Journal of Medicinal Plants Studies
www.PlantsJournal.com

**ISSN (E): 2320-3862**
**ISSN (P): 2394-0530**
**NAAS Rating 2017: 3.53**
JMPS 2017; 5(3): 23-26

Received: 09-03-2017
Accepted: 10-04-2017

**Poorva Dubey**
Research Scholar, School for Home Sciences, Babasaheb Bhimrao Ambedkar University (A Central University) Vidya Vihar Lucknow, India

**Sunita Mishra**
Professor, School for Home Sciences, Babasaheb Bhimrao Ambedkar University (A Central University) Vidya Vihar Lucknow, India

**Correspondence**
**Poorva Dubey**
Research Scholar, School for Home Sciences, Babasaheb Bhimrao Ambedkar University (A Central University) Vidya

# A review on: Diabetes and okra (*Abelmoschus esculentus*)

**Poorva Dubey and Sunita Mishra**

**Abstract**
Diabetes mellitus is the most common endocrine disorder it is the leading cause of morbidity and mortality in developed countries, and is gradually emerging as an important health problem in developing countries. In the last few years there has been an rapid growth in the field of herbal medicine these medicine are gaining popularity both in developing and developed countries because of their natural and less side effects. Okra, *Abelmoschus esculentus L*. (Moench) is an important vegetable crop. This plant is popular and has been acclaimed to have various health benefits which include anti-diabetic properties.

**Keywords:** Diabetes mellitus, endocrine, anti-diabetic, *Abelmoschus esculentus*.

## 1. Introduction
Diabetes mellitus, a leading non-communicable disease with multiple etiologies, affects more than 100 million people worldwide and is considered as one of the five leading causes of death in the world (Zimmet PZ. 1999) [1]. It is a metabolic disorder affecting carbohydrate, fat and protein metabolism. A worldwide survey reported that diabetes mellitus (Vetrichelvan T *et al* 2001) [2] Diabetes mellitus is a progressive metabolic disease and it has affected considerable percentage of population throughout the world. Epidemiologic data indicated that 2.8% of the world's population was diabetic in the year 2000 and it may progress to 4.4% of the world's population by 2030. It affects all age groups of people and ethnic groups. (Xing XH *et al* 2009) [3] N India, statistical analysis revealed that the number of diabetics will rise to 57 million in the year of 2025 compared to 15 million diabetics in 1995. (Shikarwar MS *et al* 2010) [4] Okra (Abelmoschus esculentus), also known as lady's finger or gumbo, is a tropical vegetable belonging to the mallow family. Immature okra pods are consumed in most areas of the world, supplying carbohydrates, minerals and vitamins and are also a source of dietary medicines. Okra seeds may serve as alternative sources of protein, fat, fiber and sugar (Adelakun OE *et al* 2009) [7, 5] Okra is rich in flavonoid compounds that have antioxidant activity. [5-8] Okra is reported to have its hypolipidemic effect by decreasing absorption of cholesterol from diet. [Huynh T *et al* 2008] It is found that okra polysaccharides lowered body weight and glucose levels, improved glucose tolerance, and decreased serum total cholesterol (TC) levels.

### Diabetes Mellitus
Diabetes mellitus is a metabolic disease usually characterized by the classic triad of polydipsia, polyuria and polyphagia, consequences of homeostasis disruption due to impaired glucose metabolism. (Bascones-Martinez A *et al* 2011) [11]

Types of Diabetes mellitus
- Type 1 diabetes
- Type 2 diabetes
- Gestational diabetes

| Type 1 diabetes | Type 2 diabetes | Gestational diabetes |
|---|---|---|
| 10 to 15 % cases | 80 to 90 % cases | 5 to 10 % of pregnant women develop gestational diabetes. |
| Typically occurs in people under 35, but can occur at any age. | Most of time develops in adult over age of 45 years. | First detected in pregnancy. |
| Require insulin from diagnosis for the management of type 1 diabetes. | Diet and life style change can reverse it. Then add Oral medication may require insulin for the management of type 2 dibetes. | Diet and life style change and medication help in management of gestational diabetes. |
| Type 1 diabetes occur often random. | Type 2 diabetes occur strong family history. | Family history of type 2 diabetes. |

**Okra (*Abelmoschus esculentus*)**

Okra (*Abelmoschus esculentus*) is an economically important vegetable crop grown in tropical and sub-tropical parts of the world. (H. F. Gemede *et al* 2015) [12] Okra (*Abelmoschus esculentus*) is the only vegetable crop of significance in the Malvaceae family and is very popular in the Indo-Pak subcontinent. In India, it ranks number one in its consumption but its original home is Ethiopia and Sudan, the north-eastern African countries. (D. Sathish Kumar *et al* 2013) [13]

**Nutritional Potential of Okra**

K, Na, Mg and Ca are the principal elements in pods, which contain about 17% seeds; the presence of Fe, Zn, Mn and Ni also has been reported (Moyin-Jesu, 2007) [37]. Fresh pods are low in calories (20 per 100 g), practically no fat, high in fiber, and have several valuable nutrients, including about 30% of the recommended levels of vitamin C (16 to 29 mg), 10 to 20% of folate (46 to 88 g) and about 5% of vitamin A (14 to 20 RAE) (NAP, 2016) [15]. Both pod skin (mesocarp) and seeds are excellent source of zinc (80 g/g) (Glew, 1997; Cook *et al.*, 2000) [38, 39]. Okra seed is mainly composed of oligomericcatechins (2.5 mg/g of seeds) and flavonol derivatives (3.4 mg/g of seeds), while the mesocarp is mainly composed of hydroxylcinnamic and quercetin derivatives (0.2 and 0.3 mg/g of skins). Pods and seeds are rich in phenolic compounds with important biological properties like quarcetin derivatives, catechin oligomers and hydroxycinnamic derivatives. (Arapitsas, 2008) [8, 16] These properties, along with the high content of carbohydrates, proteins, glycol-protein, and other dietary elements enhance the importance of this foodstuff in the human diet. (Manach *et al*., 2005; Arapitsas, 2008) [17, 8, 16]

Dried okra sauce (pods mixed with other ingredients and regularly consumed in West Africa) does not provide any beta carotene (vitamin A) or retinol. (Avallone *et al.*, 2008) [18] However, fresh okra pods are the most important vegetable source of viscous fiber, an important dietary component to lower cholesterol. Seven-days-old fresh okra pods have the highest concentration of nutrients. (Habtamu Fekadu Gemede, *et al*, 2015) [12]

**Okra and Its Effect in Lowering the Glucose Level**

In traditional medicine Okra seeds are reported to have ability in managing increased blood glucose concentration. Modern research has correlated this traditional claim with scientific evidences.

(Tomoda *et al*. 1989) [21] Reported that okra polysaccharide possesses anti complementary and hypoglycemic activity in normal mice. [Ramachandran, Sandeep, Srinivas, & Dhanaraju, 2010 [22] reported anti-diabetic activity of okra on alloxan-induced diabetic rats. [Ramachandran, Naveen & Panneerselvam Sabita *et al* 2013] [24] has reported antidiabetic and antihyperlipidemic potential of okra peel and seed powder in streptozotocin (STZ)-induced diabetic rats. Administration of peel and seed powder at 100 and 200 mg/kg dose in diabetic rats showed significant reduction in blood glucose level and increase in body weight than diabetic control rats. Water-soluble fraction of the fruits of Okra was studied to check the absorption of oral glucose as well as metformin from the gastrointestinal tract in the Long Evans rats. It showed significant reduction in absorption of glucose as studies in the 24 hours fasting rats. (Thanakosai & Phuwapraisirisan 2013) [26] has reported, the presence of two major flavonolglucosides named isoquercetin (2) and quercetin-3-O-beta-glucopyranosyl- (1"→6")-glucoside (3) in okra seeds which are α-glucosidase inhibitors. These two compounds selectively inhibited rat intestinal maltase and sucrase, in which isoquercetin (2) were 6-10 times more potent than its related diglucoside 3. [Subrahmanyam *et al* 2011] has reported anti-diabetic activity of okra fruit extract.

The effects of A. esculentus fruits on alkaline phosphatase (ALP), aspartate aminotransferase (AST) and alanine aminotransferase (ALT) activities on diabetic albino rats were also investigated. Serum glucose levels and activities of enzymes viz. ALP, AST and ALT decreased significantly after administration of the extracts. Uraku A J *et al* 2011 [28] Hypoglycemic effect of ethanolic and aqueous extract of A. esculentus fruit was studied. Results revealed that aqueous extract of powdered drug had maximum effect. Saha D, *et al* 2011 [29] Recent study reported that the extract of okra lowers blood glucose and serum lipids in high-fat diet-induced obese C57BL/6 mice. Ethanol extract of okra (EO) and its major flavonoids isoquercitrin and quercetin 3-O-gentiobioside reduced blood glucose and serum insulin levels and improved glucose tolerance in obese mice. Fan S, *et al*. 2013 [35, 10]

The mallow family has been reported to improve insulin resistance. The musk mallow (*Abelmoschus moschatus*) improves insulin resistance, increases insulin receptor substrate-1-associated phosphatidylinositol 3-kinase activity and Glut 4 translocation in insulin-resistant soleus muscles in rats fed a diet containing 60% fructose[Liu IM, *et al* 2010] and promotes Akt serine phosphorylation in the soleus muscles of obese Zucker rats. Liu IM *et al* 2007 [32] Total flavone glycosides of aibika (*Abelmoschus manihot*) have been reported to decrease urinary microalbumin and glomerular podocyte apoptosis in streptozotocin (STZ)-induced diabetic nephropathy rats, suggesting that aibika could prevent diabetic renal damage. Fan S *et al* 2014 [30]

The peel and seed powders of *Abelmoschus esculentus* have been reported to play antidiabetic and anti-hyperlipidemic roles in STZ induced diabetic rats. Sabitha V *et al* 2012 [23] Recently, in a study found that okra polysaccharides lowered body weight and glucose levels, improved glucose tolerance, and decreased serum total cholesterol (TC) levels in high-fat (HF) diet-fed C57BL/6 mice Fan S *et al* 2014 [30] In addition, okra effectively decreased tumor necrosis factor-alpha levels in 3 T3-L1 adipocytes,

Okada Y*et al* 2010 [36] indicating that okra may play a role in the regulation of glucose and lipid metabolism.

In a study, (Sabitha*et et al* 2011) [34] demonstrated the antidiabetic activities of *Abelmoschus esculentus*peel and seed powder (AEPP and AESP respectively). The author showed

that administration of AEPP and AESP at 100 and 200 mg/kg dose in diabetic rats showed significant reduction in blood glucose level and increase in body weight than diabetic control rats. A significant increased level of Hb, TP, and decreased level of HbA1c, SGPT were observed after the treatment of both doses of AEPP and AESP. Also, elevated lipid profile levels returned to near normal in diabetic rats after the administration of AEPP and AESP, 100 and 200 mg/kg dose, compared to diabetic control rats. In a similar study, (Saha *et al* 2011) [29] observed that the aqueous extract of powdered *Abelmoschus esculentus* had maximum effect when Glibenclamide was used as a standard.

**Reference**


1. Zimmet PZ. Diabetes epidemiology as a tool to trigger diabetic research and care. Diabetologia. 1999; 42:499-518.
2. Vetrichelvan T, Jagadeesan M, Uma Devi BA. Antidiabetic activity of alcohol of Celosia argentea Linn. Seeds in rats. Bio Pharm Bull. 2001; 25:526-528.
3. Xing XH, Zhang ZM, Hu XZ, Wu RQ, Xu C. Antidiabetic effects of *Artemisia sphaerocephala* Krasch. gum, a novel food additive in China, on streptozotocin-induced type 2 diabetic rats. J Ethnopharmacol. 2009; 125:410-6.
4. Shikarwar MS, Patil MB. Antidiabetic activity of *Crateva nurvala* stem bark extracts in alloxan-induced diabetic rats. J Pharm Bioallied Sci. 2010; 2:18-21. [PMC free article] [PubMed]
5. Adelakun OE, Oyelade OJ, Ade-Omowaye BI, Adeyemi IA, Van de Venter M. Chemical composition and the antioxidative properties of Nigerian okra seed(Abelmoschus esculentus Moench) flour. Food Chem Toxicol. 2009; 47:1123-6.
6. Liao H, Liu H, Yuan K. A new flavonol glycoside from the Abelmoschus esculentus Linn. Pharmacognosy Magazine. 2012; 8:12-5.
7. Adelakun OE, Oyelade OJ, Ade-Omowaye BI, Adeyemi IA, Van de Venter M, Koekemoer TC. Influence of pre-treatment on yield chemical and antioxidant properties of a Nigerian okra seed (Abelmoschus esculentus moench) flour. Food Chem Toxicol. 2009; 47:657-61.
8. Arapitsas P. Identification and quantification of polyphenoliccompounds from okraseeds and skins. Food Chem. 2008; 110:1041-5.
9. Huynh T, Nguyen Q, Tran A, Van T, Phung N. Hypolipidemic effect of extracts from Abelmoschus esculentus L. (Malvaceae) on tyloxapolinduced thyperlipidemia on mice. Mahodol. Uni J Pharmacol Sci. 2008; 35(1-4):42-46.
10. Fan S, Guo L, Zhang Y, Sun Q, Yang B, Huang C. Okra polysaccharide improves metabolic disorders in high-fat diet-induced obese C57BL/6 mice. Mol Nutr Food Res. 2013; 57:2075-8.
11. Bascones-Martinez A, Matesanz-Perez P, Escribano-Bermejo M, González-Moles MÁ, Bascones-Ilundain J, Meurman JH. Periodontal disease and diabetes-review of the literature. Med Oral Patol Oral Cir Bucal. 2011; 16:e722-9.
12. Habtamu Fekadu Gemede, Negussie Ratta, Gulelat Desse Haki, Ashagrie Z Woldegiorgis, Fekadu Beyene Nutritional Quality and Health Benefits of Okra (Abelmoschus esculentus): A Review, J Food Process Technol. 2015, 6:6.
13. Sathish Kumar D, Eswar Tony D, Praveen Kumar A, Ashok Kumar K, Bramha Srinivasa Rao D, Ramarao Nadendla. A REVIEW ON: ABELMOSCHUS ESCULENTUS (OKRA) Int. kRes J Pharm. App Sci. 2013; 3(4):129-132.
14. Emmanuel Ibukunoluwa. Moyin-Jesu, Use of plant residues for improving soil fertility, pod nutrients, root growth and pod weight of okra (*Abelmoschus esculentum* L)
15. National Academies Press. Lost Crops of Africa Volume II: Vegetables, 2006. www.nap.edu/catalog/11763.html; 287-301.
16. Arapitsas P. Identification and quantification of polyphenolic compounds from okra seed sand skins. Food Chemistry. 2008; 110:1041-1045.
17. Manach C, Williamson G, Morand C, Scalbert A, Remesy C. Bioavailability and bioefficacy of polyphenols in humans. I. Review of 97 bioavailability studies. American Journal ofClinical Nutrition. 2005; 81:230-242.
18. Avallone S, Tiemtore TWE, Rivier CM, Treche S. Nutritional value of six multi-ingredient sauces from Burkina Faso. Journal of Food Composition and Analysis. 2008; 21:553-558.
19. Kendall CWC, Jenkins DJA. A dietary portfolio: maximal reduction of low-density lipoprotein cholesterol with diet. Current Atherosclerosis Reports. 2004; 6:492-498.
20. Agbo AE, Gnakri D, Beugre GM, Fondio L, Kouame C. Maturity degree of four okrafruit varieties and their nutrients composition. Electronic Journal of Food and Plant Chemistry. 2008; 5:1-4.
21. Tomoda M, Shimizu N, Gonda R, Kanari M, Yamada H, & Hikino H. Anti-complementary and hypoglycemic activity of okra and hibiscus mucilages. Carbohydrate Research.1989; 190(2):323-8.
22. Ramachandran S, Sandeep VS, Srinivas NK &Dhanaraju M D. Anti-diabetic activity of Abelmoschusesculentus Linn on alloxan-induced diabetic rats. Research & Reviews in BioSciences. 2010, 4.
23. Sabitha V, Ramachandran S, Naveen KR, Panneerselvam K. Investigation of in vivo antioxidant property of *Abelmoschus esculentus* (L) moench. Fruit seed and peel powdersinstreptozotocin-induced diabetic rats. Journal of Ayurveda and Integrative Medicine. 2012; 3(4):188-93.
24. Sabitha V, Ramachandran S, Naveen KR, Panneerselvam K. Antidiabetic and antihyperlipidemic potential of *Abelmoschus esculentus* (L.) Moench. instreptozotocin-induceddiabetic rats. Journal of Pharmacy and Bioallied Sciences. 2013; 3(3):397-402.
25. Khatun H, Rahman A, Biswas M & Islam AU. Water-soluble Fraction of *Abelmoschus esculentus* L Interacts with Glucose and Metformin Hydrochloride and Alters Their Absorption Kinetics after Coadministration in Rats. ISRN Pharmaceutical. 2011, 260-537.
26. Thanakosai W, Phuwapraisirisan P. First identification of α-glucosidase inhibitors from okra (*Abelmoschus esculentus*) seeds. Natural Product Communications. 2013; 8(8):1085-8.
27. Subrahmanyam GV, Sushma M, Alekya A, Neeraja CH, Harsha HS, Ravindra J. Antidiabetic activity of *Abelmoschus esculentus* fruit extract. International Journal of Research in Pharmacy and Chemistry. 2011; 1:17-20.
28. Uraku AJ, Onuoha SC, Offor CE, Ogbanshi ME & Ndidi US. The effects of *Abelmoschus esculentus* fruits on

ALP, AST and ALT of diabetic albino rats. International Journal of Science and Nature. 2011; 2:582-6.
29. Saha D, Jain B & Jain VK. Phytochemical evaluation and characterization of hypoglycemic activity of various extracts of *Abelmoschus esculentus* Linn. fruit. International Journal of Pharmacy and Pharmaceutical Sciences. 2011; 3:183-5.
30. Fan S, Zhang Y, Sun Q, Yu L, Li M, and Huang C. Extract of okra lowers blood glucose and serum lipids in high-fat diet-induced obese C57BL/6 mice. The Journal of Nutritional Biochemistry, 2014.
31. Liu IM, Tzeng TF, Liou SS. *Abelmoschus moschatus* (Malvaceae), an aromatic plant, suitable for medical or food uses to improve insulin sensitivity. Phytother Res. 2010; 24:233-9.
32. Liu IM, Tzeng TF, Liou SS, Lan TW. Improvement of insulin sensitivity in obeseZucker rats by myricetin extracted from *Abelmoschus moschatus*. Planta Med. 2007; 73:1054-60.
33. Zhou L, An XF, Teng SC, Liu JS, Shang WB, Zhang AH, *et al***.** Pretreatment with the total flavone glycosides of flosabelmoschusmanihot and hyperoside preventsglomerular podocyte apoptosis in streptozotocin-induced diabetic nephropathy. J Med Food. 2012; 15:461-8.
34. Sabitha V, Ramachandran S, Naveen KR, Panneerselvam K. Antidiabetic and antihyperlipidemic potential of *Abelmoschus esculentus* (L.) Moench. Instreptozotocin-induced diabetic rats. J Pharm Bioallied Sci. 2011; 3:397-402.
35. Fan S, Guo L, Zhang Y, Sun Q, Yang B, Huang C. Okra polysaccharide improvesmetabolic disorders in high-fat diet-induced obese C57BL/6 mice. MolNutr Food Res. 2013; 57:2075-8.
36. Okada Y, Okada M, Sagesaka Y. Screening of dried plant seed extracts foradiponectin production activity and tumor necrosis factor-alpha inhibitoryactivity on 3 T3-L1 adipocytes. Plant Foods Hum Nutr. 2010; 65:225-32.
37. Moyin-Jesu EI. Use of plant residues for improving soil fertility pod nutrients root growth and pod weight of okra *Abelmoschus esculentum* L. Bioresour. Tech. 2007; 98:2057-2064.
38. Glew RH, VanderJagt DJ, Lockett C, Grivetti LE, Smith GC, Pastuszyn A, Millson M. Amino acid, fatty acid, and mineral composition of 24 indigenous plants of Burkina-Faso. J. Food Comp. Anal. 1997; 10:205-217.
39. Cook JA, Vander Jagt. DJ, Pastuszyn A, Mounkaila G, Glew RS, Millson M *et al*. Nutrient and chemical composition of 13 wild plant foods of Niger. J. Food Comp. Anal. 2000; 13:83-92.