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Phytochemical, Nutritional and Pharmacological evidences for *Abelmoschus esculentus* (L.)

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ABSTRACT

Okra is a nutritional source of power used throughout history for both medicinal and culinary purposes. Okra is good source of minerals, vitamins and nutrients that are responsible for the health benefits. It has various reported pharmacological properties like antidabetic, antioxidant, nootropic, eye, heart disease and neurological disorders etc. This effort is towards providing the evidence in support to encourage more scientific research to find out more pharmacological and nutritional potential of *Abelmoschus esculentus* that may be suggestive of new drug discovery.

Keywords: *Abelmoschus esculentus* (L.), Okra, Nutritional, Health benefits.

INTRODUCTION

Okra *(Abelmoschus esculentus* (L.) Moench) is one of the important vegetable having better dietary value with medicinal and industrial importance. It isalso known as lady's finger, is flowering plant in the mallow family. Even though, the plant is cultivated in tropical and warm temperate region around the world but the species is still poorly studied [1].

It is one of the most widely known and utilized species of the family Malvaceae [2] and an economically important vegetable crop grown in tropical and sub-tropical parts of the world [3].

Okra originated in Ethiopia [4] and was then propagated in North Africa, in the Mediterranean, in Arabia and India by the 12th century BC [5]. The name Okra probably derives from one of Niger-Congo group of languages (the name for okra in the Twi language is nkuruma) [6]. The term okra was in the use of English by the late 18th century [7]. Okra is a multipurpose crop due to its various uses of the fresh leaves, buds, flowers, pods, stems and seeds [8].

Various Names of okra [9]

Sr. No.	Country	Name
1.	India	Bhendi
2.	United States	Okra
3.	Caribbeans	Okro
4.	China	Qui-kui
5.	Europe	Quiabo
6.	Portuguese	Guigambo
7.	Spanish	Gombo
8.	French	Gombo

Okra dietary and nutritional values

Okra plays an important role in the human diet by supplying carbohydrate, minerals and vitamins. K, Na, Mg and Ca were found to be the principle elements, with Fe, Zn, Mn and Ni also present [10]. Okra seeds could serve as alternate rich sources of protein, fat, fiver and sugar [11]. The natural phenolic content of okra seeds has been reported [12].

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Nutritional Value of Okra per 100gms [13]	
Energy 33kcal	
Dietary fibre	3.2gm
Carbohydrates	7.6gm
Fat	0.1gm
Proteins	2.0gm
Calcium	75mg
Magnesium	57mg
Potassium	299mg
Vitamin A	669IU
Vitamin C	23mg
Vitamin K	31mg

Figure 1: Okra Plant

Phytochemical properties

Phytochemical words came from Greek word *Phyto*–plant and chemicals. The term phytochemical is usually used to those chemicals that may have biological significance but are not established as important nutrients. But in narrower sense the term phytochemical describe the number of secondary metabolic compounds found in plants. The scientists estimate that approximately 10,000 different phytochemicals having the potential therapeutic effects on various ailments. Okra seed consists of tannins, terpenoids and glycosides[12, 14].

Reported pharmacological properties

Gastro protective effect

Abelmoschus esculentus lectin (AEL) gastro protective effect on gastropathy induced by ethanol. 0.2 ml/animal, p.o. given to fasted mice of ethanol 99.9% received previously AEL (0.01, 0.1, 1.0, 10 or 50 mg/kg, i.v.), saline (5 ml/kg; i.v.) or ranitidine (80 mg/kg, p.o.). The mice were euthanized 30 min after ethanol challenge to verify the stomach damages. Gastric oxidative stress, tissue hemoglobin content and microscopic features were taken in order to characterize the AEL gastro protective effect. AEL (1 mg/kg) was capable of protect mucosa against ethanol damages in presence of two Evaluation of microscopic features, oxidative stress, and Hb levels pointed the protective effects of AEL. AEL simultaneously showed antioxidant effect that is probably implicated in its intricate defensive mechanism of action[15].

Anti-fatigue and antioxidant effects

The contents of total polyphenols and total polysaccharides were 29.5% and 14.8% in okra seeds and 1.25% and 43.1% in okra skin, respectively. Total flavonoids, isoquercitrin and quercetin-3-O-gentiobiose (5.35%, 2.067% and 2.741%, respectively) were only detected in okra seeds. Antioxidant assays, including 1-diphenyl-2-picrylhydrazyl scavenging, ferric reducing antioxidant power and reducing power test, and weight-loaded swimming test showed okra seeds possessed significant antioxidant and anti-fatigue effects. Moreover, biochemical determination revealed that that anti-fatigue activity of okra seeds is caused by reducing the levels of blood lactic acid and urea nitrogen, enhancing hepatic glycogen storage and promoting antioxidant ability by lowering malondialdehyde level and increasing superoxide dismutase) and glutathione peroxidise levels[16].

Antiadhesive effects against H. Pylori

Polysaccharide containing extracts from immature fruits of okra (Abelmoschus esculentus) are known to exhibit antiadhesive effects against bacterial adhesion of Helicobacter pylori (H. pylori) to stomach tissue. The present study investigates structural and functional features of polymers responsible for this inhibition of bacterial attachment to host cells. Ammonium sulfate precipitation of an aqueous extract yielded two fractions at 60% and 90% saturation with significant antiadhesive effects against H. pylori, strain J99, after preincubation of the bacteria at 1 mg/mL [17].

Neurological disorders (Alzheimer)

The okra treatment provides important in vitro data on the effects of okra on various AlD-associated cellular processes in H63D variant HFE cells. These results suggest okra may be beneficial in people expressing the H63D variant to reduce the risk of Alzheimer's disease and other neurodegenerative diseases related to oxidative stress[18].

Nootropic potential

The seed extracts of Abelmoschus esculentus L. possess antioxidant, antistress, and nootropic activities which promisingly support the medicinal values of ladies finger as a vegetable. So the pretreatment of mice with aqueous and methanolic seed extracts of Abelmoschus esculentus (200 mg/kg, p.o.) for seven days significantly ($P < 0.01$) attenuated scopolamine-induced cognitive impairment in the passive avoidance test. These extracts were significantly reduced the blood glucose, corticosterone, cholesterol, and triglyceride levels elevated by acute restraint stress[19].

Hypolipidemic and Anti diabetic effects

The ethanolic extract of okra which contains, isoquercitrin and quercetin 3-O-gentiobioside reduced blood glucose and serum insulin levels and improved glucose tolerance in obese mice. The isoquercitrin treatment shows serum triglyceride levels and liver morphology in the mice were significantly ameliorated. Total cholesterol levels in isoquercitrin and quercetin 3-O-gentiobioside treated mice were also reduced. So okra may serve as a dietary therapy for hyperglycemia and hypertriglyceridemia[20].

Immunomodulating activity

A water-soluble polysaccharide (OFPS11) was obtained from okra (Abelmoschus esculentus) flowers using aqueous extraction and purification with DEAE-52 cellulose and Sephacryl™ S-500 column. Its preliminary characterization and immunomodulating activity were investigated. Results showed that OFPS11 is mainly composed of galactose and rhamnose in a molar ratio of 2.23:1 with molecular mass of 1,700 kDa. RAW264.7 cells pretreated with OFPS11 significantly inhibited the proliferation of HepG-2 cells. Additionally, OFPS11 enhanced the phagocytic ability and induced the elevation of NO production, TNF-α and IL-1β secretion of RAW264.7 cells. OFPS11 can strongly increase NF-κB levels in nucleuses, which is an important transcription factor that can modulate expressions of iNOS, NO and TNF-α. These outcomes support that OFPS11 exerts its antitumor activity by probably stimulating macrophage activities through nuclear NF-κB pathway[21].

Hepatoprotective Actvity

The antioxidant effect was assessed using DPPH and hydroxy radical scavenging assays. The hepatoprotective effect of the extract was evaluated using CCl_4 intoxicated $HepG_2$ cell line and Wistar rats by estimating the levels of hepatic and antioxidant markers. The root extract of A. esculentus showed IC_{50} values of 270.99 and 532.86 µg/mL for DPPH and hydroxy radical scavenging assays, respectively. The incubation of HepG2 cells with CCl_4 drastically decreased the cell viability and increased the leakage of transaminases. Pre-treatment with the extract significantly restored the cell death by 31.25 and 39.04% at 200 and 400 µg/mL concentrations, respectively. The reduction of ALT leakage by the treatment was 18.62, 38.59 and 52.15% compared to the CCl_4 treated cells at 100, 200 and 400 µg/mL, respectively. In in-vivo experiments also the treatment reduced the levels of transaminases, ALP, MDA, total bilirubin and hepatic TNFα levels as well as increased the antioxidant levels in a dose dependent manner. Histological observations of liver sections showed reduction in steatosis, necrosis and inflammation[22].

Cardiovascular disease

Okra is also used to improve cardiovascular disease. The okra reduce serum cholesterol and therefore decreases the chance of heart disease. The use of okra is an efficient method to manage the body's cholesterol level. Okra is additionally loaded with pectin that can help in reducing high blood cholesterol simply by modifying the creation of bile within the intestines [23].

Vital substance for optimum pregnancy

Okra is full of both foliate and vitamin C. Which is responsible for maintaining and creating fresh cells, foliate is a vital substance for optimum pregnancy. It is preventing birth defects in the developing baby. Vitamin C also as well required for baby development. Foliate is a vital nutrient that increases the growth and development of the fetus' brain. The high quantity of folic acid within okra performs a huge role within the neural tube formation of the fetus through the fourth to the 12th week of pregnancy [24].

Eye-sight improvement and Skin nourishment

For eyesight improvement Okra pods are used. The okra pods are implausible options for Vitamin A and also beta carotene that are both important nourishment for sustaining an excellent eye-sight along with healthy skin [25].

CONCLUSION

In this review article, compiled all medicinal and nutritional importance of Okra plant. Okra plant is a rich source of vitamins, minerals and phytoconstituents which are used in treatment of various types of ailments. It is essential the scientific community continues to unravel the mechanisms involved in disease prevention and determine how food bio-actives from such foods as Okra can influence human health. So we can say that Okra plant is a miracle plant.

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