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Review Article

**A REVIEW OF ABELMOSCHUS ESCULENTUS****Dr. S. Kusuma Kumari\*, K. Divya Vani, B.Jhansi, B.V. Ramana**

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**Abstract:**

*The present review aimed to compile up to date and comprehensive information of Abelmoschus esculentus with special emphasis on its phytochemistry, various scientifically documented pharmacological activities, traditional and folk medicine uses. It is one amongst these, found all over the world. It is traditional vegetable crop with considerable area under cultivation in Africa and Asia with huge socio-economic potential in west and central Africa. It has been called a perfect villager's vegetable because of its robust nature. This review describes a general overview of okra nutritional economic potential with special reference to its past and recent progress on germplasm regeneration, genetic studies and efforts on genetic improvement in west and central Africa. It plays an important role in good diet and is a good source of protein, carbohydrates, vitamins, calcium, potassium, enzymes and total minerals. It is an important vegetable crop widely grown in tropical, subtropical and warm temperature regions of world. The fruit or pods containing seeds are harvested when immature and are eaten as vegetables.*

**Key words:** Plant profile, Synonym of okra, Morphological characters, varieties and Pharmacological activities of okra

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**INTRODUCTION:**

*Abelmoschus esculentus* has fruit popularly known as Okra. It is an important vegetable grown for its green tender fruits. It is a perennial plant but most cultivated as an annual plant. Its immature green seed pod is eaten as a vegetable. Okra originated in Ethiopia and propagated in North Africa, in the Mediterranean, in Arabian and India. It is particularly popular in West Africa, India, the Philippines, Thailand, and Brazil. India is of great economic importance in the subtropical region of the world. It is an important vegetable in the diet of tropical countries. The major global producers are India, Sudan & Iraq.

The okra plant, also known as lady's finger, is a warm season vegetable that is popular in many cuisines worldwide. It is an annual plant that grows up to 3 to 6 feet in height and produces elongated, ribbed green pods. Okra thrives in warm climates and requires full sun exposure and well-drained soil. It is relatively easy to grow from seeds and is known for its hardiness.

Okra is versatile in cooking and can be used in stews, soups, curries, stir-fries, and pickled dishes. It acts as a natural thickening agent due to its slimy texture when cooked.

Okra is a nutritious vegetable, low in calories, and a good source of dietary fiber, Vitamins C and K, Folate, and Anti-oxidants. It offers several health benefits, including aiding digestion, promoting a healthy immune system, and potentially helping regulate blood sugar levels.

**PLANT PROFILE**

Botanical name - *Abelmoschus esculentus*  
 Kingdom- Plantae  
 Sub Kingdom- Trophobiont vascular plant  
 Super Division- Spermatophyta seed plant  
 Class -Magnoliopsida or dicotyledonous  
 Order -Malvaceae  
 Family -Malvaceae  
 Genus -Abelmoschus  
 Genus-Hibiscus



**FIG: Lady's Finger (*Abelmoschus esculentus*)**

**SYNONYMS FOR OKRA**

Gumbo, okra plant, lady's finger, *Abelmoschus esculentus*, hibiscus esculentus, Vegetable, Herb, Herbaceous plant, Pod, Seed pod.

**MORPHOLOGICAL CHARACTER****1. Leaves**

- It contains different shapes of leaves.
- Mostly they are heart-shaped.
- They are large with thick limbs.
- It contains three to five limbs.  
Color- Dark green on top, Gray on bottom
- They are petiole leaves
- These leaves are used as cattle feed

**2. Flowers:**

- They are yellow color /white
- They are solitary
- They are hermaphrodite.
- Bloom from July to September.
- They are rich in polysaccharides, polyphenols, and trace elements Etc.
- Okra flowers contain higher content of flavonoids than other parts.

**3. Fruits:**

- Color – Green yellow /Green. sometimes purple /white
- The fruit of okra is a capsule which is a simple dry fruit.
- It is dehiscent in nature.
- Multisided, multicarpellary, Syncarps, superior ovary
- Axile placentation

**4. Seeds:**

- Okra seeds were used throughout for the mineral, vitamins, amino acids, Fatty acids
- Seed oil -Rich source of linoleic acid.
- Seed should germinate in around 12-14 days

- Soil temperature 23-33c
- Seeds are small,0.5mm.
- The dry side contain 18 -20%  
20-23% oil

#### APPLICATIONS:

- Used to treat hypertension.
- It is an important medicinal plant of tropical and sub-tropical India.
- It is used as elixir in the treatment of various ailments.
- It plays an important role in human diet.
- It is used in treatment of Genito urinary disorder, spermatorrhea, chronic dysentery
- It is good source of proteins, vitamins, Ca, K, & enzymes.
- It causes relief from Hemorrhoids.
- It is rich in phenolic compounds with important biological properties like quaternary, flavanol derivatives.
- It helps to lower the serum cholesterol.
- It is the powerhouse of valuable nutrients.
- It is lower cost vegetable

#### VARIETIES OF OKRA

The number of varieties of okra has been released by private and public sector in India. The various varieties and cultivars differ in growth habit.

Plant height, fruit character presence of purple pigmentation on plant parts, color and number of ridges of fruits etc. Arka Anamika, Arka Abhay, sushthira, Anjitha, Manjima are resistant to yellow vein mosaic.

The characteristics of some varieties cultivated in India are:

##### 1. Pujab Padmini

This varieties have been developed by Ludhiana. Fruits are quick growing, dark green smooth, thin long with five ridged and retentive of tenderness. Fruiting starts 55-60 days after sowing. It has field resistance to yellow vein mosaic virus. This varies is suitable for cultivation under spring season

##### 2. Pusa Sawani

This is released from Indian Agriculture Research Institute new Delhi. It is an old variety which is resistance to yellow vein mosaic. This is suitable for cultivation under both spring and rainy seasons. Fruits are five ribbed, dark green in color and free from bristles.

##### 3. Pujab -8

This variety has been realised from Ludhiana. The plants are medium tall with splashes of purple pigmentation on stem. Fruits are thin, long, dark, green and five ridged. Its highly resistant to yellow-veins-mosaic virus. Moreover, it is tolerant to Jassi and borer

##### 4. Sushthira

The sushthira variety has been released from Kerala Agriculture University. It is high yielding perennial type okra producing 180g green okra fruits. It is resistant to yellow vein mosaic virus and is recommended for rainy season.

##### 5. Araka Anamika

It is released from Indian Institute of Horticulture, Bangalore. Fruits are special with spine less with 5-6 ridges delicate aroma and good keeping quality. It is resistant to yellow vein mosaic virus average yield is 300qha and can be harvested in 130 days

#### PHARMACOLOGICAL ACTIONS OF OKRA

*Abelmoschus esculentus* L. Moench (okra) which belongs to the family Malvaceae is a commonly consumed vegetable that consists of the seed component which is rich in polyphenolic compounds. The aim of this study is to highlight the chemical and biological diversity of *A. esculentus*. This plant contains many vitamins, minerals, proteins and carbohydrates in addition to flavonoids, terpenes, phenolic compounds and sterols. These variations in the chemical composition resulted in different therapeutic activities including antidiabetic, hypolipidemic, antioxidant, antimicrobial, anticancer, wound healing, hepatoprotective, immunomodulator, neuroprotective, and gastroprotective activities in addition to cardioprotective activity. *A. esculentus* promotes relief from emotional and mental illnesses like depression and laziness. It has a powerful cure for ulcers and promotes joint health. It is used for sore throats, gastrointestinal irritations and pulmonary inflammations. By modulating how quickly sugar is absorbed from the digestive tract, the Fibers in *A. esculentus* contribute to blood sugar stabilization. The *A. esculentus* polysaccharide was found to have hepatoprotective properties, according to earlier investigations.

*A. esculentus* is very rich in flavonoids. It has been known that flavonoids are a very important bioactive substance existing in the plant world. Additionally, it is very rich in terpenes, vitamins and steroidal derivatives. *A. esculentus* can not only be used as a kind of medicine for preventing cardiovascular and cerebrovascular diseases, but can also have physiological activities like antihyperlipidemic, antioxidant, antidiabetic, anticancer and cancer prevention, immune regulation, etc.

### ANTICANCER ACTIVITY OF OKRA

To examine raw polysaccharides, extract of okra as an anticancer agent against human liver cell.

#### Preparation of polysaccharides:

Okra fruits are obtained from market. Fresh okra pods were rinsed with water. These pods are cut and macerated with 500 ml of distilled water. The diseased okra fruits are separated, and centrifuged at 4300rpm for 5 min. These are precipitation with absolute ethanol (1:1 ratio) Incubate at 4c 24 hrs. then centrifuged the pellets are formed dissolved in distilled water and centrifuged. The supernatant was collected, lyophilized and labelled as okra raw polysaccharide extract.

#### Method :

Human liver cancer cell line it was grown in Dulbecco's modified eagle medium. These are cultured for 24hrs prior to treatment with extract (ORPE). The cell culture was divided into 3 groups.

1. Negative control group (KN).
2. Positive control group (KP, treated with 10 ml doxorubicin)
3. ORPE (p) group.
  - ORPE (p) group was divided into 5 sub-groups based on the dose used for treatment.
  - They are 50(P1) 100(P2) 200(P3) 400(P4) and 600(P5)
  - In vitro cell proliferation was measured using the MIT assay.
  - While measurement of Huh7 its cell apoptosis, necrosis, and cell cycle analysis were carried out using annexin V FITC -PI antibody test and flow cytometry.

#### RESULT

ORPE significantly inhibited Huh7 its cell proliferation and induced apoptosis. ORPE treatment with 600 ml extract caused 5.82% late cell

apoptosis and 5.62% early apoptosis cell cycle arrest occurred during G0/G1 phase

#### CONCLUSION:

Okra raw polysaccharides extract exerts anticancer effect on Huh7 its cancer cell significantly decreasing cell proliferation and inducing cell apoptosis. Thus, okra raw polysaccharide extract management of liver cancer patients.

The anticancer effect on okra on different type of cancer cell had been revealed. Lectin isolate from okra was able to induce significant cell growth inhibition in human breast cancer. Hence this study was design to evaluate the anticancer activity of okra raw polysaccharide extract (ORPE) in vitro

#### ANTIHYPERSENSITIVITY OF OKRA

The main aim of study was to know the antihypertensive activity of okra seed in fructose induced hypertensive rat model. In the experiment male Albino Wister rat was selected for experiments.

The selected rats were divided into four groups First group -Normal group  
Second group – Treat with only 10% w/v fructose solution for 6 weeks'

Third group – Treat with only 10% w/v fructose solution for 6 weeks

After 3 weeks it is treated with ethanolic extract of okra seed.

Fourth group – Treat with 10% w/v fructose solution for 6 weeks.

Enalapril used as drug control in this rat after 3 weeks.

Record the ECG, heart rate, and pressure of each rat and observe them. The total content of cholesterol and triglyceride were measured.

#### RESULT:

The ECG pattern and Heart rate was improved in the EAESE treated Hypertensive rats. Remarkable reduction in the Blood pressure [systolic arterial pressure (SAP), diastolic arterial pressure (DAP) and mean arterial pressure (MAP)] levels were observed along with a significant reduction in the Total cholesterol.

#### NOOTROPICACTIVITYOFOKRA

The main aim of these study was nootropic activity of okra. Mouse was gently placed in the illuminated compartment for the acquisition trial and the door

between the two compartments was opened 10 s later. When the mouse entered the dark compartment, the door automatically closed and an electrical foot shock (0.5 mA) of 2 s duration was delivered through the stainless-steel rods. Twenty-four hours after this acquisition trial, the mouse was again placed in the illuminated compartment for a retention trial. The time taken for a mouse to enter the dark compartment after its door was opened was defined as step-down latency for both acquisition and retention trials. Latency for entering the dark compartment was recorded up to 300 s. If a mouse did not enter the dark compartment within 300 s, the mouse was removed and assigned a latency score of 300 s.

The step-down latency of scopolamine ( $79.4 \pm 15$  s) treated mice in the passive avoidance task was significantly shorter than that of saline control mice ( $269.02 \pm 23$  s).

### CNS DEPRESSANT ACTIVITY OF OKRA

#### 1. Plant material & extraction:

The roots of okra plant were collected. The dried and coarsely powdered leaves (400g) were extracted with methanol at room temperature for 72 hrs. The filtrate was evaporated to dryness under reduced pressure.

#### 2. Animals;

Swiss albino mice were selected for this experiment. The animals were housed under standard laboratory conditions. Relative humidity – (55-65%). Room temperature –23. The animals are fed with standard diet and water.

#### 3 Preliminary phytochemical screening

The crude extract of *abelmoschus esculentus* roots was subjected to preliminary phytochemical screening for the presence of alkaloid, polyphenols, tannins, & glycoside. The total phenolic compounds & flavonoid content of okra was determined using Folin-ciocalteu reagent & alcohol calorimetric method. The total phenolic content of extract was expressed in terms of gallic acid equivalent. The flavonoid content quercetin equivalent.

#### 4. Acute toxicity test:

Test animals were divided into 6 groups which were administered different doses of crude extract (62.5,125,250,500,1000,2000&4000mg/kg). While the control group received only the vehicle (1% tween 80 in water, po).

The general signs & symptoms of toxicity were observed for 24hrs and mortality was recorded for

each group at end of period.

In CNS depressant activity 2 test are there

1. Open field test.
2. Hole cross test

#### 1 OPEN FIELD TEST:

The animals were divided into 3 groups:

1. Control group
2. Standard group
3. Test group
  - **Control Group:** It receives Vehicle (1% Tween 80 in water at the dose of 10ml/kg)
  - **Standard group;** Received diazepam at the dose of 1mg/kg body weight orally
  - **Test group:** Received crude extract (at the dose of 100 and 200 mg/kg p.o)
  - These animals are placed on open field. The number of squares visited by each animal was counted for 3min on 0,30,60,90,120,180, &240 min during the study period.

#### 2.HOLE CROSS TEST

The animals were divided into 3 groups

1. Control group
2. Standard group
3. Test group

**a) Control group:** It receives vehicle (1% Tween 80 in water at the dose of 10ml/kg)

**b) Standard group:** It receive diazepam at the dose of 1mg/kg body weight orally

**c) Test group:** Received crude extract at the dose of 100 and 200 mg/kg p.o

#### RESULT

In the open field test, extract exhibited a decrease in the movement of the test animal at all the doses level tested. The presence of alkaloids, flavonoids, and tannins, in the extract so, might be this Phytoconstituent.

#### ANTI BACTRERIAL ACTIVITY OF OKRA

- It refers to chemicals that kill or limit the growth of bacteria on a local level while remaining Nontoxic to surrounding tissue.

- The okra extract contains anti-bacterial property that can inhibit the growth of bacteria.

#### AIM

- The aim of the study was to determine the antibacterial potency of extract of various Parts of okra vegetables on Streptococcus Mutans.
- S. mutans is the main bacteria which are responsible for dental caries It is the wide variety of bacterial species. These are major cariogenic organisms produce large quantities of glucans as well as acids

#### Preparation of extract:

- ✓ One kg of fresh okra vegetables was taken
- ✓ Select the vegetables which are disease free
- ✓ The diseased vegetables are discarded and selected vegetables are washed with sterile with distilled water
- ✓ The peels and seeds of vegetable are separated
- ✓ The separated vegetables are dried under sunshade for 5days
- ✓ The dried part is grinded into fine powder
- ✓ Weigh 5gm of dried part and placed in separate test tube

A) one test tube -25ml acetone

B) other test tube -25 ml of ethanol

- ✓ The mixture was allowed to stand at room temperature 37 degree
- ✓ This preparation was stirred for every 24hrs
- ✓ Extract was filtered through Whatman's filter paper
- ✓ Filtered content were dry for 24 hrs.
- ✓ Final preparation was mixed mixed with 2ml of either solvent
- ✓ Mixture was used for antibacterial assay

#### ANTIMICROBIAL ASSAY

S Mutans are isolate from caries lesions of 10 patients. They are sub cultured On Brain Heart infusion agar Fresh colonies were obtained after 24hrs.

Determination of antibacterial activity was done by agar were diffusion method's The Brain heart infusion was poured into the sterile Petri plates.

After sometimes/ solidification 4mm well are cut with sterile microtip Ofloxacin used as positive control.

- Then 50 ml of test agents were placed into wells. The plates are incubated at 37degees for 24hrs. Zone of inhibition were recorded

#### RESULT

- The highest zone of inhibition was observed in seed acetonic extract.
- Finally, it was noted that the all the combination of plant as solvent procedure. anti-bacterial activity than ofloxacin.

#### HEPATIC PROTECTIVE ACTIVITY OF OKRA

The aim of the study determined the effect of okra pod methanol extract on mice with hepatotoxicity induced by sodium nitrate. sodium is a chemical widely used for preserving food especially cured meats.

The fresh green okra pods are collected from market. These pods cut and dried in shade for 7 days. These pods are coarsely powdered and macerated in 96% methanol for 72 hrs. After that concrete collected for every 24hrs. The solvent is evaporated at 80c and collect the extract was freeze dried.

Mice were divided into six group's (KN, K-, P1, P2, P3, P4) Group -1: (KN) – standard control.

Group -2 (k-) – It was administered sodium nitrate and after 2hrs was administered distilled water.

Group – (3-6) (P1-P4) -First administered sodium nitrate and after 2hrs it was administered with at doses 50,100,200, &400 mg/kg.

- After that serum was used for biochemical evaluation and liver histological analysis was performed.

#### RESULT

The result of the study showed that okra pods methanol extracts exerted hepatoprotective effect by lowering no levels. I t also improved catalase levels & recovered damage lever tissue to it normal state.

Okra pod methanol extract has potential as natural hepatoprotective agent against sodium nitrate exposure.

#### ANTIDIABETIC ACTIVITY OF OKRA

This research aims to know the antihyperglycemic activity of okra fruit extract and fractions vin two conditions of diabetic rats. This study used two groups of rats. Each group have 35 rats. One group of

male Wister rats for streptozotocin induced diabetic model. Another group of 35 rats for insulin resistance diabetic model. Gliclazide and metformin were used as drug control in Streptozotocin induced diabetes and insulin resistance diabetes. The fruit of okra extract like ethanol, n-hexane, ethyl acetate, and water are administered orally with dose of 200; 107; 6; and 86mg/kg for 28 days. Blood glucose levels are measured every week. The result revealed that ethyl acetate was most effective in lowering blood glucose level in both condition of diabetes. Ethyl acetate decrease the necrosis of pancreatic cell in streptozotocin induced diabetic rats and increase the expression of glucose transporter -4 in muscle cell of insulin resistance diabetic rats.

### ANTI ULCEROGENIC AGENT

The aim of the study was in Vivo in antiulcerogenic effect of okra on ethanol induced acute gastric mucosal lesions in animals. In this experiment we select 49 male Wister rats with weight 225 -250 g were used for the experiments .The rats are treated with 500, 250, /100mg/kg okra 20mg/kg famotidine (fam) & 75mg/kg quercetin (que).After one hour all the rat were given 1ml of ethanol(80%).Okra 500,250,100 famotidine 20 & quercetin 75 inhibited the ulcer formation .While these groups showed a higher percentage of cell proliferation compared with ethanol group These okra 500 decreased edema , hemorrhage & inflammation compared with ethanol group. Finally, it indicates the okra has gastro protective effect against ethanol, and it has gastroprotective effect against ethanol and it has therapeutic anti-ulcer effect.

### ANTI INFLAMMATORY ACTIVITY OF OKRA

The aim of study was to analyze the anti-inflammatory properties of okra fruit extract and it effect towards wound healing process.

In this experiment we use wistar rat which they are effect toward wound healing process in diabetic mellitus rats. Nearly 27 rats are selected.

They are divided into three groups

- Negative control (K+)
- Positive control (K+)
- Streptozotocin induction & 250 mg/kg body weight okra fruit extract.

Three rats from each group were sacrificed on the 1<sup>st</sup> ,4<sup>th</sup>, and 7<sup>th</sup> days after extraction their left lower incisor and excised for histological examination by Hematoxylin Eosin staining to enable evaluation of

the neutrophil's expression. The administration of okra extract to the tooth extraction wounds significantly reduced neutrophils expression compared to that in the untreated group. There was a significantly difference on day 1 between the following groups

- 1) K- and K+
- 2) K+ and P.

On day 4 the most significant difference was between K- and P. On day 7 the most significantly difference was between K- and K+ group K+ and P group.

Okra fruit extract exhibits anti-inflammatory activity and is therefore an effective agent for healing process of tooth extraction wounds in diabetic mellitus rat.

### ANALGESIC ACTIVITY OF OKRA

#### 1. Acetic acid induced writhing method

The analgesic activity of okra was studied using acetic acid induced writhing model in rats. Test samples (at the dose of 100 and 200 mg /kg) and vehicle (1% tween 80 in water) were administered orally to rats (n=6) 30 min prior to intraperitoneal administration of 0.7 % V/V acetic acid solution (0.1ml/10 kg).

The positive control group received Diclofenac Na at the dose of 10 mg/kg p.o. After an interval of 5 min the mice were observed for specific contraction of body referred to as Writhing for the next 10 min.

- Acetic acid induced is writhing response is a sensitive procedure to evaluate peripherally acting analgesics and represent pain sensation by triggering localized inflammatory response.

#### 2. Formalin test

The analgesic activity of drugs was determined using the formalin test. control group received 5% formalin 20 of 5 % formalin was injected into the dorsal surface of the right hind paw 60 min after administration of (100 and 200 mg/kg p.o) and Diclofenac Na (10 mg /kg p.m.) The mice were observed for 30 min after the injection of formalin and the amount of time spent licking the injected hind paw was recorded. The first 5 min post formalin injection is referred as the early phase and period between 15 and 30min as the late phase. The total time spent licking or being the injured paw (pain behavior) was measured with stop watch.

### RESULT

- ❖ The Acetic acid induced writhing test shows the effect of extract of an acetic acid induced writhing in mice. The oral administration of both doses of significantly inhibited writhing response induced by acetic acid in a dose dependent manner.
- ❖ Formalin test shows that the significantly suppressed the licking activity in either phase of the formalin induced pain in mice in a dose dependent manner.

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