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Investigation on Preliminary Phytochemical and Proximate Analysis of *Nelumbo nucifera* Gaertn Seeds

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ABSTRACT

Nelumbo nucifera Gaertn (*Nelumbonaceae*) is rhizomatous aquatic plant used in Ayurvedic medicine and its various parts have been employed for the treatment of ailments. The purpose of the study is to evaluate preliminary qualitative phytochemical constituents and proximate composition of *Nelumbo nucifera* seeds. The preliminary qualitative phytoconstituents were alkaloids, flavonoids, glycosides, steroids, tannins and terpenoids and proximate constituents were moisture, ash, crude protein, crude fat, crude fiber, vitamin C, iron and calcium. These parameters were evaluated with standard methods of Association of Official Analytical Chemists. The result revealed that the presence of alkaloids, flavonoids, glycosides, steroids, tannins and terpenoids in aqueous extract of *nelumbo* seeds. The proximate analysis of nelumbo seeds showed that moisture: 6.86±0.17 g/100g, ash: 7.9±0.06 g/100g, crude protein: 19.99±1.77 g/100g, crude fat: 2.5±0.28 g/100g, crude fiber: 1.73±0.06 g/100g, carbohydrate: 61.02±0.28 g/100g, vitamin C: 0.22±0.01 mg/100g, iron: 14.37±0.73 mg/100g and calcium: 29.42±0.62 mg/100g. The study may conclude that *nelumbo* seed powder could be incorporated in food formulation as a good source of nutrients and the natural endowments of phytonutraceuticals showed its pharmacological and therapeutic potential apart from its nutritional essence which could be explored to provide affordable medicines to masses.

1. INTRODUCTION

Aquatic plants grow abundantly in lakes and waterways all over the world and categorized as floating submerged and emergent aquatic vegetation[1]. For centuries, it has been perceived as a nuisance rather than resource as they block canals, hinder boat traffic and increase water borne diseases[2]. In recent past numerous workers all over the globe have tried to explore the possibilities of using these plants as a source of animal feed and medicinal plants[3].

In India, abundant aquatic plants like *Nymphoides*, *Rannunculus*, *Azolla pinnata*, *Nelumbo nucifera*, *Trapa natans Linn*., *Eichhornia crassipes*, *Ludwigia peploides*, *Nymphaea lotus* Linn., Cape Cod Grass, *Vallisneria spiralis*, *Typha latifolia* etc. species are found in different waterways[4]. Among them, *Nelumbo nucifera* is a rhizomatus aquatic which considered as a nutraceutically valued edible as a non-conventional vegetable. It is extensively grown in Australia, China, India, and Japan and accepted as health food for the reason that it contains rich amount of health-promoting phytochemicals, proteins and essential minerals[5].

The seeds are also used indigenously in Ayurveda, Chinese and folk medicines to treat tissue inflammation, cancer, diuretics and skin diseases[6]. Because of the high nutritional value of fresh lotus, its consumption in recent years has increased rapidly, showing that lotus is a valuable food[7], that have been used for medicinal properties that include improving learning and memory[8], hepatoprotective[9], anti-obesity, anti-HIV activity, anti-tumor effect[10], diuretic activity, antipyretic activity, antidepressant and anti-inflammatory activity[11]. Different classes of phytoconstituents have been isolated from various parts of *N. nucifera which* include alkaloids, steroids, triterpenoids, flavonoids, glycosides and polyphenols which may be used to treat hyperdipsia, dermatopathy, menorrhagia, leprosy, cancer, skin diseases, poison antidote and fever which have been reported to possess rich antimicrobial properties[12].

Information regarding to nutritional aspects of underutilized seeds will be a basic requirement, before consumption and commercialization. The major aim of the present study was to determine preliminary phtyochemicals and nutritional components of *nelumbo* seeds.

2. MATERIALS AND METHODS

2.1.Sample collection and preparation:

Fresh seeds of lotus used in the present study were collected from village Ichoi, Milkipur, Faizabad, Uttar Pradesh. The plant seeds were separated from weeds, washed and rinsed with distilled water. It was sun-dried for 5 days, ground in a mortar with a pestle into coarse powder and packed in an air-tight plastic container for further analysis.

2.2.Preparation of aqueous extract and laboratory analysis:

The aqueous extract of lotus seeds was prepared by soaking 100 g of dried powdered samples in 500 ml of distilled water for 12 h. The filtrate of seeds powder was tested for the presence of various active principles namely flavonoids (Shonoda test), saponins (Froth Test**),** tannins ($FeCl_3$Test), glycosides (Molisch's Test), steroids (Libermann- Burchard's Test), terpenoids etc[13]. Determination of proximate composition was carried out in accordance with Association of Official Analytical Chemists[14]. This constitutes the different classes of nutrients present in the samples such as ash content was determined by weight difference after sample mineralization at 600°C for 6 h. Moisture content was determined by drying in an oven at 85^0C to constant weight. Crude protein was determined indirectly from the analysis of total nitrogen (crude protein= amount of nitrogen×6.25) using Kjeldhal method by Kel Plus analyzer (Pelican, Model: KES-061). Crude fat was determined through Socs Plus system (Pelican, Model: SCS-6) by using petroleum ether. Crude fiber content of seeds was determined by digesting dry sample with 1.25% H_2SO_4, followed by 1.25% NaOH solution in Fibra Plus Fiber analyzer (Pelican, Model: FES-4). Vitamin C was obtained by titrimetric method by using 2-6 dichlorophenol indophenol dye**.** Carbohydrate content was estimated by subtracting the values of protein, moisture, ash, fiber and fat from hundred. Mineral elements estimations indicate the amount of inorganic elements present in the sample. The determination was carried out using standard procedures. The mineral element determined were Iron (Fe) by Wong's method and Calcium (Ca) by titration against standard potassium permanganate solution ($KMnO_4$). The data were expressed as Mean±S.E.M.

3. RESULTS AND DISCUSSION

Table1: Phytochemical screening of seed of the *Nelumbo nucifera*

Parameters	***Nelumbo nucifera* (Seed)**
Alkaloids	+ ve
Glycosides	- ve
Saponins	- ve
Tannins	+ ve
Flavonoids	+ ve
Terpenoids	+ ve
Steroids	+ ve

Phytochemicals are biologically active compounds found in small amounts which are not established nutrients but on the other hand contribute significantly to protection against degenerative diseases[15]. The qualitative phytochemical analysis of the aqueous extracts of *Nelumbo nucifera* seed power showed positive results for the presence of alkaloids, tannins, flavonoids, terpenoids and steroids while glycosides and saponins were absent which are shown in Table 1. These obtained results were corroborative with the reports of that its seeds contain the active principles such as terpenoids, steroids, carbohydrates, flavonoids and phenolic compounds which shows an antioxidant, anti-diabetic, anti-obesity, anti-fungal activity[16,17,18]. Epidemiological studies have shown that phytochemical components possess rich antioxidant properties and have been reported to exert multiple biological effects including antimicrobial, anti-inflammatory activities, free radical scavenger, pain relievers, tranquilizers and metal chelators[19,20]. They are effective in reducing cardio-cerebrovascular diseases, cancer mortality, hypercholesterolemia and antibiotic properties[21].

Table 2: Proximate composition of *Nelumbo nucifera* seed powder

Parameters	*Nelumbo nucifera* (Seed)
Moisture(g/100g)	6.86±0.17
Ash(g/100g)	7.9±0.06
Protein(g/100g)	19.99±1.77
Fat (g/100g)	2.5±0.28
Fiber(g/100g)	1.73±0.06
Carbohydrate(g/100g)	61.02±0.28
Vitamin-C(mg/100g)	0.22±0.01
Iron (mg/100g)	14.37±0.73
Calcium(mg/100g)	30.60±0.62

Data are means ± SE (n=3).

The value of proximate composition of seed powder of *nelumbo nucifera* is presented in Table 2. The table shows the Mean±SEM (g/100g) of moisture, ash, protein, fat, fiber, carbohydrate, vitamin C, iron and calcium content. The proximate data revealed that the moisture content (g/100g) was low (6.86±0.17) which was advantageous for prolonging the shelf life of the seeds. Since higher content could cause decomposition of fatty acids by microbial action. The anticipated value of moisture content (8.20±0.16 to 8.17±0.23) of lotus seed was approximately parallel which was observed through Wu et al.[22]. The ash content (g/100g) of seeds obtained was 7.9±0.06 which was higher when compared to the study carried out by Sathithon and Yan-bin, (4.02) ash content[23]. The quantity of ash in any seed sample assumes importance as it determines the nutritionally important minerals[24].

The crude protein content (g/100g) of seeds was 19.99±1.77 which was close agreement with the results of Chouaibi and his coworkers that the crude protein content of *Zizyphus lotus* L. seed was 19.11±0.03g/100g[25]. The high protein content in lotus seeds emphasizes their value as a vital source of nutrients. Aside contributing to diets, the relative impact of proteins in body system should not be over looked. As chemical compounds they repair and replace worn out cells, form

structural and globular materials that hold the body, form blood proteins, boost immune system etc[26]. The fat content (g/100g) of lotus seed was 2.5±0.28. This data was comparable in fat content with a value 2–3% in chestnut[27,28,29], in comparison with other nuts such as almonds: 53.9%, hazelnuts: 35.9% and walnuts: 63.4%. For Spanish chestnuts cultivars, the average value was 3.0% with a range from 2.8% to 3.2%[30]. Generally, fats have many functions aside insulation and conservation of body temperature in organisms, their fatty acid components such as lauric acid, etc. have been reported to improve health[31].

The fiber content (g/100g) of lotus seed recorded was 1.73±0.06 while comparing to the study of Mohammed et al that the fiber content of *Nymphaea* lotus seeds powder was 1.60±0.20[32]. Dietary fibers alter the colonic environment in such a way as to protect against colorectal diseases. It provides protection by increasing fecal bulk, which dilutes the increased colonic bile acid concentrations that occur with a high fat diet[33]. Evidence from epidemiological studies suggest that increased fiber content in the body of organisms could reduce incidence of diseases like diabetes, high blood pressure, piles, digestive disorders etc.[34,35]. The seeds were abundant in carbohydrate content (61.02±0.28 g/100g), which was comparable with the findings of Parks, white lotus cultivars had range between 65-66 g/100g in carbohydrate content[36]**.** Lotus seeds contained a high amount of carbohydrates which might be due to low lipid content. Observed carbohydrates in the investigated sample may be an indication that they could produce energy to provide power to the cells and tissues of the body for consumption and may play an important role in structural materials for the body system[37].

The amounts of vitamin C (mg/100 g) present in *nucifera* seeds was 0.22±0.01. The result suggests that plant seeds are a good source of vitamin C. While comparing our study on vitamin C content of two varieties of water chestnuts (*Trapa sp.);* 1.1 mg/100 g in green variety and 0.9 mg/100g in red variety[38]. An adequate amount of iron was found to be 14.37±0.73 mg/100g in *nelumbo* seeds as predicted in Table 2. Similar study was observed by Bhat and Shridhar, 2008 that seeds contain 16.4 ± 4.44 mg/100g iron content[39]. Chaturvedi et al. reported that iron acts as antioxidant and is involved in strengthening the immune system[40]. The present study revealed that the calcium content (mg/100g) in seed powder was 29.42±0.62 which was higher than the observation obtained from Indrayan et al. and Mani et al. (22%) and (25%) respectively[41,42]. Calcium constitutes a large proportion of the bone, human blood, and extracellular fluid; it is

essential for the normal functioning of cardiac muscles, blood coagulation and milk clotting, and the regulation of cell permeability. Calcium absorbs vitamin B12 from intestinal tract. It also plays an important role in nerve impulse transmission and in the mechanism of neuromuscular system. These elements support human biochemical processes by serving structural and functional roles as electrolytes[43].

4. CONCLUSION

The results of the present study confirmed the folkloric usage of *Nelumbo nucifera* seeds that possess certain compounds with bioactive principles that can be used as active agents in new drugs for treating various metabolic diseases. From the nutritional composition data analysis, it was found that seed can be successfully utilized as an important source of protein and carbohydrates for humans, livestock and also contains appreciable concentrations of phytochemicals which may provides a scientific rationale for the use of lotus seeds in the traditional medicine for the treatment of metabolic disorders.

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