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 a 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
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-Jusu, 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 oligomeric catechins (2.5 mg/g of seeds) and flavonol derivatives (3.4 mg/g of seeds), while the mesocarp is mainly composed of hydroxychalcone 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 quercetin derivatives, catechin oligomers and hydroxyxycinnamic 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. ([Avalone 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, Strinivas, & 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. (Thanakosi & Phuwapraisirisan 2013) [28] has reported, the presence of two major flavonolglycosides named isouqueretin (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 isouqueretin (2) were 6-10 times more potent than its related digluicoside 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 3 et al 2011]) [25] 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 isouqueretin 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, 16]

The mallow family has been reported to improve insulin resistance. The musk mallow (*Abelmoschus moschatius*) improves insulin resistance, increases insulin receptor substrate-1-associated phosphatidylinositol 3-kinase 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]) [36] 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]) [36] 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, ([Sabithaet et al 2011]) [34] demonstrated the antidiabetic activities of *Abelmoschus esculentus* peel and seed powder (AEEP and AESP respectively). The author showed

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<th>Type 1 diabetes</th>
<th>Type 2 diabetes</th>
<th>Gestational diabetes</th>
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<tr>
<td>10 to 15 % cases</td>
<td>80 to 90 % cases</td>
<td>5 to 10 % of pregnant women develop gestational diabetes.</td>
</tr>
<tr>
<td>Typically occurs in people under 35, but can occur at any age.</td>
<td>Most of time develops in adult over age of 45 years.</td>
<td>First detected in pregnancy.</td>
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<tr>
<td>Require insulin from diagnosis for the management of type 1 diabetes.</td>
<td>Diet and life style change can reverse it. Then add Oral medication may require insulin for the management of type 2 diabetes.</td>
<td>Diet and life style change and medication help in management of gestational diabetes.</td>
</tr>
<tr>
<td>Type 1 diabetes occur often random.</td>
<td>Type 2 diabetes occur strong family history.</td>
<td>Family history of type 2 diabetes.</td>
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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 glucose level and increase in body weight than diabetic control rats. A significant increased level of HbA1c, SGPT were observed after the treatment of both doses of AEPP and AESP. Also, elevated decreased level of HbA1c, SGPT were observed after the treatment of both doses of AEPP and AESP. In a similar study, (Saha et al. 2011) observed that the aqueous extract of powdered *Abelmoschus esculentus* had maximum effect when Glibenclamide was used as a standard.

Reference

28. Uraku AJ, Onuoha SC, Offor CE, Ogbanshi ME & Ndidi US. The effects of *Abelmoschus esculentus* fruits on


