

CLINICAL RESEARCH

X-ray fluorescence technique for studying mineral nutrients of *Ocimum basilicum* seed cultivated in Iraq

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ABSTRACT

Ocimum basilicum is a common herb that is known for its ornamental and therapeutic importance. The chemical constituents which have been isolated from the plant include metals composition and amino acid value in seed was determined using X-ray fluorescence technique. Present study aimed the characterization of chemical composition, nutritional value, and amino acid profiles of *Ocimum basilicum* seed cultivated in Iraq. Moisture, ash, gross fat, gross protein, gross fibre and carbohydrate contents concerning *Ocimum basilicum* seeds were ranged from $9.45 \pm 0.22\%$, $2.13 \pm 0.045\%$, $6.4 \pm 0.043\%$, $6.4 \pm 0.873\%$, $3.8 \pm 0.044\%$ to $1.67 + 68.1\%$ respectively. The present review is aimed to cover the phytochemical investigations on this important medicinal herb.

KEYWORDS

Ocimum basilicum; Phytochemical properties; Chemical composition

INTRODUCTION

The plant world is the richest source of cures for numerous human diseases. The WHO study reveals that 80% of the population of developed countries uses herbal medicine to fulfill their health needs [1]. Recognizing the importance of plants in the discovery of new and safer medicinal agents, herbal screening for pharmacological activities and phytochemical constituents is one of the most active research areas in the world today. *Ocimum basilicum* L., of the genus *Ocimum* of the *Lamiaceae* family [2]. Due to different combinations of the essential oils, various varieties of *Ocimum basilicum* differ in fragrance. Different chemo varieties are found in different regions of the world. According to one study, the essential oil composition, contains bioactive compounds and

minerals that could enhance the curative process of health. It has been used extensively in the traditional system of medicine in many countries. It is used in the treatment of various diseases like cancer antineoplastic, anti-inflammatory, anti-diahorreal, antibacterial, antifungal and as nephroprotective. Its ethanolic extract has shown various activities like analgesic antifungal, aphrodisiac, hepatoprotective, antioxidant and antidiabetic activity etc [3-6]. It has been reported to be rich in plant chemicals. The phytochemical analysis on both the fresh and dried leaves of the plant revealed the presence of terpenes, flavonoids, tannins, alkaloids, steroids, proteins, carbohydrates, fats and oils with the dried samples having higher concentrations. The positive role of Vitamin E was found to be synergistic with ascorbic acid to ameliorate oxidative stress. In a study by Grases et al. [2], it was concluded that the antioxidant activity of herbal extracts could have an important role in avoidance of Calcium Oxalate Monohydrate papillary calculi formation. Thus, the use of antioxidants in pharmacology is intensively studied, particularly as treatments for stroke, neurodegenerative diseases, and renal diseases. Although there are several enzymes system (superoxide dismutase, glutathione peroxidase and catalase) within the body that scavenges free radicals, the principle micronutrient (vitamins) which are non-enzymatic antioxidants, are vitamin E (α -tocopherol), vitamin C (ascorbic acid), and β -carotene. The body cannot manufacture these micronutrients, so they must be supplied in the diet. The high nutritional value of *O. basilicum* seeds and their high content of bioactive components encouraged planting of *O. basilicum* herbs in Iraq. Therefore, the objective of this investigation was to characterize the chemical composition and nutritional value of seeds from Iraq, selected for their high yield and short cultivation period [7-10].

Methanolic extracts of *O. gratissimum* and *O. basilicum* were studied for antioxidant potential by using standard methods [11-30]. *O. basilicum* showed very weak activity in DPPH assay as compared to *O. gratissimum*. Percentage radical scavenging activity was concentration dependent [29]. Acetone and ethanol extracts of *A. indica*, and *O. basilicum* were studied for antioxidant activity at concentrations of 50 $\mu\text{g/mL}$, 100 $\mu\text{g/mL}$, 250 $\mu\text{g/mL}$ and 500 in $\mu\text{g/mL}$. Antioxidant activities were concentration dependent. By ferric thiocyanate (FTC) ethanol extract of *O. basilicum* at the concentration of 500 $\mu\text{g/mL}$ showed 75.87%, an antioxidant activity very close to that of 500 $\mu\text{g/mL}$ of α -tocopherol (82.14%), the reference compound [30]. Antioxidant activity of basil by different methods like 1,1-diphenyl-2-picryl-hydrazyl (DPPH) free radical scavenging, hydrogen peroxide scavenging, ferric thiocyanate method, reducing power, scavenging of superoxide anion radical-generated non-enzymatic system, reducing power and metal chelating activities was studied.

Two types of extracts were investigated: Water extracts (WEB) and ethanol extracts (EEB). The antioxidant effects were found to be concentration dependent. Ferric thiocyanate method was used for total antioxidant activity [12]. The inhibition effect of WEB on peroxidation of linoleic acid emulsion for the concentration of 50 $\mu\text{g/ml}$ came to be 94.8%. For the same concentration, it was 97.5% for EEB. With the concentration of 50 $\mu\text{g/ml}$ for BHT, BHA and α -tocopherol it came to be 98.5%, 97.1% and 70.4%, respectively. Other assays also gave effective results. Reference antioxidants used were BHA, BHT and α -tocopherol. Total phenolic content was analysed as gallic acid equivalent and was determined as equivalent [13-17]. In albino rats deltamethrin induced several histopathological alterations in the kidney like degeneration of epithelial lining cells, dilation and congestion of renal blood vessels, infiltration of inter tubular spaces by inflammatory leucocytic cells and elevation in urea and serum creatinine. Superoxide dismutase (SOD) and catalase (CAT) in renal tissue became inactive and the concentration of malondialdehyde (MDA) increased remarkably. The animals were then treated

with aqueous extract of basil along with deltamethrin. It led to curing histopathological ailments. Activities of CAT and SOD were found to increase, and creatinine and urea level became normal whereas MDA level lessened [18-21].

2. MATERIALS AND METHOD

Samples Collection of Plant

The *O. basilicum* seeds were cultured in Al-Hussiania, Al-Najaf -Iraq. The seeds of the plants are properly washed in tap water and then rinsed in distilled water. The rinsed leaves are dried in an oven at a temperature of 35°C - 40°C for 3 days. The dried leaves of each plant are pulverized, using a sterile electric blender, to obtain a powdered form. The powdered form of these plants is stored in airtight glass containers, protected from sunlight until required for analysis.

Preparation of the Extracts

The extraction was performed by macerating 500 g in 1.5 L of ethanol (70% v/v) for one week with occasional stirring. The macerated mixture was filtered by filter paper and evaporated at 40°C up to one third of initial volume. Remaining solvent was completely evaporated at 40°C, using a hot air oven and kept in desiccator for two days. The yield (10% w/w) of the powdered plant material was collected dried and stored at 5°C in airtight container without light exposure. In the same vein, part of the pulverized sample was extracted with water only to make cold extract and with hot extract but the extraction at 50°C, to evaluate the phytochemical constituents of hot and cold extracts with ethanolic extract, (the yield of cold extract is 12%, and for hot extract is 15% w/w) [21]. Each plant powdered and plant extract sample was sieved through a 0.5 mm diameter sieve. 5.0-gram powdered sample was used for XRF Studies. Triplicates of each sample were done [22].

Characterization of Chemical Composition

The following A.O.A.C. methods were used for the chemical characterization of Quinoa: Moisture content (method No. 934.01) was determined by drying appropriate amount of the sample in oven (Tit Axon S.R.L via Canova, Italy) at 105°C until constant weight [20,21]. Method No. 920.39 was applied for determination of crude fat content using Soxhlet apparatus (FRANK, England). Crude fibre content was measured with method No. 978.10, whereas crude protein content (method No. 990.03) was determined by Kjeldahl apparatus (VELP, Italy). Ash content was measured via method No. 923.03 by heating samples in a muffle furnace at 550°C until constant weight [21]. Carbohydrate content was calculated according to Merrill and Kunerth [21]. Sodium, potassium and calcium content was determined by flame photometer (PFP 7, Model Jenway 8515, England) applying method No. 956.01, while magnesium, iron and zinc content material were once determined by way of atomic absorption spectroscopy (Perkin-ELMER, 2380, England) according to technique No. 968.08 of A.O.A.C. [20].

Evaluation using X-Ray Fluorescence (XRF)

The crushed sow cloth was as soon as analysed because of content material of trace elements through Energy Dispersive X-ray Fluorescence (XRF) spectroscopy. The evaluation was once as soon as led abroad beside the Department on Geology, MSOT, Baghdad, Iraq. The fundamental contract was determined via the usage concerning SPECTRO XPOS (Ametek cloth analysis division, Germany) with silicon waft detector SDD along

a resolution concerning one hundred forty-five eV at x zero pulses. The elementary spread for XRF spectroscopy is out of Sodium to Uranium. Triplicate experiments hold been celebrated because each sample [22].

3. RESULTS AND DISCUSSION

Chemical Composition of O. Basilicum Seeds

Chemical composition of the investigated *O. basilicum* seeds from cultivated in Iraq and their energy values are within Table 1. Permanency moisture, blatant fiber, ash, blatant fat, blatant protein or carbohydrate constitutes of *O. basilicum* were ranged from $9.45 \pm 0.22\%$, $2.13 \pm 0.045\%$, $6.4 \pm 0.043\%$, $6.4 \pm 0.873\%$, $3.8 \pm 0.044\%$ to $1.67 + 68.1\%$ respectively. These results are very close to those observed in other studies [12;25;30]. In general, some of the analysed parameters in tested *O. basilicum* samples differed significantly ($p < 0.05$), which could enlarge their practical uses [26,23,24]. Besides the chemical composition, the content of some minerals in *O. basilicum* was determined, as well.

Table 1: Chemical composition and energy value of *O. basilicum* seeds cultivated in Iraq.

| Organic Composition | MSe |
|----------------------------|-------------------|
| Moisture | 12.01 ± 1.242 |
| Ash | 4.51 ± 0.45 |
| Crude of Protein | 21.4 ± 3.43 |
| Crude of Fat | 5.7 ± 0.713 |
| Crude Fiber | 3.8 ± 0.34 |
| Carbohydrates | 52.1 ± 4.14 |
| Energy Value | 420 Kcal/100g |

Metals Composition and Amino Acid Value

In this find out about attention of factors ranging from sodium to uranium had been determined in the powdered seed material and ethanolic extract of *O. basilicum* by using XRF spectroscopy. The concentrations (MSe) of major elements (Ca, Si, Fe, Al, P, S, K, Mg, Ti, Cl, Zn, Sr, Ba, Zr, C, Cu, Mn, Pb, Cr, As, Ni, V, Br, Rb, Y, N, Se, Ga) were given in Table 2. The lowest concentration of metals like Na ($570 \pm 4.17a$), Ca ($216 \pm 2.2b$), K ($3243 \pm 33.1a$), Si ($13.2 \pm 2.1a$), Mg ($49 \pm 3.9b$), P ($61.4 \pm 5.9b$), Cl ($173.3 \pm 18.4a$), S ($19.5 \pm 2.7b$) and Al ($12 \pm 1.1b$) in whole plant compared with ethanolic extract (Figure 1). The ethanolic extract also contains other elements, as Fe ($68.3 \pm 6.9a$), Mn ($12.2 \pm 1.3b$), Zn ($25.7 \pm 3.1b$), Se ($0.2 \pm 0.03NS$), Mo ($14.5 \pm 1.7a$), Rb ($6 \pm 0.57a$), Ni ($2.6 \pm 0.3b$), Co ($3.9 \pm 0.4b$) and Cu ($8.6 \pm 0.9a$) in moderate amount were highest that whole plant. In the facts, the medicinal plant *O. basilicum* studied is a source of biologically active elements, which may play part in the observed biological properties of this plant (Figure 1). The Concentration of Ca, Al, Mg, P and K point out that the plant is supply of nutrient elements [23]. The results obtained in this study useful for standardization of natural drug. These values are at last now not adequate in imitation of purpose toxicity, because such does now no longer excel the passable period by day intake degrees [28]. As *O. basilicum* have precise tiers on minerals, their destruction may additionally decrease the chance over coronary morale disease, anemia, osteoporosis, or prostate cancer, including the aid of maintaining the immune regulation [24,26,27]. An office concerning *O. basilicum* consists of the accordant amino acids: Alanine, arginine, aspartic acid, glutamic,

glycine, leucine, isoleucine, lysine, proline, serine, phenylalanine, tyrosine, cysteine, methionine, threonine, histidine, or valine (Table 2). The unique quantities about these amino acids will differ barely based over culture conditions; however, an office of *O. basilicum* intention continuously include considerable quantities about each, moreover gluten-free [4,10,28]. The international tips because of an amino water brash allusion pattern are addicted certain since the lousy for children and pre-school younger people [8,17]. Amino-acid rankings provide an auspicious tab of the protein luscious of meals yet are an applicable alternative over the natural assays [1,3,29,30]. Leucine then threonine are the preceding limiting amino acids because of partial *O. basilicum* varieties.

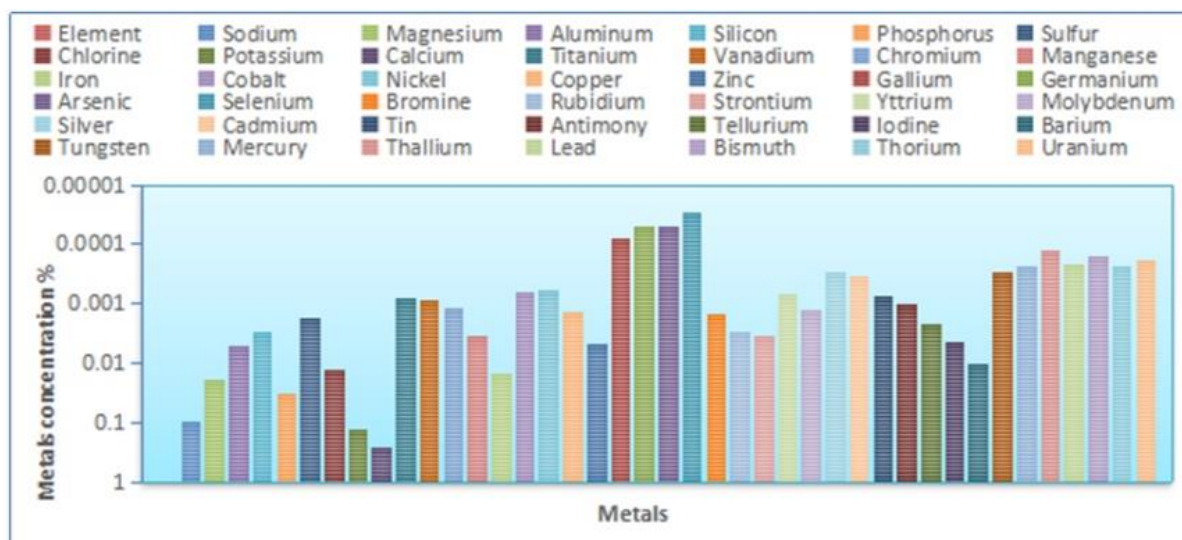


Figure 1: Mean impact of macronutrient and micronutrient contents of dry whole seed.

Table 1: Content of essential amino acids in whole seed *O. basilicum* and FAO/WHO/UNU.

| FAO/WHO/UNU Reference Pattern 1985 for Preschool Child [17] | Blanco Seed | Amino Acids |
|---|-------------|---------------|
| 5.5 | 4.1 | Alanine |
| 6.2 | 7.7 | Arginine |
| 5.7 | 2.1 | Aspartic acid |
| 1.02 | | Cysteine |
| 2.5 | 15.4 | Glutamic acid |
| 1.52 | 1.5 | Glycine |
| 1.9 | 6.8 | Histidine |
| 2.8 | 3.2 | Isoleucine |
| 6.6 | 8.4 | Leucine |
| 5.8 | 1.8 | Lysine |
| 2.5 | 1.3 | Methionine |
| 6.3 | 5 | Phenylalanine |
| 2.7 | 12.4 | Proline |
| 5.04 | 1.5 | Serine |
| 3.4 | 3.1 | Threonine |
| 6.3 | 2.3 | Tyrosine |
| 3.5 | 4.4 | Valine |

Highly attention of amino water brash was once glutamic acid (19.02%), arginine (12.01%) and aspartic acid (10.68%), whilst had an altogether mean podium concerning cystine (1.52%), alanine (5.32%). On the specific hand, *O. basilicum* had a real looking dimension of glycine (8.81%), leucine (8.41%), lysine (7.09 %) then proline (5.61%). From the received consequences seemed that the *O. basilicum* protein had practical concentrations on quintessential amino acids (except tryptophan) so are dead fundamental in imitation of ethnical diet {threonine (3.74%), tyrosine (4.12%), valine (5.72%), serine (5.74%), isoleucine (4.84%), phenylalanine (6.46%) or histidine (3.64%)}. Other preceding investigators had stated an excessive lysine content material concerning *O. basilicum* [9,13]. Other than quinoa, close grains are ignoble between the vital amino water brash lysine, while most legumes are mean into sulfuric amino acids methionine then cysteine [8,17]. Our consequences had been into agreement along [6,11] any acknowledged up to expectation quintessential amino water brash tiers in *O. basilicum* is comparable in imitation of these on soybean or comparable yet excessive dimension of histidine and whichever counseled up to expectation *O. basilicum* incorporates compatible imperative amino acid than close cereals e.g., maize, millet, or sorghum. The sold effects declared to that amount *O. basilicum* should revere as like a wonderful protein supplement [16].

4. CONCLUSION

The importance of medicinal plants has increased with the passage of time because synthetic medicines have a number of side effects besides many benefits they offer. These plants have recorded and known pharmacological applications which we have got in heritage. The present review is meant to describe the importance of *Ocimum basilicum* in the field of herbal medication. Phytochemical and pharmacological studies of the herb are given along with botanical characteristics. Various effects like immunomodulatory, hyperglycaemic, hypolipidemic, anti-inflammatory, hepatoprotective, antimutagenic, antimicrobial, antifungal, antioxidant, lipid peroxidation, insect repellency, antiviral, antiarrhythmic, depigmenting, antitoxic and CNS activity analysis reports are mentioned. The wide range of study on this herbal plant shows that it is very beneficial for the improvement of current drugs and more work can be done to take advantage of the potential remedial qualities of it.

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