids. Additionally, the powdered purslane seed has high levels of all optional amino acids.

Physical Properties of dry vegetables soup fortified with different levels of purslane leaves and seeds powder

Physical Properties (bulk density, rehydration, dispersibility, wettability, water solubility index, Water activity and pH) of dry vegetables soup are presented in (Table 5). We did not see a significant difference in bulk density across all samples, despite the fact that particle size and the initial moisture content of the flour are the key factors affecting bulk density with larger bulk density when particles are smaller. The dispersibility of the soups that had been fortified was much lower than that of the control soup sample, indicating that the purslane leaves and seeds powder soups would not reconstitute as well in water (**Ibidapo *et al*., 2016)** Inversely related to time, wettability defines a material's capacity to absorb water. The dry soup enhanced with 10% purslane seeds powder had the longest wetting time (2.83 s), while the control sample had the shortest time (1.99 s). In comparison to the control soup, the water solubility index of the vegetable soups fortified with various concentrations of purslane leaves and seeds powder significantly increased, reaching its highest value in the 10% soup fortified with purslane seeds powder.

The water activity (a_w) values of the soup were not considerably altered by the purslane leaves and seeds powder. Because, that all values of a_w were in the range (0.47-0.48) of the ranges (0.47-0.48) fell below the level necessary for microbial growth (>0.9), they were all encouraging. (**Fellows, 2000**). The control soup had a pH value was noticeably higher than those of the other soups. These results are same line with those of **Monteiro *et al*. (2014),** who found a negative correlation between value and the

Table 4. Amino acids composition of purslane leaves and seeds powder (g/100g protein).

Amino acids	(Purslane) leaves powder	(Purslane) seeds powder
Essential Amino Acids (EAA)		
Threonine	0.45	0.59
Valine	0.75	0.81
Methionine	0.30	0.43
Isoleucine	0.65	0.59
Leucine	1.32	1.50
Phenylalanine	0.92	1.22
Tyrosine	0.41	0.65
Lysine	0.69	0.91
Histidine	0.52	0.39
Total EAA	6.01	7.09
non-Essential Amino Acids (NEAA)		
Asparagine	1.12	1.53
Serine	0.53	0.60
Glutamine	1.50	2.30
Proline	0.49	0.62
Glycine	0.52	0.69
Alanine	0.89	1.13
Arginine	0.72	0.81
Total NEAA	5.77	7.68
Total AA	11.78	14.77

water solubility index and explained it by the influence of temperature and water content.

Viscosity of the instant dry vegetables soup fortified with different levels of purslane leaves and seeds powder

The viscosity of the resultant soup samples at different shear rates are found in Fig.1. All soups of the studied samples viscosity decreased as the shear rate increased (Fig.2). This suggests that the viscosity pattern in these soups is distinct and is probably identifiable within the non-Newtonian pseudo plastic flow behavior. The 10% Dried vegetables soup fortified with purslane seeds recorded the highest viscosity pattern (498 -893 mPas) as compared to the prepared soups by 10% purslane seeds (347–822 mPas), 10% purslane leaves (235–660 mPas) Purslane leaves and seeds powder, 5% purslane leaves (220–635 mPas) and the control soup (201–628 mPas). The high viscosity of 10% purslane seeds added to dried vegetable soup may be a result of the higher concentration and usefulness of Purslane leaves and seeds. These results are in line with those of **Hanan *et al.* (2020),** who noted a comparable rise in soup pea pod viscosity, with the peak viscosity of the control soups being 219.7 mPas. The soup samples made with powdered purslane leaves and seeds were thicker. This increased viscosity may be as a result of molecular interactions and solubility in water, which may also be explained by the soup powders' inability to rehydrate and form crosslinks due to the high fiber concentration, which creates competition for water absorption.

Chemical composition (%) of dry vegetables soup fortified with different levels of purslane leaves and seeds powder on dry weight

The nutritional compositions of dry vegetables soup fortified with different levels of purslane leaves and seeds powder were presented in Table 6. The highest moisture of soup sample was found in **S_4** (10% purslane seeds powder) (10.09), followed by **S_2** (10% purslane leaves powder) (9.89). while **S_0** (10% corn flour) had low moisture content (9.18). In the same Table ash content of **S_2** soup was higher than other soup samples, it was 10.98% followed by **S_1** (5% corn flour + 5% purslane leaves powder) soup sample 10.09%. On the contrary, **S_0** (10% corn flour) soup sample recorded the lowest ash content (6.83).

The data in the Table 6 indicated that, **S_4** sample of dry vegetables soup had the highest fat content (8.22 %) on (DWB). Likewise, dry vegetables soup sample **S_2**

Table 5. Physical Properties of dry vegetables soup fortified with different levels of purslane leaves and seeds powder.

Attribute	Sample				
	S0	S1	S2	S3	S4
Bulk density (g/ml)	0.48	0.49	0.50	0.50	0.52
Rehydration%	6.50a	6.41b	6.36c	6.47b	6.38c
Dispersibility	76.20a	75.91b	75.87c	75.99b	75.90b
Wettability (sec	1.99e	2.43d	2.79b	2.52c	2.83a
Water solubility index	53.30e	55.69d	58.56b	57.54c	59.99a
Water activity	0.48a	0.47a	0.48a	0.48a	0.47a
PH	5.91a	5.66b	5.34d	5.51c	5.29e

recorded lowest fat content (5.29 %). The results may be due to the differences in fat content in both of purslane leaves and purslane seeds powder. From the same Table, it could be noticed that $\mathbf{S_2}$ dry vegetables soup sample had the highest fiber and ash contents (9.14% and 10.98 %) followed by S_4 dry vegetables soup sample (8.47% and 10.10 %), respectively. The increase of fiber content in samples may be due to the increase of fiber content with an increase added proportion from purslane leaves powder of soup sample

There were significant differences (P 0.05) between all samples tested with respect to the protein of the soup sample. S_2 and S_3 soup samples had the highest protein content, it was 18.18%, followed by 15.61% of the S_1 soup sample. On the other hand, S_0 soup recorded the lowest value (10.20%) of protein content, the protein content was 10.20%. The highest protein content of the S_2 sample could be due to the higher protein content of the purslane leaves.

From the above results it could be noticed that S_2 soup sample had highest protein, moisture, fiber and ash content, while $\mathbf{S_0}$ soup sample had highest carbohydrate and energy content.

Sensory evaluation of dry vegetables soup fortified with different levels of purslane leaves and seeds

Results of sensory evaluation of soup samples are shown in Table 7. The sensory evaluation included color, texture, test, odor, appearance and overall acceptability. The highest score of color (8.7) was found to be in $\mathbf{S_0}$ (10% corn flour) soup sample. Color score was decreased by adding purslane leaves and seeds powder. The results from Table 818) indicated that, there were significant differences ($P \leq 0.05$) in texture score between all samples. The highest value of texture was recorded in $\mathbf{S_0}$. Such results indicated that, there were significant differences between all soup samples in taste. Mean score of $\mathbf{S_0}$ and $\mathbf{S_1}$ (5% corn flour + 5% purslane leaves powder) soup sample had the highest score in taste while, $\mathbf{S_3}$ (5% corn flour + 5% purslane seeds powder) soup sample had lowest value

The data in the (Table 7) indicated that, $\mathbf{S_0}$ dry vegetables soup sample had the highest value of appearance (8.8 %). Likewise, dry vegetables soup sample $\mathbf{S_4}$ (10% purslane seeds) recorded lowest value of appearance (6.4%). Taste, odor, appearance, color, thickness, and acceptability of the studied soup samples' were significantly decreased when 10% purslane seeds powder was added compared to the control sample (Table 7).

Among the three fortified soups, purslane seeds powder (5%) received the highest rating for qualitative properties and was deemed to be the most palatable. Similar to results are obtained by **Hanan *et al.* (2020) who** found that the sensory score of soup reduced when pea peel powder was added above 12.5% in the formulation.

Conclusions

According to biochemical and sensory evaluation, the newly developed vegetable soup powder enriched with purslane leaves and seeds powder performs better than any other locally accessible soup powders (S1, S2, S3, and S4). The recently created vegetable soup powder fortified with purslane leaves and seeds powder is a suitable choice for meeting the nation's nutritional needs because it is particularly high in protein, ash, fiber, Vitamin B, Vitamin C, sodium, potassium, manganese, zinc, and iron while being low in carbohydrate and energy value. This might significantly contribute to reducing the country's protein energy deficiency.

Conflicts of Interest/ Competing interest

The authors declare that they have no competing interests.

Table 6. Chemical composition (%) of dry vegetables fortified with different levels of purslane leaves and seeds powder on dry weight.

Samples	Components %						
	Moisture	Protein	Fat	Ash	Fiber	Carbohydrate	Energy
S0	9.18c	10.20e	5.41c	6.82d	5.48e	72.09a	377.85a
S1	9.63b	15.61b	5.52c	10.09b	7.83c	60.95c	355.92d
S2	9.89a	18.18a	5.29d	10.98a	9.14a	56.41e	345.97e
S3	9.72ab	12.46d	7.65b	9.00c	7.49d	63.40b	372.29b
S4	10.09a	14.65c	8.22a	10.10b	8.47b	58.56d	366.82c

Table 7. Sensory evaluation of dry vegetables soup fortified with different levels of purslane leaves and seeds powder.

Samples	Sensory attributes					
	Color	Texture	Taste	Odor	Appearance	Overall acceptability
S0	8.7a	8.8a	8.8a	8.5a	8.8a	43.4a
S1	6.6b	6.8b	6.5b	6.5b	6.9b	33.3b
S2	6.7b	5.9b	5.7b	6.2b	6.5b	30.6b
S3	7.5ab	7.0b	5.3b	6.7ab	7.2b	34.6b
S4	6.2b	5.9b	5.5b	5.8b	6.4b	29.8b

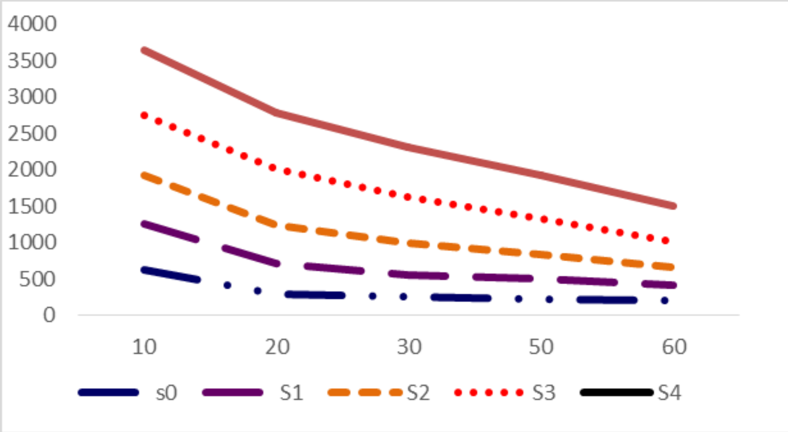

Figure 1. Viscosity of the resultant soup samples at different shear rates.

Abbreviations
GAE= Gallic Acid Equivalent
(EAA) = Essential Amino Acids
NEAA = Non-Essential Amino Acids
S_0 control (10% corn flour)
S_1 (5% corn flour + 5% purslane leaves powder)
S_2 (10% purslane leaves powder)
S_3 (5% corn flour + 5% purslane seeds powder)
S_4 (10% purslane seeds powder).
(a_w) = water activity

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