University of Thi-Qar Journal of agricultural research

Thi-Qar Journal of agricultural research

ISSN Onlin:2708-9347, ISSN Print: 2708-9339 Volume 13, Issue 2 (2024) PP 667-678

https://jam.utq.edu.iq/index.php/main *https://doi.org/10.54174/utjagr.v13i1.323*

Estimating the mineral content and analyzing the chemical composition and active groups of basil seeds (*Ocimum basilicum*), studying their antioxidant and incorporating them into healthy diets.

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Abstract

The chemical composition of basil seeds (*Ocimum basilicum*) was determined, chemical analyzes showed that the percentage content of moisture, ash, protein, fat, and carbohydrates on a dry weight basis was 22.5, 2.57, 3.15, 0.364 and 71.416 % respectively. The concentrations of the mineral elements represented by zinc, lead, cadmium, nickel, and copper were 28.3, 0.822, 0.0615, 3.643, 19.5 ppm respectively. The significant tests for the aqueous extract showed that it's contain the active compounds represented by carbohydrates, saponins, tannins, flavonoids, alkaloids, phenols and glycosides which gave a positive result. As for the antioxidant activity, it was estimated by (2, 2 diphenyl-1-picrylhydrazyl) method. The ability of the extract to capture free radicals increased with increasing concentration reaching the lowest value70.3% at a concentration of 50 mg/ ml, and the highest value 90.5% at a concentration 200 mg/ml as compared to the standard substance (butyl hydroxyl toluene), its effectiveness was 95.4. The reducing power increased with increasing concentration, at a concentration of 200 mg/ml it gave an effectiveness of 83.2% compared to ascorbic acid, which had an effectiveness of 85.4%. It was used in food applications as a thickening material in the jam industry using different ratios of 0.5, 1, 1.5 and 2 g. It was noted that the best concentration is Adding 2 gm.

I. Introduction:

Basil seed is the general term used to refer to the seeds of some types of

herbaceous plants (basil). Generally, these seeds are small in size and black in color, with a light nutty flavor and a jelly-like texture when soaked in water (Sekar *et al*., 2009).

Basil seeds contain many important nutritional elements. It contains 10, 33 and 43.9 gm of protein, fat and carbohydrates respectively, which gives it excellent nutritional properties. In addition, it is rich in plant compounds, including flavonoids and polyphenols, as they are important antioxidants that reduce cell damage. It also has anti-inflammatory and anti-cancer properties and it is a source of omega-3 fatty acids. A tablespoon of basil seeds which is equivalent to 13 gm can cover most or all of the body's daily need for omega-3 which the body needs to produce energy. In addition, contributing to reducing the risk of some diseases such as heart disease and type 2 diabetes. It can be used as a thickening agent. Basil seeds contain fibers including pectin which is widely used in the food industry, as it has no flavor and therefore can be used to thicken foodstuffs such as ice cream, salad dressing, low-fat whipped cream, and jelly without affecting their flavor, in addition to It is used as a substitute for fats in yogurt, mayonnaise and it is also considered a source of fiber (Gajula *et al*., 2009).

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Sweet basil seeds are a rich source of dietary fiber. They are added to drinks as an ideal option for dietary fiber supplements. It should also be noted that the pectin found in basil seeds can be used healthily in several ways that help the body. In obtaining the daily amount of fiber it needs, a tablespoon of basil seeds provides approximately 7 gm of fiber, which is equivalent to 25% of the daily recommended amount. It helps improve intestinal health, as one laboratory study in 2018 indicated that pectin possesses many vital benefits, which gives it the ability Increases beneficial gut bacteria and antibacterial bacteria for inflammation, which has a role in improving intestinal health (Mai *et al*.,2018).

Benefits of basil seed drink Basil seeds have been used for a long time in drinks in various regions including India and Southeast Asia. There are also drinks made from basil seeds, as these seeds add an abundant number of healthy fibers compared to some other types of drinks that lack this. Basil seeds can also be consumed in different ways, including eating them by adding them to bread dough for flavor. or soaking them in water to make them have a sticky consistency and preparing them as a refreshing drink. In addition, essential oils can be obtained from them and used to add Flavor for foods such as mustard, sauces, vinegar, etc. (Pham *et al*.,2020).

II. Materials:

1. Basil seeds were obtained from the local market in Basra, then ground with a French-made Moulinex electric grinder and stored in a bottle at laboratory temperature until use.

2. Reagents used Mulch's reagent, Marcus' reagent, aqueous mercuric chloride (5 %) aqueous lead acetate (1) , alcoholic potassium hydroxide (5N) ferric chloride (1%), Wakner Meyer's reagent and KOH (5N), H_2SO_4 and ninhydrin nitric acid reagent.

Methods:

1- Estimation of the chemical components of basil seeds:

1-1- Humidity estimation

Humidity was estimated according to the mentioned method in (A.0.A.C., 2008) using oven at 105 ºC.

1-2- Ash estimation

Estimate the ash according to the method mentioned in (A.O.A.C., 2008) in an incineration furnace at temperature of 550 ºC.

1-3- Estimation of fat

The percentage of fat was estimated according to the method mentioned in (A.O.A.C., 2008) using a Soxhlet device.

1-4- Protein estimation

The protein percentage was estimated according to the mentioned method (A.O.A.C., 2008).

1-5- Estimation of carbohydrates

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Carbohydrates were calculated based on the difference between the ingredients mentioned above (Nessrien *et al*., 2007).

2- Determination of mineral elements:

The elements Cd, Ni, pb, Zn, Cu were estimated using the inductively

coupled plasma device ICP-OES from Thermos Fisher Scientific after performing the digestion process of the sample (Aiyelaagbe and Osamudiamen, 2009).

3- Preparation of the extract:

Preparation of the aqueous extract according to method (Afandi *et al*., 2013) by soaking 20 g of ground plant powder in 100 ml of water for 24 hours at laboratory temperature, then concentrating the extract using a rotary evaporator device. As shown in Figures 2, 3, and 4.

4- Chemical detections of some active compounds:

4-1- **Saponins** were detected by placing 1 ml of the extract in a test tube and shaking vigorously for two minutes, then leaving it upright. If foam formed for 15 minutes, this indicates the presence of saponins according to the method used by (Hossain *et al*., 2017).

4-2- **Tanins** Detect by using 1 ml of 1% aqueous lead acetate with 1 ml of extract, and the formation of a white precipitate indicates a positive detection according to (Sawant and Godghate, 2013).

4-3- **Flavonides** Detection of flavonoids using alcoholic potassium hydroxide reagent (5N) according to the established method (Krishnaiah *et al*., 2009)

4-4- **ALKaloids** Detection of alkaloids using Marcus's reagent prepared by mixed 1 ml of formaldehyde with 10 ml of concentrated sulfuric acid. Adding several drops of the reagent to 1 ml of the extract indicated the formation of a yellow precipitate indicating the presence of alkaloids (Mattila and Hellström, 2007).

4-5- **Glycosides** Detection of glycosides using Benedict Reagent by mixing equal amounts of the extract with the reagent and placing it in a water bath for 5 minutes. The appearance of a brown or red precipitate indicates a positive detection (AL-Khazaraji, 1991).

4-6 **carbohydrates** were detected using the Molish test, 1 ml of the reagent was added to 1 ml of the extract, and then drops of concentrated sulfuric acid were added, forming a violet ring indicating the presence of carbohydrates (14).

5-Measuring antioxidant activity

The antifungal activity of the ethanolic extract to capture the free radical DPPH was measured according to the method (Xiao *et al*., 2020), Solutions were prepared at concentrations of 50, 100, 150, and 200 mg/ml in ethanol, and 3 ml of DPPH solution was added. The mixture was shaken vigorously and left for 30 minutes at room temperature, and the absorbance was measured at a wavelength of 517 nm, the control sample was prepared from 1 ml of methanol with 1 ml of DPPH. The absorbance was measured and the activity was calculated according to the following equation:

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Antioxidant activity = absorbance of control sample - absorbance of sample /absorbance of control sample x 100

6- Reductive power:

The reducing power was estimated according to (Zhang *et al*., 2014) by mixing 2.5 ml of solutions prepared at concentrations 50, 100, 150, and 200 mg/ml in ethanol with 2.5 ml of (0.2 M) diphosphate solution at pH 6.6 and 2.5 ml of 1% ferric potassium cyanide and incubate the mixture at 50°C. for 20 minutes, then add 2.5 ml of TCA 10% Acetic acid trichloride. The tubes were centrifuged at 2000 rpm for 10 minutes, then the top layer was taken and 5 ml of distilled water and 1 ml of ferric chloride 0.1% were added to it. Then the absorbance was read at the wavelength of 700 nm. As for the control sample, it was prepared from all of the above materials. Except the sample and compared with ascorbic acid

Reducing power = 100 – (absorbance of the sample / absorbance of the control sample) × 100.

Applications of basil seeds

Table (1) shows the manufacture jam with four concentrations of ground basil seeds, weights, temperature, and cooking time.

Table No. (1) Strawberry jam manufacturing

Basil seeds (gm)	Strawberries (gm)	Sugar (gm)	Temperature	Cooking range (min)	water (ml)
0.5 (A)	100	100	100	60	250
1 (B)	100	100	100	60	250
1.5 (C)	100	100	100	60	250
2 (D)	100	100	100	60	250
Con.	100	100	100	60	250

Table No. (2) Sensory evaluation study

Sensory evaluation:

Table No. (2) Was used to study the sensory evaluation by ten people from the Department of Food Science, postgraduate students, and fourth-year students.

Treatment symbol	color	taste/flavor	Histology	Texture	general acceptability	General sum.
A						
B						
C						
D						
Con.						

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III. Results and discussion:

The results shown in Table 3 and Figure 5 indicate the percentage of the basic chemical components of basil seeds, which are moisture, protein, fat, ash and carbohydrates. We note the high percentage of moisture, protein, and carbohydrates. The percentage of protein in basil seeds reached 3.15, which is less than some varieties of pink basil which reached 17.94 (Edeoga *et al*., 2005).

Table (3) Chemical composition of basil seeds

Ingredient	Moisture	Protein	Lipid	Ash	Carbohydrates
%	22.5	3.15	0.364	2.57	71.416

The percentage of total carbohydrates in basil seeds was 71.41, This percentage was close to that of the pink basil plant which was about 74.86 (Edeoga *et al*.,2006). Carbohydrates are the main product of the photosynthesis process and play an important role in the life of plants and animals, as they are a major source of energy, while the percentage of ash was 2.57%, which is the percentage of ash in pink basil ranged between (6.8-5.7) %, and the percentage of fat was 0.364 which is less than the percentage of total fat in sweet basil (Edeoga *et al*., 2006).

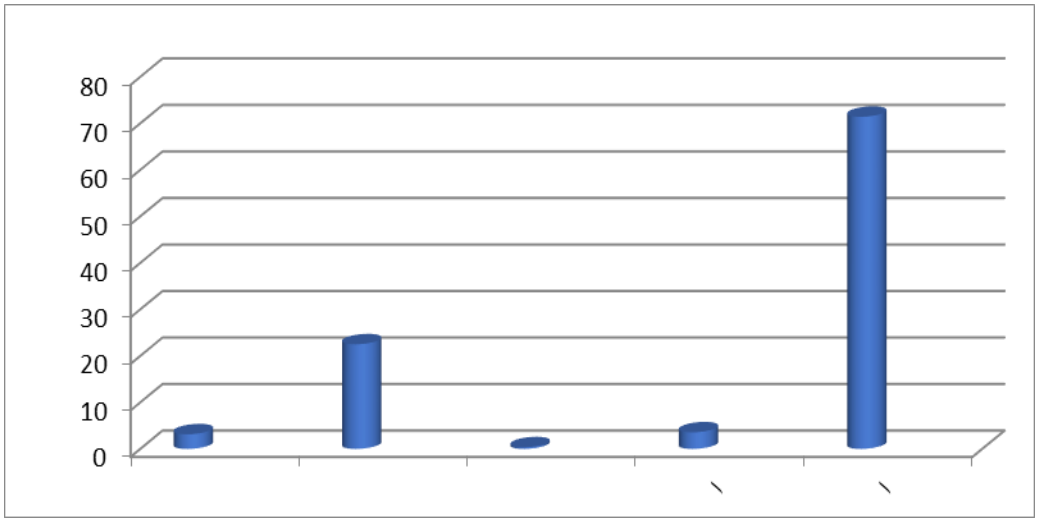

Figure No. (5): Chemical composition of basil seeds

Mineral elements:

It is clear from Table (4) and Figure (6) concentrations of some mineral elements in basil seeds represented by zinc, lead, cadmium, nickel, and copper. The content of zinc in basil seeds reached 28.3 ppm, and its content in plants usually ranges between (20-100) ppm (Okwa, and Morah, 2004). Zinc has an important role in controlling diabetes that necessary for the production of the hormone insulin in the body. The percentage of copper was about 19.5 which is considered one of the basic mineral elements for humans, plants and animals. It is reported that the copper content in plants is between 2-20 ppm (Okwa and Morah, 2004).

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Table (4) Mineral elements of basil seeds

Element	Concentration (ppm)
Zn	28.3
Pb	0.8
Cd	0.06
Ni	3.6
Cu	19.5

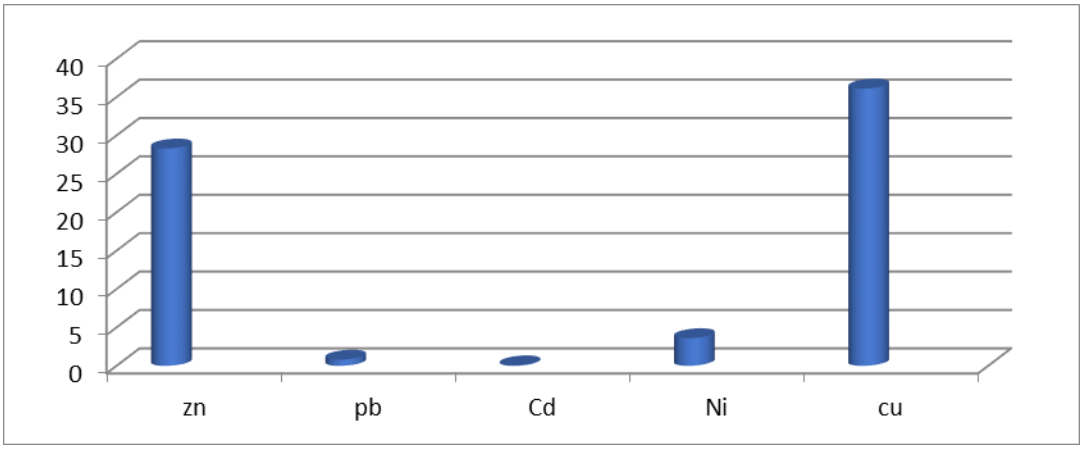

Figure (6) values of some mineral elements

Qualitative analyzes of aqueous basil seed extract:

Table (5) and Figure No. (7) Show the results of the qualitative detection of the active components of the aqueous extract. It was noted that they contain flavonoids, which are among the phenolic substances similar to tannins, but they are the simplest in composition and most widespread. The presence of saponins was noted because they dissolve in water and give soap foam, and the aqueous extract contains Tannins, which are phenolic compounds dissolved in water, are characterized by their ability to precipitate alkaloids, gelatin and protein. The presence of glycosides, carbohydrates, alkaloids and phenols was noted, all of which gave a positive detection. The presence of active compounds in basil seeds indicates their importance as a source of useful drugs and the importance of their chemical components in the pharmaceutical industry. It also enhances their use in the food industry. (Okwu and Iroabuchi 2009).

Table (5): Qualitative analyzes of the aqueous extract

The detector	Aqueous extract	Effective groups
Mulch detector	+	An indication of the presence of carbohydrates
Mercuric chloride 5%	+	Significance of the presence of saponins
Lead acetate reagent 1% and ferric chloride reagent	+	Significance of the presence of tannins

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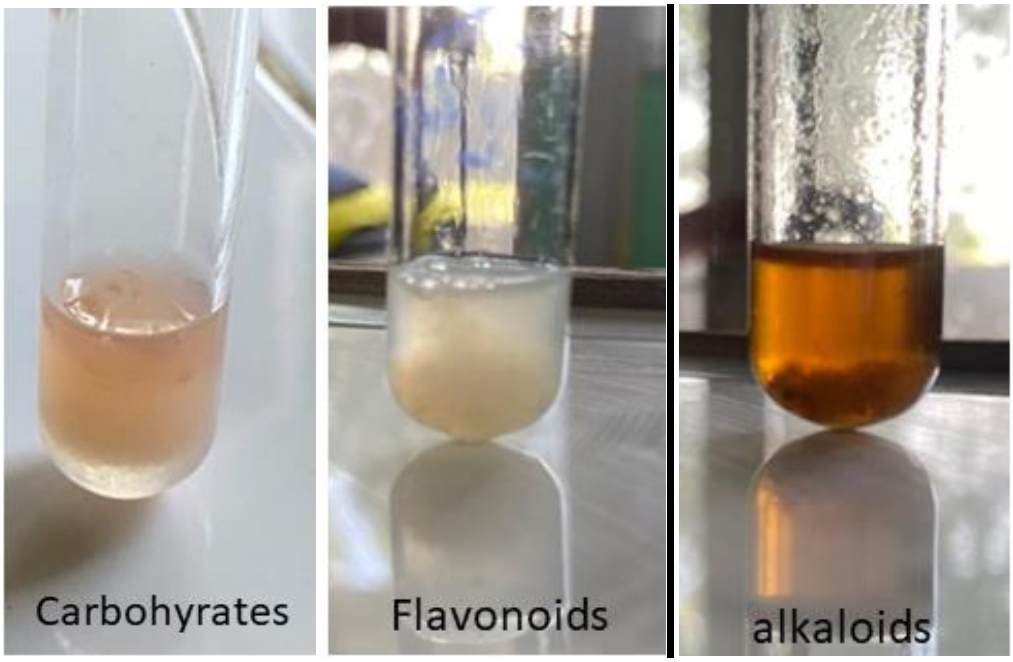
5N(KOH) reagent and concentrated H_2SO_4	+	Significance of the presence of flavonoids
Wakner-Meyer detector and Marcu's detector	+	Significance of the presence of alkaloids
Ferric chloride solution 1%	+	Significance of the presence of phenols
Benedict detector	+	Indication of the presence of glycosides

Antioxidant activity:

The antioxidant activity of the ethanolic extract is shown in Figure (8) increased and the ability of the extract to capture fixed free radicals (DPPH) increased compared to the antioxidant BHT by increasing the concentrations used. The maximum capture effectiveness reached at a concentration of 200 mg/ml reaching to 90.5%, while the antioxidant effectiveness of the compound BHT at the same concentration was 95.4%. Therefore, the change of purple color to yellow gives evidence to ability free radical capturing (DPPH).



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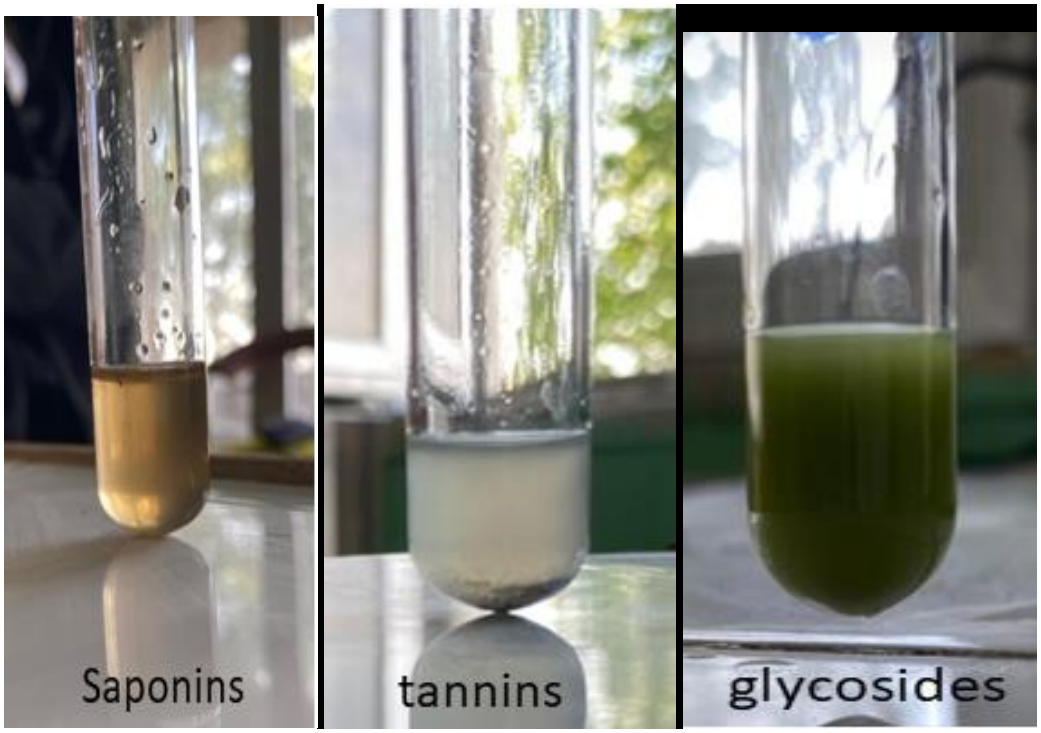

Figure. (7) The qualitative detector of the active compounds in basil seeds

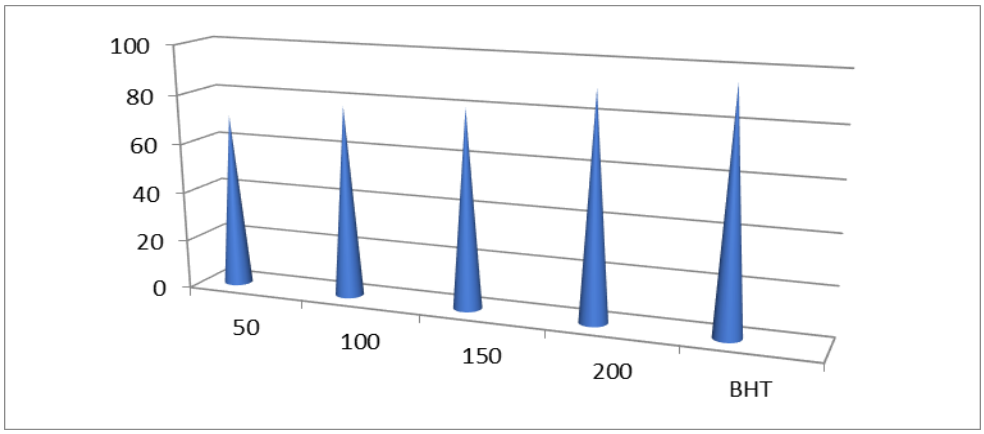

Figure. (8) The antioxidant activity of basil seeds

Figure (9) shows the reducing power of the ethanolic extract compared with standard ascorbic acid. It began to increase with increasing concentrations, as the lowest reducing power was at a concentration of 50 mg/ml reaching 50.99%, and the highest reducing power was at a concentration of 200 mg/ml, which was 83.22% compared to the standard substance ascorbic acid, 85.44%, which is in agreement with the researcher (Neeharika and Vijayalaxmi,2023).

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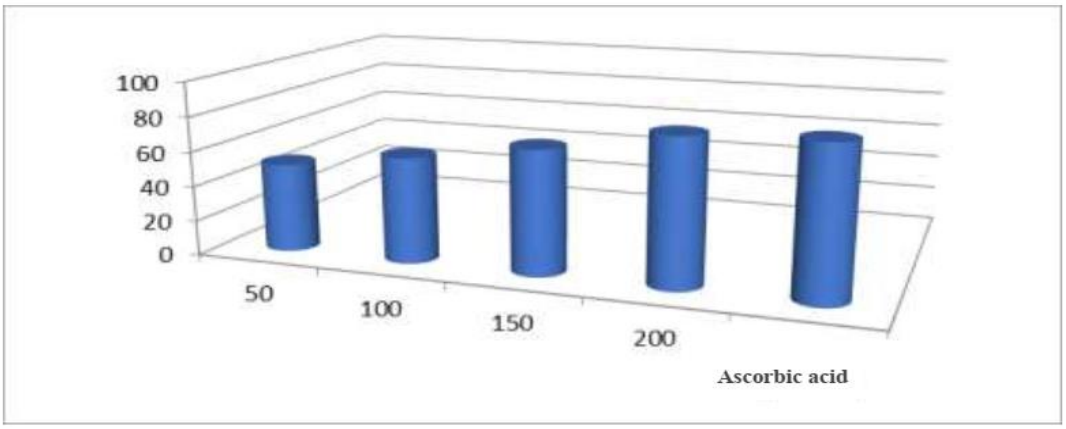

Figure (9) The reductive power of basil seeds

Nutritional application: -

Basil seeds can be used as a thickening agent due its contained fiber including pectin, which is a thickening agent used in the food industry. Pectin can be used to thicken ice cream, salad dressings, low-fat whipped cream and jelly without affecting its flavor. It can also be used as a substitute for fats in yogurt and mayonnaise. It can also be used in beverages as it was used in this research to make jam. Table (6) indicates the results of the sensory evaluation of the jam sample at different concentrations.

Sensory evaluation method:

Table no. (6) shows the results of the sensory evaluation, where it was noted that sample D was the best sample in terms of taste, texture, texture and general acceptability as it obtained a score of 23.6, 8.2, 16.5, and 17.5 compared with the rest of the samples and the control, while sample C was the best in terms of color. Sample D was the best followed by sample C, B, then A, where the general total of the samples was 82.1, 78.5, 76.0, and 75.1, respectively.

Table No. (6) Sensory evaluation

Treatment symbol	Color	taste/flavor	Texture	Consistence	general acceptability	General sum.
Evaluation score	20	30	10	20	20	100
A	16.3	22.2	7.6	13.8	15.2	75.1
B	16.4	22.6	7.8	13.9	15.3	76.0
C	16.6	22.9	7.9	15.3	15.8	78.5
D	16.3	23.6	8.2	16.5	17.5	82.1
Con.	15	20	5	10	12	62

Conclusion

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It is noted that basil seeds have effective compounds with high nutritional value, which enable them to be introduced into food products with high nutritional value to reduce the lack of elements in the body, so it is important to conduct more research to test the possibility of adding it in healthy products that serve a wide range of age groups.

IV. Acknowledgements

We would like to gratitude Food Dep. College of Agriculture, Basra University for supporting this research work.

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