



## Review Article

# Evaluation of Biological Characteristics of *Abelmoschus esculentus*

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**Abstract:** *Abelmoschus esculentus* is an economically important medicinal plant grown in tropical and sub-tropical parts of the world. This paper was aimed to review the biological characteristics and its health benefits against certain diseases. Different parts of *Abelmoschus esculentus* are used for various purposes. Its immature fruits are consumed as vegetables, used in salads, soups and stews, fresh or dried form. *Abelmoschus esculentus* mucilage has medicinal applications when used as a plasma replacement or blood volume expander. The mucilage of *Abelmoschus esculentus* binds cholesterol and bile acid carrying toxins dumped into it by the liver. *Abelmoschus esculentus* seeds are a potential source of oil, with concentrations varying from 20% to 40%, which consists of linoleic acid up to 47.4%. *Abelmoschus esculentus* is rich source of phenolic and flavonoids. These phytochemicals are responsible for its high antioxidants and antimicrobial activity. *Abelmoschus esculentus* has vast potential of health beneficial effects on some of the important human diseases like cardiovascular disease, type 2 diabetes, digestive diseases and some cancers. Overall, *Abelmoschus esculentus* is an important plant with diverse biological properties and potential health benefits. *Abelmoschus esculentus* possesses high contents of fibers. These fibers help to stabilize blood sugar because their main function is to regulate the rate of sugar absorption from the intestinal tract. The fibers present in *A. esculentus* play a vital role in minimizing blood sugar level in the body, assisting along with diabetes. These fibers also help to support the level of blood sugar by slowing down the process of sugar absorption through the intestines. *Abelmoschus esculentus* is also recognized for having high antioxidants activity. Different parts of *A. esculentus* are rich source of phenolic compounds, largely flavanols derivatives and oligomeric catechins. These phenolic compounds have attained a lot of importance among other antioxidants. So, it is a good supplier to antioxidant status as well as a promising chemo-preventive agent.

**Keywords:** *Abelmoschus esculentus*, Antioxidant, Anti-diabetes, Biological Effects, Phytochemicals

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## 1. Introduction

*Abelmoschus esculentus* is an important vegetable crop being native to tropical Africa (Jain et al., 2012). In worldwide distribution, *Abelmoschus esculentus* is the most famous species of the *Malvaceae* family that has been utilized. Economically, it is an important crop that has been grown in tropical and subtropical areas of the world [2]. Previously, *Abelmoschus esculentus* plant belongs to the genus *hibiscus* but later, it was named as *Abelmoschus esculentus* that can be distinguished from the genus *hibiscus* [3].

*Abelmoschus esculentus* is an important vegetable that is commonly found in various countries of the world [4]. However, its origin was Ethiopia and then was spread to North Africa, Arabia and India by the 12th century B. C. Within historic times, important consideration was taken to determine the relation between Ethiopia and the rest of the world. So, it is not amazing that this plant has been known from the early history and distribution of *Abelmoschus esculentus* [5]. *Abelmoschus esculentus* has been recognized by many local names in different areas of the world. In England, its name is lady's finger, called gumbo in the United States of America. It

is known as guibeiro in Portuguese, guinogombo in Spanish and bhindi in India [6]. The language which assigned it the name as *A. Esculentus* originates from the Niger-Congo group. In Twi language, nkuruma is the specific name of it [7]. *Abelmoschus esculentus* has a wide potential range in earning crops of the foreign exchange crops countries. In India, its export is about 60% which accounts of fresh vegetables [8]. In the whole world, the largest producer of *A. esculentus* is India which produces 3.24 million tones annually. Other smallest producers are; Pakistan, Egypt, Ghana, Brazil, Ethiopia, Japan, Iraq, USA, Iran, Guyana, Japan and Turkey [9].

In Pakistan, *A. esculentus* is used as favorite vegetable, which requires too much attention and care for increase in its area and production. Although, the native environment and weather of Pakistan is appropriate for its cultivation at commercial level but comparing with other countries of the world, its average pod yield per unit area is still low [10]. *Abelmoschus esculentus* is an annual or perennial dicotyledonous plant with height of 2m. Preferably, this plant grows in well-drained fertile soil which is rich in humus with pH (6-6.7). It can also endure the types of soil with pH ranges from (5.5-8.0). It is a straight herbaceous irregular herb that is about 1.5 m tall having long slender like roots [11]. The genus *Abelmoschus* has four famous domesticated species [12].

Among these, *A. esculentus* is known as okra is most commonly cultured in South and East Asia, Africa, and the southern USA [13]. Plants of *A. esculentus* sometimes fail to flower. So, different countries like South Pacific Islands, Papua New Guinea and Solomon Island cultivate this specie widely only for leaves [14]. Leaves of *A. esculentus* are alternative, uneven, hairy and heart shaped. The leaf is palmately lobed, crenate or rectangle oval shaped, flat and often with an even prominent midrib. Its leaves are 10-40 cm long and wide with 3-7 lobes, that are very flexible in depth from basely lobed to cut almost to the base of leaf, which is more or less scab rid and hairy, ovate, acute and sometimes cordate (Todarwa et al., 2011). Flowers are like watermelon pink, white or cream in color [15].

These flowers are lonely, not attach to the other parts of plant and axillary. Their diameter is about 4-8 cm with five petals having color ranges from white to yellow, but frequently red or purple spot are present at the base of each petal. Its fruit is about 10 to 25 cm long having diameter of 1.5 to 3 cm that are thinning at a rounded point. The seeds of *A. esculentus* are rounded and kidney shaped arranged in rows. The ripening time of fruits of *A. esculentus* is 60-180 days of after sowing the seeds. Depending on cultivars, this duration can be counted 5-10 days after flowering of plant. After ripening, fruits are removed from the stacks little force. Sometimes, frustrating hairs are present on the surface of leaves, stems and fruit [16]. Roots of this plant are yellowish brown in color, 3-6 cm long and curly shaped. The roots of *A. esculentus* possess many healing properties in the cuts of wounds [17].

Different parts of *Abelmoschus esculentus* such as pods, flowers, stems, leaves and seeds have been used for various purposes. So, it is named as versatile crop. It is being used for

curing different diseases. Tender green pods of *A. esculentus* are rich sources of vitamins (A, B1, B3, B6, C and K), magnesium, potassium, calcium and folic acid. In most developing countries, these are often missing in the diet of people. So, *A. esculentus* has been utilized for nutritious fulfilment [18]. Its immature fruits (green seed and pods) are consumed as vegetables in soups, salads and stews in fresh, fried, boiled and dried form [4]. The *A. esculentus* mucilage is suitable for industrial and medicinal application and could also be applied in replacement of plasma or blood volume expander. The leaf buds and flowers of *A. esculentus* are used for eating purpose [19].

In terms of nutritious matter, its dried seeds are used to make vegetable curds. It can be used as coffee preservative in roasted and ground form [20]. *A. esculent* Ushas a good contribution as an antioxidant and chemo preventive agent. It is rich in phenolic and flavonoids components that have recently attained a lot of interest among other antioxidants. Pods and seeds of *A. esculents* rich sources of phenolics having potent biological attributes like quatering derivatives, catechin oligomers and hydroxycinnamic derivatives [21].

The fibers of *A. Esculentus* help blood sugar to stabilize. In this process, sugar is being absorbed from the intestinal tract at the regular rate. The polysaccharides present in *A. esculentus* possess antifungal, anti-inflammatory, hepatoprotective, antidiabetic, antiulcer, anticancer, laxative, antihyperlipidemic and analgesic activities. In recent studies, some quercetin derivatives and well-known antioxidants were also identified and separated from *A. esculentus*. The most nutritious part of *A. esculentus* plant is the dried seeds. The oil of *A. esculentus* seeds is eatable and its residual meal is rich in protein contents [22]. Its seeds may work as another source of protein, fat, fiber and sugar. It is reported that *A. esculentus* possess hypolipidemic effect which decreases the absorption of cholesterol from diet. It has also found that *A. esculentus* polysaccharides lower down the bodyweight, glucose levels, improved glucose tolerance and decreased total cholesterol level [23, 24].

*A. esculentus* ripped fruits and stems comprise of fiber that is being used in the paper industry. The oil of *A. esculents* extracted from pressing its seeds, which has a pleasant flavour, odour. This oil is rich source of unsaturated fats like linoleic acids and oleic acid which is greenish yellow color and eatable. The oil contents in some diversity of the seed can be relatively more than 40%. From *A. esculentus* crops, oil yield is also high. Previous study found that *A. Esculentus* oil is fit for being used as biofuel. Roots and stems of *A. esculentus* are being used for clearing of sugarcane juice in order to obtain brown sugar [23].

This vegetable is a good nutritious source for those persons who feel weak and suffering from depression. It is also used in the diseases of sore throat, ulcers, lung inflammation and irritable bowel. *A. esculentus* is suitable for the patients suffered from asthma and it also help to normalize the cholesterol and blood sugar level [25]. It has been reported that polysaccharide of *A. esculentus* keeps hypoglycemic and anticomplementary activity in normal

mice [26]. *A. esculentus* polysaccharide has the ability to bind with the bile acids so that it may lower cholesterol level in blood and prevent cancer [27]. Additionally, *A. esculentus* seeds retain blood glucose at normal level under diabetic condition [28].

Since ancient times, this plant has been known for its healing properties and has been used for treatments of many diseases. Its bark is known as an emmenagogue and used for treatment of wounds and cuts [29]. The current investigation is designed to isolate, identify and characterize bioactives from leaves and seeds of *Abelmoschus esculentus*. This study also investigates that leaves and seeds of *A. esculentus* possess phytochemicals which might be responsible for possessing antimicrobial activity of leaf and seeds of mature plant [30].

## 2. Taxonomical Description

Biological name: *Abelmoschus esculentus*

Kingdom: Plantae

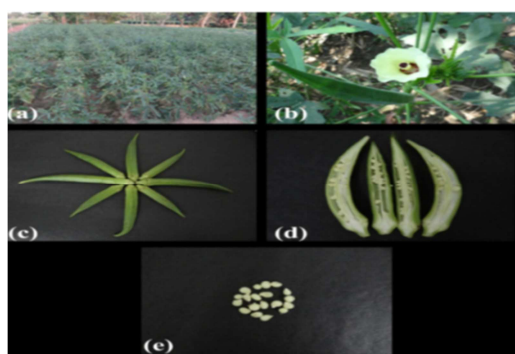
Division: Magnoliophyta

Class: Magnoliopsida

Order: Malvaceae

Genus: *Abelmoschus*

Species: *Abelmoschus esculentus* [30]



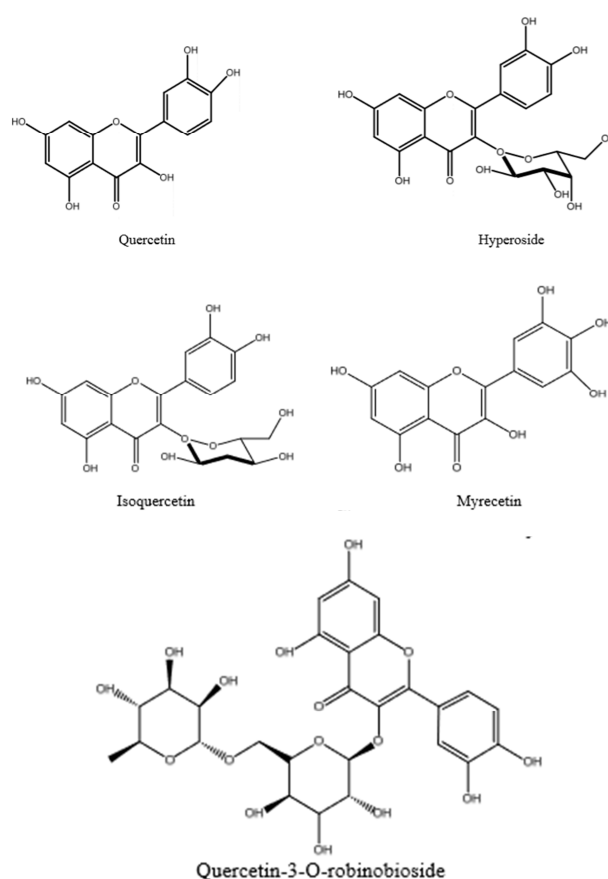
**Figure 1.** Different parts of *A. esculentus* (a) *A. esculentus* in field (b) *A. esculentus* fruit and flower (c) *A. esculentus* fruit (d) cross sectional view (e) *A. esculentus* seed [30].

### 2.1. Nutritive and Phytochemical Profile

Phytochemicals like proteins, carbohydrates and vitamins are present in *A. esculentus*. These phytochemicals play a dynamic role in the human diet [31]. It possesses essential and nonessential amino acids. *A. esculentus* is rich source of ascorbic acid and calcium. Usually carbohydrates are present in mucilage form [32]. The fruit of fresh *A. esculentus* is comprised of protein, fats, carbohydrate, fiber, calories, minerals, vitamins and water. Its eatable leaf part has almost 4.4 g protein, 11 g carbohydrate, 56 calories and 81 ml water. 100 g of ripe and mature seed of *A. esculentus* contains 20.23% crude protein and 20% edible oil. This is due to high lysine contents and it is a basic source of vitamins [33]. The composition of *A. esculentus* pods per 100g eatable portion is: thiamin 0.04 mg, riboflavin 0.08mg, niacin 0.60, ascorbic acid 47.00 mg and  $\beta$ -carotene 185.00 $\mu$ g. 100 g of edible portion of *A. esculentus* leaves contains:  $\beta$ -carotene 385.00 $\mu$ g, water 81.50 g, ascorbic

acid 59.00 mg, riboflavin 2.80 mg, thiamin 0.25 mg, niacin 0.20 mg. The mature fruit of *A. esculentus* consists of chain of large molecules with a molecular weight is 170,000. Sugar units and amino acids are the main constituents that build the long chain. The remaining constituents are galacturonic acid (27%), galactose (25%), rhamnose (22%) and amino acids (11%). The mucilage of *A. esculentus* water soluble with the thickness value of about 30% [10]. *A. esculentus* also has remarkable vitamin and mineral content. Sugar and minerals are also present in large quantity. In order to eat in meal, a sensible portion of okra that is based on its raw materials contains vitamin A 716 IU (14.3%), vitamin B-6 0 mg (10.8%), vitamin C 23mg (38.3%), vitamin K 31.3 mg (39.1%), folate 60 micro-g (15%), sodium 7mg, potassium 299mg (8.5%), calcium 82 mg (8.2%), magnesium 57 mg (14.3%), sugar 1.5 g and thiamin 0.2mg [34].

Phytochemicals which are secondary metabolites of plants are: tannins, alkaloids, carbohydrates, terpenoids, steroids, flavonoids and phenols which are accountable for their biological aspects given by such as antimicrobial, antidiabetic, anti-inflammatory, antibacterial, antioxidant activity [35]. Previous phytochemical studies indicated that the main components that were isolated from the flower of *A. esculentus* are flavonoids. The flavonoids that are isolated from the flower of *A. esculentus* include quercetin-3'-O-glucoside, hibifolin, isoquercetin, quercetin-3-O-robinobioside, hibifolin, myricetin, and quercetin [36].



**Figure 2.** Phytochemicals of *A. esculentus* [36].

In plants, flavonoids belong to the group of polyphenolic compounds usually prevailing in it. Flavonoids possess an extensive ability to combine with sugars to form glycosides. Moreover, in the antioxidant activity, flavonoids play a major role to scavenge free radicals [36].

## 2.2. Pharmacological Properties

The *Abelmoschus esculentus* has been used extensively as a vegetable and it is a basic source of nutritive medicine. As a mucilaginous food, the pods of *A. esculentus* are used to combat gastritis in traditional Asian and African medicine. Previous pharmacological studies have shown that *A. esculentus* possess several biological attributes like antimicrobial, antioxidant, antidiabetic, antifatigue, anticancer, antihyperlipidemic and neuroprotective activities [37]. These pharmacological attributes of *A. esculentus* might be ascribed to bioactive compounds that are present in it. These compounds are glycosides, terpenoids, tannins, carotenoids, flavonoids, alkaloids, steroid and phenolic compounds [38].

## 2.3. Antioxidant Property

Living organisms are prepared with a defense system to protect and to neutralize oxygen species in reactive form and free radicals. This defense system not only includes enzymes but certain other compounds are also present in it. Glutathione reductase, catalases, glutathione peroxidase, superoxide dismutase, glutathione peroxidase, glutathione reductase are the enzymes while the compounds are glutathione, vitamins E and C etc. As long as free radicals are stable by the body's antioxidative defense system, the body will be in condition which is being considered as healthy. However, depletion or loss of levels of antioxidant may lead to free radical-caused oxidative stress. Oxidative stress can cause the diseases like cellular and tissue damages, DNA mutation, cancer etc. [39].

Plants are the chief source of natural antioxidants. Phenolic compounds or polyphenols, which are mostly secondary metabolites, made a huge and complex group of phytochemicals that revealed antioxidant actions. Epidemiological studies have revealed that regular consumption of foods that is rich in phenolic compounds is related with reduced risk of cardiovascular diseases, neuron degenerative disease and certain cancers. These phenolic compounds hold good abilities in the development of health foods, supplements regarding nutrition and herbal medicines for the applications as antioxidants, ROS-related diseases and chemopreventive agents. Medicinal plants have a significant role in the discovery and progress of natural antioxidants with more competencies and less toxicity over synthetic drugs. Thus, the natural antioxidants are always being found as cost effective and safe [40].

*Abelmoschus esculentus* is also recognized for having high antioxidants activity. Different parts of *A. esculentus* are rich source of phenolic compounds, largely flavanols derivatives and oligomeric catechins. These phenolic compounds have attained a lot of importance among other antioxidants. So, it is a good supplier to antioxidant status as well as a promising

chemo-preventive agent [41]. According to Khomsug et al., the total phenolic contents in pulped and seeds of *A. esculentus* extracts are related to its scavenging activity. Moreover, the predominant source of phenolics are seeds which found procyanidin B2 as predominant phenolic compound followed by rutin, procyanidin B1. In pulped seed, rut in, catechin, epicatechin, procyanidin B2 are found to be present. It is reported that by the process of roasting (1600°C for 10-60 minutes) has increased the nutrient composition and antioxidant activity of the seeds of *A. esculentus*. While pre-treatment processes like (soaking and blanching) has enhanced the nutrient composition.

The peel and seed of *A. esculentus* exhibited major antioxidant property in strepto zotocin induced diabetic rats. Comparative analysis of total phenolic, flavonoid and antioxidant activity of different organs of this plant such as flower, fruit, leaf, seed was evaluated by their comparative analysis. Different enrichment fractions of water extracts of the *A. esculentus* plant confirmed that abundant amount of total phenolic and flavonoids are present in it. The presence of these phenolic and flavonoids is associated with the antioxidant activity of different organs of plant extracts although having percentage different. Flower of *A. esculentus* possesses highest amount of total phenolics and flavonoids [5].

*Abelmoschus esculentus* is also used to stimulate healthy skin and blood of human body. 50 percent of vitamin K and 27 percent of vitamin C is present in approximately one hundred grams of *A. esculentus*. Vitamin C has an essential antioxidant potential that helps in the growth of body tissues and its repairing. This is the main reason that taking more *A. esculentus* in food can regenerate our hairs, body tissues. It can also protect us from diseases that are degenerative and associated with the damage of long-term free radical [42]. *A. esculentus* plants have been found to respond the non-hostile environments by increasing the synthesis of sulfhydryl compounds, which exhibit antioxidant activity. Such antioxidant activity was concerned with components of okra seeds.

Hence, seeds of *A. esculentus* possess glutathione or substances that are beneficial for lightening the skin and anti-aging [43]. Main function of these antioxidant substances is that they block the free radical action which has great importance in the pathogenesis of Alzheimer's disease, atherosclerosis and in the aging process. The quality of food has been improved by using these antioxidants. *A. esculentus* has a good contribution in the antioxidant status and favorable chemo preventive agent as described in many traditional medicines for human race. This is due to its antidiabetic potential [44].

## 2.4. Antidiabetic Property

Diabetes is a chronic disease that happens when pancreas fails to produce sufficient insulin or when the body successfully cannot use the insulin. It is a group of metabolic disorders that is related with disturbances in the metabolism of fuel molecules due to absolute shortage of insulin, deficient insulin secretion and its action. Main causes of diabetes are genetic factors, lifestyle and it is described by hyperglycemia.

It is an extensive endocrine disease associated with considerable illness and death and is found in all population in all over the world. The worldwide occurrence of diabetes mellitus in all age groups was assessed to be about 171 million people (2.8%) in the year 2000 and the rate is estimated to increase to at least 366 million (5.4%) by 2030 [45].

The use of pharmacological agents, exogenous insulin administration and lifestyle modification are the treatments which are used for diabetes. The most extensively used pharmacological agents are drugs such as amylin, dipeptidyl peptidase-4 (DPP-4) inhibitors, sulfonylureas, thiazolidinediones, glucagon-like peptide-1 (GLP-1) receptor agonists,  $\alpha$ -glucosidase inhibitor, thiazolidinedione, biguanides, sodium glucose transporter 2 inhibitor and meglitinides [46].

Around the world, plant derivatives having hypoglycemic properties are used in traditional medicine around the world. The antihyperglycemic effects of these plants have been recognized by their capability to increase the insulin output from the pancreas. They also prevent the absorption of glucose in the intestinal tract. Many pharmaceutical industries are using the natural plants in modern medicine. More than 400 species of plants have been tested to show hypoglycemic effects, but only few have been examined [47]. *Abelmoschus esculentus* possesses high contents of fibers. These fibers help to stabilize blood sugar because their main function is to regulate the rate of sugar absorption from the intestinal tract. The fibers present in *A. esculentus* play a vital role in minimizing blood sugar level in the body, assisting along with diabetes. These fibers also help to support the level of blood sugar by slowing down the process of sugar absorption through the intestines [48].

By taking *A. esculentus* regularly may decrease the risk of kidney diseases. It has been reported that those who use *A. esculentus* daily may decreased the clinical symptoms of kidney damage than those who simply consume it for a diabetic diet. Almost 50% of kidney diseases are due to diabetes [49]. It has been investigated that *A. esculentus* possesses the anti-diabetes, reducing blood lipid and neuroprotection attributes. It has been reported that the most important active components of total flavone glycosides could significantly diminish the podocyte apoptosis and lessen urinary albumin excretion in early stage diabetic nephropathy. It is investigated that treatment with extract of *A. esculentus* can minimize the blood glucose, serum triglyceride, total cholesterol and serum insulin levels and increase the glucose tolerance. *A. esculentus* also helps as a dietary therapy for hyperglycemia and hypertriglyceridemia. [50] reported that *A. esculentus* peel and seeds can be used for the treatment of diabetic rats and it significantly reduced the level of blood glucose and increase the weight of body.

### 2.5. Antimicrobial Property

In the history of human beings, many human diseases have been cured with herbal medicine. Additionally, the recovery of these drugs that are derived from plants is due to their certainty. Natural drugs are safe, more reliable and less expensive than synthetic drugs that are costly, toxic and have many side effects.

Thus, curiosity is increasing in order to discover the alternative source which produces drugs from different plant species that have antimicrobial properties and can also be used as antibiotic resources. In Asian medicine, the mucilaginous food is being preserved by using the fruit of the *A. esculentus* plant against inflammations and gastric irritative diseases [49]. *A. esculentus* has also been shown to keep antibacterial properties against infective disease caused by *Bacillus subtilis*, *Streptococcus pyogenes*, *Klebsiella pneumoniae*, *Staphylococcus aureus* (Taiye *et al.*, 2013). The efficiency of the fruits and flowers of *A. esculentus* can be used to inhibit *Bacillus cereus* and *P. aeruginosa* growth [52]. Seeds of *A. esculentus* exhibited important antibacterial properties against *Salmonella enteritidis* and *S. typhimurium*. The antifungal properties of seeds were observed against fungal strains like *Aspergillus versicolor* and *Cladosporium cladosporioides* [53].

### 2.6. Anticancer Property

Cancer is one of the most prominent causes of death in whole world. Although a widespread range of the therapeutic methods for treating the cancer have been invented for treating the cancer but still it cannot be cured easily. There are many types of cancer that have very low cure rate. Radiotherapy and chemotherapy are essential for its treatment, but there are many side effects. The main challenge is the improvement of new therapies. Recently, natural phytochemicals have been achieved from the plants attained great interest in the treatment of cancer. These phytochemicals have capability to modulate the gesturing pathways that involved in metastasis and cancer proliferation [52].

*A. esculentus* is rich in pectin and pectin is known as dietary fiber which is a complex constituent of the primary cell wall of plant. Pectin have polysaccharides like rhamnogalacturonan-II (RG-II), homogalacturonan (HG), substituted galacturonans and rhamnogalacturonan-I (RG-I). Homogalacturonan (HG) is a polymer of  $\alpha$ -1,4-linked-D-galacturonic acid. Homogalacturonan residues can be methyl esterified at the C-6 carboxyl or acetylated at the O-2 or O-3, reliant on the pectin source. The backbone of HG is covalently cross-linked with RG-I and RG-II. RG-I is a branched polymer and disaccharide ( $\alpha$ -1,4-D-GalA-  $\alpha$ -1,2-LRha) make the backbone which repeats in such a way that Rha residues can be replaced with  $\beta$ -1,4-galactan. RG-II has a critical structure. Complex side chains are attached to backbone of HG and these chains are made up of 12 types of glycosyl residues that are connected together with 22 different glycosidic bonds. Pectin oligosaccharides also induce apoptosis in myeloma cells. So, RG-I region of *A. esculentus* pectin encourages apoptosis in melanoma cells and decreases proliferations [54].

## 3. Antiulcer Activity

*Abelmoschus esculentus* is used to treat diseases of digestive system. The polysaccharide present in immature *A. esculentus* pods possesses remarkable antiadhesive properties. It helps to eradicate the adhesion 'between stomach tissues

and bacteria by inhibiting the spreading of culture. It has also been reported that during complex formation of glycoproteins with highly acidic sugar compounds, a three-dimensional structure is formed. Gastric irritations and inflammation have been cured by using the pods of *A. esculentus* [52]. Polysaccharides of *A. esculentus* were found to be active by stopping the *Helicobacter pylori* adhesion. It is a bacterium which exists in the stomach and may cause the diseases like gastric ulcer and gastritis. Therefore, consumption of more *A. esculentus* in food can keep our stomach hygienic from germs and bacteria. It also creates an environment that inhibits destructive cultures from its flourishing [55]. It has been used to improve the health of colon. From the colon, it easily sails down through its path by absorbing all toxic substance and extra water. *A. esculentus* filled with nutritional fiber that is essential for colon and digestive health. The fibers of *A. esculentus* support to clean the intestine. These fibers enable the colon to work properly. Additionally, function of vitamin A is that it plays a basic role in order to improve mucous membranes which enhance the efficiency of digestive system [56].

### 3.1. Anticoagulant Activity

Vitamin K plays a significant role in the blood clotting. Blood becomes too thin which results in bleeding of gums, hurting, regular nosebleeds and heavy menstrual bleeding. By taking the food enriched with vitamin K improves blood clotting and also enhances the coagulation ability of blood [56].

### 3.2. Fetal Development

*Abelmoschus esculentus* is used to promote the health of the pregnancy. As, vitamin B is present in *Abelmoschus esculentus* is essential to produce and maintain the new born cells. Folate is also a vital substance for finest pregnancy. These vitamins help in stopping the defects of birth just like spina bifida and also enable the baby to grow completely. Additionally, Vitamin C is required for baby growth and development. Large quantity of foliate and vitamins are present in *A. esculentus*. During pregnancy, if more quantity of foliate is taken in the form of *A. esculentus* it will be helpful for the fetus development. Folate is a vital nutrient that enhances the growth of the fetus brain. Within *A. esculentus*, high amount of folic acid is present that performs a huge role in the formation of neural tube during the fourth to the 12th week of pregnancy [57].

### 3.3. Cardiovascular Health

*Abelmoschus esculentus* is used to improve heart health. Due to the presence of soluble fibers within *A. esculentus*, serum cholesterol level may be reduced which also reduce the chances of cardiovascular disease. Consumption of *A. esculentus* is an effective method to manage cholesterol level of body. *A. esculentus* also possesses pectin which may reduce the high blood cholesterol level. Simply it regulates the bile creation within the intestines [48]. There are many diseases that are related to high cholesterol level in the body. So, this

healthy vegetable is beneficial in decreasing cholesterol [3].

### 3.4. Eye Vision Improvement

Vision of eye has been improved by using *Abelmoschus esculentus* pods are strange source of vitamins. Usually vitamin A and beta carotene are present in it. These are important nutritious components used for sustaining the better eyesight [49].

## 4. Conclusion

The information presented here shows the potential nutritional importance of *Abelmoschus esculentus* and its role in improved nutrition and health. It is an affordable source of carbohydrates, protein, minerals and vitamins, dietary fibers and health promoting fatty acids. Scientific studies provide some evidence to support the potential beneficial effects of *Abelmoschus esculentus* components in lowering the risk for various chronic diseases. Although information pertaining to the role of edible plant parts of Okra in disease prevention and the mechanisms of action are limited to date. This is due to the complex nature of disease etiology and various factors impacting their occurrence. Therefore, promoting the consumption of traditional medicinal plants such as *Abelmoschus esculentus* could provide cheap sources of macro and micronutrients and mineral elements that can improve the nutritional status. Furthermore, this vegetable can also be used as an indispensable tool when it comes to reducing the prevalence of malnutrition, especially among resource-constrained urban households in addition to rural household. Consumption of Okra by both low-income and high-income groups can also use as a means of dietary diversification approach. *A. esculentus* pods possesses remarkable antiadhesive properties. It helps to eradicate the adhesion 'between stomach tissues and bacteria by inhibiting the spreading of culture. Radiotherapy and chemotherapy are essential for its treatment, but there are many side effects. The main challenge is the improvement of new therapies. Recently, natural phytochemicals have been achieved from the plants attained great interest in the treatment of cancer.

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