Assessment Quality of Instant Vegetables Soup Fortified with Artichoke Powder

A. M. EL-Ghareep [1,*], M. A. Othman [1], H. M. Fahmy [2], and S. A. Mahmoud [2]

[1] *Food Science and Technology Department, Faculty of Agriculture, Al-Azhar University, Cairo, Egypt.*
[2] *National organization for Drug Control and Research, Giza, Egypt.*

*Corresponding author E-mail: Adel magdey26@gmail.com (A. EL-Ghareep)

ABSTRACT:

This study aimed to maximize the benefit from one of plants which is not optimally utilized although it's many health benefits, artichoke, by fortified one of easy product. Therefore, artichoke powder (AP) was prepared and added to instant vegetables soup at different levels (10, 20 and 30gm) and sensory, physical, chemical chractrestics, minerals, antioxidants and amino acides content were determined in all treatments. The results of chemical composition showed an increase in values of the important nutrients, when compared control sample with sample included the highest level of addition (30gm), protein, fat, fiber and ash were increased from (12.55, 1.55, 4.81 and 4.03) to (13.90, 1.92, 9.04 and 4.80%) respectively. Also, Ca, Mg, P, Cu and Zn were increased from (180, 210.20, 136.60, 0.16 and 0.89) to (237.08, 212.54, 191.22, 0.39 and 1.52 mg/100g) respectively. Likewise, total phenols, flavonoids, carotenoids were increased from (136.73, 27.45 and 12.86) to (621.54, 124.29 and 56.51 mg/100g) and consequently scavenging activity was increased from 8.53 to 23.95% respectively. Also and markedly, levels of all studied essential amino acids, Cystin and Glycine were increased. With regard to physical properties, values of pH, Rehydration ratio, Total soluble solids and viscosity were increased while the three indicators of color were decreased. As well, the results appeared that sample with 30gm of AP have highest score of most tested organoleptic parameters. And so, it can be concluded that additoin of artichoke powder caused a noticeable amelioration in sensory, physical characteristics and all nutritional parameters of instant vegetables soup.

Keywords: instant soup; vegetables; artichoke powder; formulas.

INTRODUCTION

Artichoke (*Cynara scolymus*) is an perennial herbaceous crop belonging to the Asteraceae family and native to North Africa, the Canary Islands and southern Europe, and widely cultivated in the Mediterranean area, the countries of this zone being the main world producers (Souhila and Nacéra 2022). Chemical components of artichoke (*Cynara scolymus*) have been studied extensively, and proven that it is an excellent source of active compounds such as Chlorogenic acid, Cryptochlorogenic acid, Caffeoylquinic acid, Luteolin and Apigenin that act as reducing agents and proven its ability to thus inhibit free radicals (Akbari *et al*., 2022). Also, artichoke (*Cynara scolymus*) rich in vitamins, Macro and micro minerals such as Na, K, Ca, Mg, P, Fe, Zn, Cu, Mn, Cr and Se (Albayrak *et al*., 2022). However, there are obstacles that prevent the use it in their natural form, as the degree of their popularity and availability varies according to customs and traditions, in addition to that suffer from seasonality and an undesirable taste, Moreover a large amount of it is required to be consumed to reach the desired effect, these factors were a stumbling block in the way of the ideal use of this unique plant and created an urgent need to benefit from it by adding it to other foods (Kidane and Kejela, 2021).

Nowadays, with the increasing pace of life, many people have relied on instant foods, and instant vegetable soup is one of the most famous and common instant foods, instant soups are pre-cooked and dried foods prepared in the powder form that are rehydrated and presented in liquid form when used, and characterized by availability throughout the year, exert light weight for shipping, possibility of obtaining them from the market spread in all countries, storage does not require additional energy to preserve them and have a long shelf life (Sinchaipanit *et al.,* 2023). In addition to, instant soups is ease and speed to prepare (4-6 min) which means are ready for reconstitution in a short time for working families, hotels, hospitals, restaurants and institutional use as well as to military rations and can enjoy healthy and delicious soup in just a few minutes (Rasitha and Sharma, 2023). Morever, instant soups is very popular and suitable for a large number of

consumer tastes and suitable for all age groups which make it the perfect choice to be exploited for delivering bioactive compounds to improve human health (Gomathi and Parameshwari, 2023). Indirectly, Instant vegetables soups played an important role in preserving health by providing a healthy alternative to harmful fast foods such as hamburger, instant noodles with Soda, which contains a lot of salt, fat and sugar (Lolge *et al.*, 2022). Directly, consumption vegetable soup in moderation is beneficial to our health, because and the body absorbs it more easily and also reduces hunger and increases the feeling of satiety and thus it is inversely proportional to risks of obesity and diseases resulting from it (Chen *et al.*, 2021). Therefore, the aim of this study was to combine the many advantages of instant vegetable soup and artichoke and producing new formulas of instant vegetable soup with monitoring and evaluating the sensory, physical and nutritional qualities of the developed instant vegetable soup formulas.

MATERIALS AND METHODS

Materials

Fresh vegetables (potato, carrot, peas and tomato), wheat flour (72% extraction) and spices (dried onion, dried garlic, sodium chloride, Cumin and black paper) were obtained from local market in Alexandria, Egypt. Artichoke (*Cynara Scolymus*) of the french variety were obtained from the Department of Vegetables Research, Horticultural Research Institute, Agricultural Research Center, Alexandria, Egypt. All solvents, chemicals and reagents used in this study were analytical grade and were provided from Omega Lab co., Egypt.

Methods

Preparation of vegetables Powder

Fresh Potato, carrot and tomato were prepared and washed with tap water then cut into slices 2 mm thick, the pea pods also were removed to get the inner grain and all vegetables (potato, carrot, peas and tomato) were cooked under steam until soft, after drying in an air oven at 55-60 ˚C for 10-12 hr, the dried flakes and pea grains were ground in a grinder (Moulinex Genuine Lm242 Blender, Mayenne, France) to particles passing through a 20-mesh sieve then potato, carrot, peas and tomato powders were packaged by polyethylene packages and stored in freezer at -18 ˚C until further treatments and analyses.

Preparation of Artichoke Powder

Artichoke were washed with tap water then cut into small slices, after drying in under vacuum dryer at 40±2 ˚C for 5-6 hours, dried artichoke was finely ground separately in a grinder in a grinder (Moulinex Genuine Lm242 Blender, Mayenne, France) into particles passing through a 20-mesh sieve then artichoke powder were packaged by polyethylene packages and stored in freezer at -18 ˚C until further treatments and analyses.

Preparation of tested instant vegetables soups treatments:

Four samples of instant vegetable soup were prepared, a control sample, three samples of instant vegetable soup with addition of artichoke powder at levels 10, 20 and 30gm:100gm basal mixture, the formulas are shown in Table (1).

Determination of Physical properties

The pH value of fresh and dried samples was determined as described in AOAC (2012) by using a Jenway 3505 pH Meter (UK) with a combined pH electrode at 25 ˚C. Rehydration ratio was performed according to Krokida and Marinos-Kouris (2003). Total soluble solids were carried out according to the method described by AOAC (2012) using a refractometer, Carl Ziess, Jena (Germany). Viscosity was measured according to Brookfield Manual (1998) by using Brookfield Engineering labs DV-III Ultra Rheometer. Color values were determined according to Yam and Papadakis (2004) by a Konica Minolta Colorimeter (CR-300; Minolta, Osaka, Japan).

Determination of chemical composition

Moisture, Ash, protein, fat, available carbohydrates and fibers was determined according to AOAC (2012) while energy was calculated according to Paul and Southgate (1979).

Determination of minerals content

Minerals content were determined according to AOAC (2003) by atomic absorption spectrometry.

Determination of Natural antioxidant parameters

The measurement of total phenols content of samples was conducted according to the modified Folin-Ciocalteu colorimetric method (Singleton *et al.*, 1999). Total flavonoids were analyzed according to Toor and Savage (2006). Total carotenoid was determined according to Asker and Treptow (1993), while the antioxidant activity of samples was measured according to Baliyan *et al.* (2022) using the DPPH technique with some modifications.

Amino acids profile

The amino acids profile was determined as described by Cosmos and Simon-Sarkadi (2002) using automatic amino acid analyzer (model :AAA 400).

Sensory evaluation

25 gm of powdered instant vegetables soup was dissolved in 250 mL of water then exposed to medium heat for 4-6 minutes, The instant vegetables soup samples were subjected to a sensory test according to the methode descripted by Semwal *et al.* (2001), the sensory panel was composed of 6 men and 4 women ranging in age from 22 to 60 and who were volunteer participants from the staff of the Food Science and Technology Dep., Faculty of Agriculture in cairo, Al-Azhar University, the order of samples was randomized and panelists used a hedonic test 10-point scale to evaluate the organoleptic properties (color, taste, odor, flavor, texture, appearance and overall acceptability) Where 1 indicates not accepting and 10 indicates extreme accepting.

Statistical analysis

Data obtained in this study were subjected to the statistical analysis according to Analysis of Variance (ANOVA) and Duncan's multiple range test (DMRT) of completely randomized design as described by Gomez and Gomez, (1984) Treatment means were compared using the Least Significant Differences (LSD) at 0.05 levels of probability and Standard Error. Computations and statistical analysis of data were done using the facilities of computer and statistical analysis system by using SPSS (version 20.0 software Inc. Chicago, USA).

RESULTS AND DISCUSSION

Physical properties of instant vegetables soups formulated with artichoke powder

Physical criteria (pH, Rehydration ratio, Total soluble solids, viscosity and color) were measured and the obtained data were presented in Table (2).

As shown in Table (2), statistical analysis of the data showed a non-significant difference ($p \leq 0.05$) between all pH values of investigated samples, as it was a slight increase with the gradual increase of addition level (10, 20 and 30gm) of AP from 6.24 at control sample then increased to 6.32, 6.33 and 6.47 at addition levels 10, 20 and 30 gm respectively, a similar result was observed by Oluwafemi and Adesina (2020), and this may be due to that pH value of AP was higher than value of control sample.

In the same vein but at a higher pace, rehydration ratio and total soluble solids were revealed a significant increase ($p \leq 0.05$), where samples with 10, 20 and 30 gm of AP were recorded (3.56, 3.84 and 4.18) and (17.96, 18.41 and 20.78%), while the control sample was recorded (3.12) and (15.78%) for rehydration ratio and total soluble solids respectively, the results of RR were in line with the results obtained by Dadali (2023) while results of TSS were consistent with Rathore (2021), this increase because of AP had higher values of rehydration ratio and total soluble solids compared to the control sample, in this context, Hanan *et al.* (2020) and Abdel-Haleem and Omran (2014) attributed the increase in the RR to a higher fiber content and a lower moisture content, actually from Table 3 it is noted that the percentages of fiber and moisture for the artichoke powder (AP) were 16.81 and 5.32% while for control sample were 4.81 and 6.26% respectively. Also, viscosity showed the same behavior and recorded 54, 59 and 66 (cP) at addition levels 10, 20 and 30 gm respectively while control sample was recorded 51 (cP), this behavior was similar to what Hanan *et al.* (2020) found in a similar study, as who noticed a positive relationship between the viscosity value and the level of adding pea pods powder to instant vegetable soup, but the relationship was non-linear, and they explained this by increasing the content of soluble fibers and the occurrence of molecular interactions which can give the sample lubricating properties, then the viscosity collapsed as a result of the excessive concentration of fibers and competition for water absorption and thus the inability of the powders to form crosslinks.

With regard to color, a different trend was observed as L, a and b were revealed decrease, where samples with levels 10, 20 and 30 gm of AP were recorded (44.19, 43.80 and 42.65), (0.77, 0.75 and 0.71) and (13.71, 13.39 and 13.15) while the control sample was recorded 44.77, 0.80 and 13.91 for L*, a* and b* respectively. This decrease in color values because of that AP had lower values of these criteria compared to the control sample, and these results were agreed with the results of the study conducted by Ansari *et al.* (2020) and they indicated that food color is the first measure of quality that is evaluated by consumers, Dadali (2023) also reached the same result in a study was conducted to develop cereal soup and attributed the decrease in indicators to the potential green color of the artichoke bracts used in the development.

Chemical composition of instant vegetables soups farmulated artichoke powder

Chemical composition and energy of instant vegetable soup fortified by adding different levels (10, 20 and 30 gm) of artichoke powder was estimated, and the results were described in Table (3).

From Table (3), It could be noticed that addition of different levels (10, 20 and 30 gm) from AP caused remarkable changes in the main constituents of instant vegetable soup, as The values of protein, fat, fiber and ash were showed a gradual increased from (12.55, 1.55, 4.81 and 4.03%) at control sample to (12.94, 13.40 and 13.90%) for protein, (1.65, 1.79 and 1.92%) for fat, (6.02, 7.47 and 9.04%) for fiber and (4.25, 4.51 and 4.80%) for ash at addition levels 10, 20 and 30 gm of AP respectively, these results were agreed with the results of the study conducted by Hanan *et al.* (2020) on instant vegetable soup fortified with pea pods powder and this increase may be due to that AP contains higher levels of protein, fat, fiber and ash compared to the control sample.

On the contrary, the values of carbohydrates and moisture showed a gradual decrease with the gradual increasing of addition level of AP. Where, the values were (77.06 and 6.26%) at control sample then were decreased to (75.14, 72.83 and 70.33%) and (6.17, 6.05 and 5.93%) at addition levels 10, 20 and 30 gm of AP respectively, Ansari *et al.* (2020) and Rathore (2021) also revealed the same trend in their studies and this decreasing trend may be due to that AP contains lower levels of carbohydrates and moisture compared to the control sample.

Also, the energy values showed the same behavior, the value was 372.36 Kcal/100g at control sample then was gradually decreased to 367.16, 361 and 354.26 Kcal/100g at addition levels increaswd 10, 20 and 30 gm of AP respectively, this behavior was similar to what Asker *et al.* (2022) found in a similar study on dried vegetable soup fortified with purslane leaves and this is because of the difference between the energy values of both (energy value of AP was 320.95 Kcal/100g while energy value of control sample was 372.36 Kcal/100g), but despite this decrease, the all tested instant vegetable soup is still can be relied upon to provide energy, as the statistical analysis did not show a significant difference ($p \leq 0.05$) between the energy values at all addition levels.

Minerals content of instant vegetables soups formulated with artichoke powder

Macro and micro minerals content of instant vegetable soup fortified by adding different levels (10, 20 and 30 gm) of artichoke powder were determined and the results were tabulated in Table (4).

From shown data in Table (4), It could be seen that addition of different levels 10, 20 and 30 gm from AP led to significant changes in minerals values of instant vegetable soup. Except K, Fe and Mn, the values of all determined minirals (Ca, Mg, P, Cu and Zn) were showed a gradual increase from 180, 210.20, 136.60, 0.16 and 0.89 mg/100g on dry weight basis at control sample until it were reached to 237.08, 212.54, 191.22, 0.39 and 1.52 mg/100g at addition level 30 gm of AP respectively, also this effect was consistent with what achieved by Mahrous *et al.* (2016) and the reason for this increase may be that AP contains higher levels of these minirals compared to the control sample (Table 4).

In contrast, the values of K, Fe and Mn showed a gradual decrease from 954.60, 3.93 and 1.16 mg/100g at control sample to 809.13, 3.15 and 1.08 mg/100g at addition level 30 gm of AP respectively, these results were different from previous relevant study conducted by Mahrous *et al.* (2016) where they found a positive relationship between increasing the level of artichoke and all determined minerals and this decrease may be due to that the control sample contains higher levels of both these minirals

compared to AP. The richness of foods in minerals reflects their ability to protect the body through some minerals act as antioxidants independently to scavenge free radicals and reduce oxidative stress in cells (Elgendey *et al.,* 2022).

Natural antioxidants content of instant vegetables soups formulated with artichoke powder

Natural antioxidants parameters of instant vegetable soup developed by 10, 20 and 30 gm of artichoke powder were tested and the obtained results were recorded in Table (5).

The obtained results in Table (5) showed a clear increase in all natural antioxidants parameters with an increase in the addition level of AP from 10 to 30 gm, the total phenols content was started from 136.73 mg/100g at control sample then ended to 621.54 (mg/100g) at the highest addition level (30 gm), a similar result was observed by Dadali (2023) when they improved instant fermented cereal soup with artichoke powder.

Likewise, total flavonoids and total carotenoids contents were started from (27.45 and 12.86 mg/100g) at control sample and ended to (124.29 and 56.51 mg/100g) at the highest addition level (30 gm) respectively, These results also were in line with the results obtained by Mahrous *et al.* (2016) in the study focused on using artichoke to raise flavonoids of whey beverages, and this can be explained by that AP is richer in both total phenols, total flavonoids and total carotenoids compared to instant vegetable soup sample without addition, also, Pagano *et al.* (2016) pointed out that artichoke is considered a promising and cheap source of biologically active compounds such as inulin, caffeoylquinic acids and other nutrients and can be used to produce food additives.

Also, scavenging activity (DPPH%) was increased to 12.99 at 10 gm then 17.46 at 20 gm and finally was ended to 23.95% at the highest addition level (30 gm) compared to value of scavenging activity at control sample which was recorded 8.53%, this behavior was harmonious with observed behavior by Guven *et al.* (2018) and Dadali (2023) in a similar investigations and this effect comes as an expected result of the clear increase of tested natural antioxidants with the increase in the addition level of AP, furthermore AP was had higher scavenging activity compared to instant vegetable soup sample without addition, and according to what Souhila and Nacéra (2022) stated, in addition to the preventive role of antioxidants in protecting the cell, the availability of a sufficient amount of them in food ensures the neutralizing free radicals resulting from toxin metabolism in the early stages.

Amino acids content of instant vegetables soups formulated with artichoke powder

In this study, essential amino acids (EAA) and non-essential amino acids (NEAA) of improved instant vegetable soup by 10, 20 and 30 gm of artichoke powder were examined and the compositional appearance is presented in Table (6).

From compositional appearance of amino acids in table (6) and from afar, it could be seen that addition 10, 20 and 30 gm from AP caused a clear changes in amino acids levels of instant vegetables soup, levels of all determined essential amino acids (Thereonine, Histidine, Valine, Lysine, Leucine and Isoleucine) were showed a gradual increase from 0.39, 0.25, 0.58, 0.78, 0.83 and 0.45 g/100g in control sample until it were reached to 0.71, 0.59, 0.70, 0.93, 1.01 and 0.66 g/100g in treatment contained 30 gm of AP respectively, These results were consistent with the results reported by Khalil (2002) in study on fortifying wheat bread with artichoke powder and this increase may be due to that AP contains higher levels of essential amino acids compared to the control sample. In the same regard, previous studies have indicated that essential amino acids play a crucial role in improving health, For example, threonine is involved in the synthesis of other amino acids such as glycine and serine, which are necessary for detoxification and modifying the expression of pro-inflammatory cytokines (Fallah *et al.,* 2024). Moreover, Hou *et al.* (2020), Lin *et al.* (2022) and Liu *et al.* (2023) reported that leucine, isoleucine and valine are involved in the formation of the enzymes necessary to metabolize toxins and then eliminate them.

Also, the other category indicated that the addition of different levels from AP caused a slight decrease in Aspartic acid, Glutamic acid, Serine and Alanine coinciding with a gradual increase in levels of Cystin and Glycine from 0.10 and 0.41 g/100g at control sample until were reached to 0.13 and 0.45 g/100g at the highest level of addition (30 gm) of AP respectively Also,

this increase may be justified by AP contains higher levels of both compared to the control sample, actually and this comes in line with El-Hadidy *et al.* (2022). It is worth noting that non-essential amino acids play a very important role in the process of detoxification, for example, glycine, cysteine, and glutamic acid are involved in the synthesis of glutathione, which acts as a powerful antioxidant in the first stage of toxicity, also binds to toxin metabolism and turns it into a soluble compound that can be excreted outside the body (Potęga, 2022).

Sensory evaluation of instant vegetables soups formulated with artichoke powder

Sensually, all samples were evaluated for depending on several individual and combined organoleptic characteristics, and results are listed in table below (Table 7)**.**

The results in Table (7) appeared that the instant vegetables soup with 30 gm of artichoke powder have highest score of most tested organoleptic parameters such as color, taste, flavor, texture, appearance and overall acceptability than other treatments, the obtained score for instant vegetables soup enhanced by adding 30 gm artichoke powder were 8.25, 8.91, 8.23, 8.70, 8.66, 9.13 and 8.52, while the values 7.71, 7.42, 7.85, 7.73, 8.14, 8.32 and 7.89 were corporate with control sample at both color, taste, odor, flavor, texture, appearance and overall acceptability respectively, and although samples enhanced by adding 10 and 20 gm artichoke powder showed values less than treatment at 30 gm, but both treatments showed more preference than the control sample, The development of taste and flavor may be due to the pleasant bitter taste distinctive of artichoke (Souhila and Nacéra, 2022). Also, this can be attributed to the presence of soluble dietary fiber which gives lubricating properties to the sample and thus the mouth feels a creamy texture when the tongue and palate come close together while swallowing liquid food (Hanan *et al.,* 2020), and this is reinforced by what Ravindran and Matia-Merino (2009) mentioned that the soup formulation with the highest viscosity levels was the most acceptable in sensory evaluation.

CONCLUSION

This study succeeded in achieving its main aim of making optimally utilized of artichok in developing new formulas of instant vegetable soups to be more Sensually, technologically and nutritionally valuable, whereas the addition of artichoke powder to instant vegetables soup was improved the sensory, physical and chemical characteristics, not only that, but also it was caused increased many necessary nutrients for human health such as minerals, essential amino acids and natural antioxidants. Finally, it can be said that utilization of artichoke to improve food properties is considered an attractive and inspiring tool for development of more ordinary foods that may be promoted and referred to as functional foods later, and especially it can be predicted that it has a promising future in administration of oxidative stress.

REFERENCES

Abdel-Haleem, A.M., Omran, A.A. 2014. Preparation of dried vegetarian soup supplemented with some legumes. Food and Nutrition sciences, 5(22), 2274.

Akbari, B., Baghaei-Yazdi, N., Bahmaie, M., Mahdavi Abhari, F. 2022. The role of plant-derived natural antioxidants in reduction of oxidative stress. BioFactors, 48(3): 611-633.

Albayrak, S., Barış, D.E.N.K., KARPUZ, B., AKKOL, E.K., Gülcan, A.V.C. 2022. Determination of In vitro Antioxidant Activities and Macro and Micro Elements Level in Different Extracts of Cynara Scolymus L. leaf. Kocatepe Veterinary Journal, 15(4): 412-422.

Ansari, F., Singh, A., Baidya, K., Rana, G.K., Bharti, A. 2020 Formulation and development of instant soup mix using Moringa oleifera leaf powder. Journal of Pharmacognosy and Phytochemistry, 9(6S): 429-432.

AOAC 2003. Official methods of analysis of the association of official's analytical chemists, 17th edn. Association of official analytical chemists, Washington. DC. USA.

AOAC. 2012. Official Methods of Analysis of the Association of Official Analytical Chemists International (19th ed). Washington. DC. USA.

Asker, A., Treptow, H. 1993. Amines. Encyclopedia of Food Science, Food Technology and Nutrition, 141-146.

Asker, G., El-Sayed, S., Bader, S. 2022. Development and Quality Analysis of Dried Vegetable Soup Enriched with Purslane Leaves and Seeds Powder. New Valley Journal of Agricultural Science, 2(6): 372-383.

Baliyan, S., Mukherjee, R., Priyadarshini, A., Vibhuti, A., Gupta, A., Pandey, R.P., Chang, C.M. 2022. Determination of antioxidants by DPPH radical scavenging activity and

quantitative phytochemical analysis of Ficus religiosa. Molecules, 27(4): 1326.

Brookfield Manual 1998. Brookfield Manual Operating Instruction. No. M/98-211-B0104. Brookfield Engineering Laboratories Inc., Middleborough.

Chen, C., Zhang, M., Xu, B., Chen, J. 2021. Improvement of the Quality of Solid Ingredients of Instant Soups: A Review. Food Reviews International, 1-26.

Cosmos, E., Simon-Sarkadi, L. 2002. Characterization of tokay wines based on free amino acid and biogenic amine using ion-exchange chromatography. Chromatographic supplement, 56:185-188.

Dadali, C. 2023. Fermented cereal soup with artichoke (Cynara scolymus L.) bracts: volatile profile, functional, powder and sensory properties. Journal of the Science of Food and Agriculture, 103(5): 2564-2573.

Elgendey, F., Al Wakeel, R.A., Hemeda, S.A., Elshwash, A.M., Fadl, S.E., Abdelazim, A.M., Khalifa, O.A. 2022. Selenium and/or vitamin E upregulate the antioxidant gene expression and parameters in broilers. BMC Veterinary Research, 18(1): 310.

El-Hadidy, G.S., Elmeshad, W., Abdelgaleel, M., Ali, M. 2022. Extraction, identification, and quantification of bioactive compounds from globe artichoke (Cynara cardunculus var. scolymus). Sains Malaysiana, 51(9): 2843-2855.

Fallah, S., Asri, N., Nikzamir, A., Ahmadipour, S., Sadeghi, A., Rostami, K., Rostami-Nejad, M. 2024. Investigating the Impact of Vitamin A and Amino Acids on Immune Responses in Celiac Disease Patients. Diseases, 12(1): 13.

Gomathi, G.K., Parameshwari, S. 2023. Formulation and Evaluation of Nutritional, Rheological, Microstructural Parameters and Shelf Life of Instant Buckwheat Soup Mix. Biosciences Biotechnology Research Asia, 20(1).

Gomez, K.A., Gomez, A.A. 1984. Statistical procedures for Agricultural research 2nd End. John Wiley, New York, USA.

Guven, O., Sensoy, I., Senyuva, H., Karakaya, S. 2018. Food processing and digestion: The effect of extrusion process on bioactive compounds in extrudates with artichoke leaf powder and resulting in vitro cynarin and cynaroside bioaccessibility. Lwt, 90, 232-237.

Hanan, E., Rudra, S.G., Sagar, V.R., Sharma, V. 2020. Utilization of pea pod powder for formulation of instant pea soup powder. Journal of Food Processing and Preservation, 44(11): e14888.

Hou, Y., Hu, S., Li, X., He, W., Wu, G. 2020. Amino acid metabolism in the liver: nutritional and physiological significance. in Amino Acids in Nutrition and Health: Amino acids in systems function and health book, 21-37.

Khalil, M.M. 2002. Bioavailability of zinc in fiber-enriched bread fortified with zinc sulphate. Food/Nahrung, 46(6): 389-393.

Kidane, L., Kejela, A. 2021. Food security and environment conservation through sustainable use of wild and semi-wild edible plants: a case study in Berek Natural Forest, Oromia Special Zone, Ethiopia. Agriculture and Food Security, 10(1): 1-16.

Krokida, M.K., Marinos-Kouris, D. 2003. Rehydration kinetics of dehydrated products. Journal of food engineering, 57(1): 1-7.

Lin, Z., Wang, G., Gu, W., Zhao, S., Shen, Z., Liu, W., Yan, T. 2022. Exploration of the protective mechanism of naringin in the acetaminophen-induced hepatic injury by metabolomics. Oxidative Medicine and Cellular Longevity, 2022.

Liu, Z., Li, N., Dang, Q., Liu, L., Wang, L., Li, H., Han, X. 2023. Exploring the roles of intestinal flora in enhanced recovery after surgery. Iscience, 26(2):105959.

Lolge, R.M., Agarkar, B.S., Kshirsagar, R.B., Patil, B.M., Shinde, S.B. 2022. Technology development for preparation of Instant soup mix powder from yam, drumstick leaves and roselle calyces. The Pharma Innovation Journal, 11(12): 676-681.

Mahrous, H., El-Kholy, W.M., Al-Saman, M.A. 2016. Effects of enrichment with globe artichoke roots and Jerusalem artichoke tubers on nutritional and functional properties of whey beverages. World Journal of Dairy and Food Sciences, 11(1): 24-36.

Oluwafemi, G.I., Adesina, E.I.O.K. 2020. Development and evaluation of instant clove basil soup (Officium gratssimum). Development, 99, 26-31.

Pagano, I., Piccinelli, A.L., Celano, R., Campone, L., Gazzerro, P., De Falco, E., Rastrelli, L. 2016. Chemical profile and cellular antioxidant activity of artichoke by-products. Food and function, 7(12): 4841-4850.

Paul, A.A., Southgate, D.A. 1979. The composition of foods. 4thedd. Elsevier /North. Holland Biomedical Press, Amsterdam.

Potęga, A. 2022. Glutathione-Mediated Conjugation of Anticancer Drugs: An Overview of Reaction Mechanisms and Biological Significance for Drug Detoxification and Bioactivation. Molecules, 27(16): 5252.

Rasitha, K., Sharma, S. 2023. Development of the instant soup mix with low GI ingredients and its consumer acceptability. The Pharma Innovation Journal, 12(6): 1158-1164.

Rathore, T. 2021. Preparation and nutritional enhancement of instant tomato soup mix with addition of kale. Nveo-Natural Volatiles and Essential Oils Journal| Nveo, 15796-15805.

Ravindran, G., Matia-Merino, L. 2009. Starch-Fenugreek (Trigonella foenum-graecum L.) Polysaccharide Interactions in Pure and Soup Systems. Food Hydrocolloids, 23, 1047-1053.

Semwal, A.D., Sharma, G., Patki, P.E., Padmashree, A., Arya, S.S. 2001. Studies on Development and Storage Stability of Instant Vegetable Pulav Mix. J. Food Sci. Technol. Mysore, 38, 231–234.

Sinchaipanit, P., Sangsuriyawong, A., Visetchart, P., Nirmal, N.P. 2023. Formulation of Ready-to-Eat Soup for the Elderly: Nutritional Composition and Storage Stability Study. Foods, 12(8): 1680.

Singleton, V.L., Orthofer, R., Lamuela-Raventos, R.M. 1999. Analysis of total phenols and other oxidation substrates and antioxidants by means of Folin-Ciocalteu reagent. Oxidants and Antioxidants, Part A., 299: 152-178.

Souhila, M., Nacéra, M. 2022. Biological Activities of Phenolics in Different Parts of Local Cultivar of Globe Artichoke (Cynara cardunculus, var. scolymus L.). In Biology and Life Sciences Forum (Vol. 16, No. 1, p. 30). MDPI.

Toor, R.K., Savage, G.P. 2006. Effect of semi-drying on the antioxidant components of tomatoes. Food Chemistry, 94: 90-97.

Yam, K.L., Papadakis, S.E. 2004. A simple digital imaging method for measuring and analyzing color of food surfaces. J. Food Eng., 61, 137–142.

Table 1: Formula of instant vegetables soups enreached by AP

Ingredients (g)	Control	Instant vegetables-AP soups		
		10	20	30
Potato	15	15	15	15
Carrot	15	15	15	15
Beas	15	15	15	15
Tomato	15	15	15	15
wheat flour	30	30	30	30
Onion	3	3	3	3
Garlic	2	2	2	2
Black pepper	1.5	1.5	1.5	1.5
Cumin	1.5	1.5	1.5	1.5
Salt	2	2	2	2
AP	0	10	20	30
Total	100	110	120	130

AP: Artichoke Powder

Table 2: Physical properties of instant vegetables soups enriched with AP

Physical Properties		Instant vegetables soups samples				
		AP	Control	AP 10	AP 20	AP 30
pH value		6.59	6.24±0.28^{a}	6.32±0.65^{a}	6.33±0.12^{a}	6.47±0.42^{a}
RR		6.35	3.12±0.16^{c}	3.56±0.38^{b}	3.84±0.27^{ab}	4.18±0.15^{a}
TSS (%)		28.94	15.78±0.64^{c}	17.96±0.71^{b}	18.41±0.55^{b}	20.78±0.74^{a}
Viscosity (cP)		-	51.00±0.79^{d}	54.00±0.64^{c}	59.00±0.86^{b}	66.00±0.42^{a}
Color	L	34.08	44.77±0.84^{a}	44.19±0.65^{a}	43.80±0.54^{a}	42.65±0.44^{a}
	a	0.49	0.80±0.05^{a}	0.77±0.03^{a}	0.75±0.08^{ab}	0.71±0.06^{b}
	b	11.32	13.91±0.26^{a}	13.71±0.94^{a}	13.39±0.79^{ab}	13.15±0.45^{b}

RR: Rehydration ratio, TSS: Total soluble solids (%), L= black-white, a= green-red, b= blue-yellow, AP: Artichoke powder, Values with different letters between columns are significantly different ($p<0.05$).

Table 3: Chemical composition of instant vegetables soups enriched with artichoke powder (on dry weight basis).

Chemical Components (%)	Instant vegetables soups				
	AP	Control	AP 10	AP 20	AP 30
Moisture	5.32	6.26±0.47^{a}	6.17±0.21^{a}	6.05±0.13^{a}	5.93±0.43^{a}
Ash	6.22	4.03±0.14^{c}	4.25±0.73^{bc}	4.51±0.36^{ab}	4.80±0.53^{a}
Protein	16.40	12.55±0.84^{c}	12.94±0.95^{bc}	13.40±0.62^{ab}	13.90±0.50^{a}
Fat	2.62	1.55±0.16^{c}	1.65±0.15^{bc}	1.79±0.10^{ab}	1.92±0.17^{a}
Available carbohydrate	57.94	77.06±0.94^{a}	75.14±0.17^{ab}	72.83±0.65^{bc}	70.33±0.79^{c}
Fiber	16.81	4.81±0.16^{d}	6.02±0.42^{c}	7.47±0.90^{b}	9.04±0.93^{a}
Energy (Kcal/100g)	320.95	372.36±1.56^{a}	367.16±1.94^{a}	361±1.44^{a}	354.26±1.96^{a}

AP: Artichoke powder, Values with different letters between columns are significantly different ($p<0.05$).

Table 4: Minerals content of instant vegetables soups contained defferent level of artichoke powder (on dry weight basis).

Minerals (mg/100g)	Instant vegetables soups				
	AP	Control	AP 10	AP 20	AP 30
Ca	373.64	180±0.67^{d}	199.36±0.79^{c}	218.52±0.85^{b}	237.08±0.94^{a}
Mg	217.96	210.20±1.32^{a}	210.99±1.06^{a}	211.76±1.84^{a}	212.54±1.22^{a}
K	470.33	954.60±2.66^{a}	906.71±1.28^{b}	856.47±1.50^{c}	809.13±1.47^{d}
P	312	136.60±0.95^{d}	154.14±0.88^{c}	174.68±1.21^{b}	191.22±1.28^{a}
Fe	1.18	3.93±0.11^{a}	3.54±0.19^{b}	3.28±0.17^{c}	3.15±0.13^{c}
Cu	0.87	0.16±0.06^{c}	0.23±0.07^{b}	0.32±0.05^{a}	0.39±0.09^{a}
Mn	0.80	1.16±0.06^{a}	1.14±0.08^{ab}	1.08±0.04^{b}	1.08±0.07^{b}
Zn	2.14	0.89±0.02^{c}	1.05±0.07^{b}	1.13±0.07^{b}	1.52±0.05^{a}

AP: Artichoke powder, Values with different letters between columns are significantly different ($p<0.05$).

Table 5: Natural antioxidants content of instant vegetables soups formulated by artichoke powder (on dry weight basis).

Antioxidants	Instant vegetables soups samples				
	AP	Control	AP 10	AP 20	AP 30
Total phenols (mg/100g)	1958.42	136.73±1.73^{d}	325.27±1.98^{c}	498.33±1.48^{b}	621.54±1.55^{a}
Total flavonoids (mg/100g)	391.28	27.45±0.49^{d}	61.83±0.94^{c}	97.12±0.47^{b}	124.29±0.73^{a}
Total carotenoids (mg/100g)	211.18	12.86±0.26^{d}	29.57±0.43^{c}	45.37±0.33^{b}	56.51±0.92^{a}
DPPH (%)	53.19	8.53±0.52^{d}	12.99±0.58^{c}	17.46±0.57^{b}	23.95±0.39^{a}

AP: Artichoke powder, Values with different letters between columns are significantly different ($p<0.05$).

Table 6: Amino acids content of instant vegetables soups formulated with artichoke powder (on dry weight basis).

Amino acids (g/100 g sample)	AP	Instant vegetables soups			
		Control	AP 10	AP 20	AP 30
Thereonine	1.48	0.39	0.50	0.60	0.71
Histidine	1.39	0.25	0.36	0.48	0.59
Valine	0.97	0.58	0.62	0.66	0.70
Lysine	1.28	0.78	0.83	0.88	0.93
Leucine	1.44	0.83	0.89	0.95	1.01
Isoleucine	1.16	0.45	0.52	0.59	0.66
Total EAA	7.72	3.27	3.72	4.16	4.61
Aspartic acid	0.77	1.14	1.10	1.06	1.03
Glutamic acid	0.96	1.66	1.59	1.52	1.45
Cystin	0.21	0.10	0.11	0.12	0.13
Serine	0.29	0.52	0.50	0.48	0.45
Glycine	0.54	0.41	0.42	0.43	0.45
Alanine	0.37	0.43	0.42	0.41	0.41
Total NEAA	3.14	4.26	4.15	4.03	3.92
Total AA	10.86	7.53	7.87	8.19	8.53

AP: Artichoke powder, AA: Amino Acide, EAA: Essential Amino Acide, NEAA: Non-Essential AA

Table 7: Sensory evaluation of instant vegetables soups formulated with artichoke powder.

Sensory Properties	Instant vegetables soups			
	Control	AP 10	AP 20	AP 30
Color	7.71±0.35^{b}	7.75±0.74^{b}	8.16±0.86^{ab}	8.25±0.24^{a}
Taste	7.42±0.71^{b}	7.80±0.84^{b}	8.64±0.27^{a}	8.91±0.54^{a}
Odor	7.85±0.58^{a}	7.93±0.18^{a}	8.32±0.88^{a}	8.23±0.44^{a}
Flavor	7.73±0.13^{b}	7.85±0.29^{b}	7.91±0.33^{b}	8.70±0.62^{a}
Texture	8.14±0.23^{a}	8.16±0.67^{a}	8.52±0.74^{a}	8.66±0.53^{a}
Appearance	8.32±0.48^{b}	8.64±0.31^{ab}	8.75±0.51^{ab}	9.13±0.44^{a}
Over all acceptability	7.89±0.51^{b}	8.02±0.67^{ab}	8.27±0.51^{ab}	8.52±0.62^{a}

AP: Artichoke powder, Values with different letters between columns are significantly different ($p<0.05$).

تقييم جودة حساء الخضروات سريع التحضير المدعم بمسحوق الخرشوف

عادل مجدى الغريب [1,*] ، محمد الانور عثمان [1] ، هانى محمد فهمى [1] ، سامى أحمد محمود [2]

[1] قسم علوم وتكنولوجيا الأغذية, كلية الزراعة, جامعة الأزهر, القاهرة, مصر
[2] الهيئة القوميه للرقابه والبحوث الدوائيه, الجيزه, مصر

* البريد الإلكتروني للباحث الرئيسي:Adel magdey26@gmail.com

الملخص العربى :-

تهدف هذه الدراسه الى تعظيم الاستفاده من أحد النباتات التي لم تستغل بشكل مثالي حتى الان وذلك على الرغم من فوائدها الصحيه المتعدده وهو نبات الخرشوف، وذلك من خلال تدعيم احد المنتجات سريعة التحضير. ولتحقيق هذا الغرض تم تحضير مسحوق الخرشوف المجفف وأضيف الى حساء الخضروات سريع التحضير بنسب مختلفه (10 و20 و30جم) وتم تقييم الخصائص الحسية والفيزيائية والكيميائية وكذلك محتوى المعادن ومضادات الأكسدة والأحماض الأمينية في جميع المعاملات. أظهرالتركيب الكيميائي زيادة في قيم العناصر الغذائية الهامه، فعند مقارنة العينه الضابطة مع عينة الحساء المحتويه على أعلى نسبة اضافه من مسحوق الخرشوف (30جم) وجد ان كلا من البروتين والدهون والألياف والرماد ارتفع من (12,5، 1,55، 4,81 و4,03) إلى (13,90، 1,92، 9,04 و4,80٪) على التوالي. كما زادت مستويات الكالسيوم والمغنيسيوم والفوسفور والنحاس والزنك من (180، 210.20، 136.60، 0.16 و 0.89) إلى (237.08، 212.54، 191.22، 0.39 و1.52 ملجم/100 جم) على التوالي. وبالمثل، زادت الفينولات الكلية والفلافونويدات والكاروتينات من (136.73، 27.45 و12.86) إلى (621.54، 124.29 و56.51 ملجم/100 جم) وبالتبعيه ارتفع النشاط المضاد للاكسده بشكل ملحوظ من 8,53 الى 23,95٪ على التوالي. كما زادت مستويات كل الأحماض الأمينية الأساسية المدروسة وحمضي السيستين والجلايسين بشكل ملحوظ. وفيما يتعلق بالخواص الفيزيائيه، فقد ارتفعت قيم الأس الهيدروجيني ونسبة الاسترجاع ونسبة المواد الصلبه الذائبه الكليه وكذلك قيمة اللزوجه بينما انخفضت مؤشرات اللون الثلاث. كما أظهرت النتائج أن العينة التي تحتوي على 30 جرام من مسحوق الخرشوف حصلت على القيم العليا لمعظم الصفات الحسية المختبرة. وبذلك، يمكن استنتاج أن إضافة مسحوق الخرشوف عملت على تحسين كلا من الخصائص الحسية والفيزيائية وجميع المؤشرات التغذويه لحساء الخضروات سريع التحضير بشكل ملحوظ.

الكلمات الاسترشادية: حساء سريع التحضير، خضروات، مسحوق الخرشوف، توليفات.