IJSRM
INTERNATIONAL JOURNAL OF SCIENCE AND RESEARCH METHODOLOGY
An Official Publication of Human Journals

Human Journals
Review Article
July 2018 Vol.:10, Issue:1

The Role of Active Constituents of *Abelmoschus esculentus* (Okra) on Tumor Biology: A Review

IJSRM
INTERNATIONAL JOURNAL OF SCIENCE AND RESEARCH METHODOLOGY
An Official Publication of Human Journals

Shajedul Islam[1], Kala Chand Debnath*[2], Farzana Tamanna Ummey Shaon[3], Minto Das[4], Md. Fakhrul Hasan[5]

1. *School of Dentistry, Division of Disease Control and Molicular Epidemiology, Health Sciences University of Hokkaido, Hokkaido, Japan.*
2. *Faculty of Dentistry, Department of Oral and Maxillofacial Surgery, Dhaka Medical College and Hospital, Dhaka, Bangladesh.*
3. *Faculty of Dentistry, Department of Oral and Maxillofacial Surgery, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh.*
4. *Faculty of Dentistry, Department of Oral and Maxillofacial Surgery, Dhaka Dental College, Dhaka, Bangladesh.*
5. *Department of Pharmacy, East West University. Dhaka, Bangladesh.*

Submission: 20 June 2018
Accepted: 27 June 2018
Published: 30 July 2018

HUMAN JOURNALS
www.ijsrm.humanjournals.com

Keywords: Aging, *Helicobacter pylori*, Breast Cancer, Lectin, Melanoma. Okra, Pectin, Reactive Oxygen Species

ABSTRACT

Abelmoschus esculentus (Okra) is one of the most utilize species of the Malvaceae family and garnered tremendous attention in the scientific community due to the myriad biological functions. Besides the health benefit, around the worldwide, this plant has been reported to be used extensively in traditional medicine. Meanwhile, very few studies have been conducted to evaluate the molecular mechanism in cancer, thus, ongoing research conducting to evaluate the role of okra in cancer. Recently active constituent of okra has been reported to combat the diverse type of cancer. The purpose of this review was to summarize the findings of recent publications of okra with regard to cancer and to discuss the importance of this as a possible therapeutic agent.

INTRODUCTION

Abelmoschus esculentus also is known as lady's finger and has been grown in different countries around the worldwide. It has long been used as a vegetable and a source of dietary medicines (Benchasr et al. 2012). Different parts of okra contain various active constituents that enhance human health. Immature fresh and green seed pod consumed as a vegetable and offers mucilaginous consistency after cooking. Carotene, folic acid, thiamine, riboflavin, niacin, vitamin C, oxalic acid, amino acids and polyphenolic compounds are important bioactive ingredients which have been reported to be present in the okra pod(Jain et al. 2012; Roy et al.2014). Whereas mature seeds and kernels contain essential amino acids, palmitic, oleic and, linoleic acids (Roy et al.2014; Steyn et al. 2014; Rao et al. 1985). The root of this plant contains carbohydrate, fixed oils, and flavonoid glycosides (Roy et al.2014; Steyn et al. 2014; Tomoda et al. 1985). Leaves of okra are rich in minerals and flavonol glycosides, including quercetin derivatives, thus; offer potential antioxidant activity (Jain et al. 2012; Roy et al.2014; Steyn et al. 2014; Idris et al. 2009; Xia et al. 2015; Khomsug et al. 2010). Hence, these health benefit impacts enhance the importance of this foodstuff in the human diet. Okra has been reported to be involved in many biological activities including antidiabetic, anti-inflammatory, antipyretic, antinociceptive, neurological, hemagglutinating *etc.*(Jain et al. 2012; Roy et al.2014; Steyn et al. 2014; Soares et al. 2012; Fan et al. 2014; Khatun et al. 2011; Subramanyam et al. 2011; Lengs feld et al. 2004; Messing et al. 2014). Its antitumor effect has been a major point of focus in biomedical research due to its diversified role in various physiological states. The tumor is an abnormal type of tissue growth (Geoffrey et al. 2000) and, is one of the ailments which cannot be completely subdued by chemotherapy. Although chemotherapeutic agents effective against the tumor, they are not totally free from side effects, resulting in decreasing disease-free survival rate of patients. Plant material that is used in traditional medicine is available in rural areas relatively cheap and there are no side effects compared to modern medicine, okra is one of them. Studies demonstrated that the active constituents of okra possess anti-tumor effects on the diverse type of tumor (Monte et al. 2014; Tseng et al. 2004; Solomon et al. 2016, Vayssade et al. 2010, Subramanyam et al. 2011; Lengsfeld et al. 2004; Thole et al. 2015). In this review, we summarized published reports that investigated the role of okra and its active constituent in cancer management. The literature studies were scanty, but the results revealed that okra has a potential therapeutic effect on cancer.

Such results providing the evidence in support to encourage more scientific research that may suggestive of new drug discovery. To be the best of our knowledge, this is the first review regarding okra and cancer.

Role of *Abelmoschus esculentus* on tumorigenesis

Okra has significant impacts on human health as demonstrated in some of the aforementioned studies. Beside that, it has significant anticancer effects on different cancer cell lines. Lectins of okra have been shown to inhibit cellular proliferation in human breast cancer *in vitro*(Monte et al. 2014). Lectins are a group of non-immune origin proteins, found in amicroorganism, plants and, animals (Pinto et al. 2008). Plants lectins have been reported to involve diversified biological functions including arresting the cell cycle and activate caspase cascades (Damordaran et al. 2008). Lectin of okra induces apoptosis via elevating the levels of pro-apoptotic proteins. It shows that following lectin administrationcaspase-3, caspase-9and Bax expression were upregulated, thus attributed to the induction of apoptosis without affecting healthy cells (Monte et al. 2014). Meanwhile, an upregulation of *p21*genefollowing lectin treatment inhibits cellular proliferation(Monte et al. 2014; Elmore et al. 2007). Taken together suggesting that okra may provide useful strategies in combination with standard chemotherapy without promoting systemic toxicity. Therefore, future studies required to clarify the cytotoxic effects in an *in vivo* breast cancer model.

To cope with prostate cancer, okra containing southern diet (characterized by eating with okra, grits, beans, cornbread, rice, and potatoes) had experienced 40% less prostate cancer than those eating western diets (Tseng et al. 2004). Although researcher could not conclude that okra was the key anti-cancer factor in this diet. As dietary pattern may reflect a history of living in the South and exposure to sunlight, rather than a simple measure of overall dietary habits. Sunlight protects against prostate cancer by the subsequent activation of vitamin D and in experimental studies, an active form of vitamin D reduces cell proliferation, induces cell differentiation and apoptosis in prostate cancer (Miller et al. 1999; Johnson et al. 2002; Giovannucci et al. 1998)). Further studies are required in order to evaluate the key role of okra in the inhibition of prostate cancer.

With regards to highly metastatic melanoma, pectin of okra has been shown to induce apoptosis and inhibit cellular proliferation (Vayssade et al. 2010). Pectins are oligosaccharides, have been reported to involve in cell adhesion, growth, and survival, as well as tumor

development, and cancer prevention therapy(Pienta et al. 1995; Nangia-Makker et al. 2002; OlanoMartin et al. 2003). Okra pectin contains unique rhamnogalacturonan (Sengkhamparn et al. 2009a), which has been reported to be involved in the protective effects against melanoma (Vayssade et al. 2010). Moreover, pectin inhibits the expression of N-cadherins, α5 integrin and, triggers apoptosis via interacting with Galectin-3 (Vayssade et al. 2010), which is an emerging target molecule for cancer therapy (Nangia-Makker et al. 2007). Thus, suggesting new therapeutics that can interfere with melanoma proliferation, survival, migration, and invasion. However, *in vivo* experimental evidence will require evaluating okra pectin as a therapeutic strategy in melanoma.

Helicobacter pylori have been known to play a major role in chronic gastritis, adenocarcinoma, duodenal and gastric ulceration (Warreb et al. 1983; Covacci et al. 1999). Okra possesses antiadhesive properties that interrupt the adhesion of *H.pylori* to human stomach tissues via interfering with outer membrane proteins (Subramanyam et al. 2011; Lengsfeld et al. 2004; Thole et al. 2015; Messing et al. 2014). It clearly indicates that okra could provide a preventive cytoprotective strategy to combat *H. pylori* colonization, especially to prevent its recurrence after antibiotic eradication therapy, since; lifelong use of antibiotics induces the risk of resistance. Furthermore, okra has been shown to inhibit cellular proliferation in human liver cancer *in vitro* (Solomon et al. 2016), suggesting to use as a potential anticancer agent. On the basis of these findings, we assume that different active constituents of *Abelmoschus esculentus* could be used as a potential therapeutic agent, thereby further studies will undoubtedly involve pinpointing the molecular mechanisms by which okra influence cancer.

The future research prospect and possible therapeutic agent in treating cancer

Based on the aforementioned studies and the presence of different active constituents regular uptake of okra has significant impacts on health. Okra possesses inhibitory effects to the generation of reactive oxygen species (ROS) (Xia et al. 2015; Khomsug et al. 2010). Quercetin derivatives and epigallocatechin are the major ROS scavenger agents in okra (Shui et al. 2004). Moreover, ROS are potential candidates responsible for cellular aging and tumorigenesis (Harman D et al. 1983; Feig DI et al. 1994). Based on this perspective different active elements of okra could be used in reverse aging and as anticancer agents. In addition, plant lectins have inhibitory effects on different malignant cells and capable of modulating the immune response in different ways (De Mejia EG et al. 2005; Schumacher et al. 2000; Fang et

al. 2012; Ni Y et al. 1996). Thus; in order to the development of lectin-based drugs as a therapeutic agent, further studies are warranted.

REFERENCES:

1. Benchasr S (2012) Okra (Abelmoschusesculentus (L.) Moench) as a Valuable Vegetable of the World. RatarPovrt. 49: 105-112.
2. Covacci A, Telford JL, Del Guidice G, Parsonet J, Rappuoli R (1999) *Helicobacterpylori* virulence and gastric geography. Review. Science 284:1328-1333.
3. Damodaran D, Jeyakani J, Chauhan A, Kumar N, Chandra NR, Surolia A (2008) Cancer LectinDB: a database of lectins relevant to cancer. Glycoconj J 25:191–198.
4. De Mejía EG, Prisecaru VI (2005) Lectins as bioactive plant proteins: a potential in cancer treatment. Crit Rev Food SciNutr 45:425-45.
5. Elmore S (2007) Apoptosis: a review of programmed cell death. ToxicolPathol 35:495–516.
6. Fan S, Zhang Y, Sun Q, Yu L, Li M, Huang C (2014) Extract of okra lowers blood glucose and serum lipids in high-fat-diet-induced obese C57BL/6 mice. The Journal of Nutritional Biochemistry.
7. Feig DI, Reid TM, Loeb LA (1994) Reactive oxygen species in tumorigenesis. Cancer Res. 54(7 Suppl):1890s–1894s.
8. Fang EF, Zhang CZ, Ng TB, Wong JH, *et al*. (2012) MomordicaCharantialectin, a type II ribosome inactivating protein, exhibits antitumor activity toward human nasopharyngeal carcinoma cells in vitro and in vivo. Cancer Prev Res (Phila) 5:109-21.
9. Geoffrey M Cooper (2000) The Development and Causes of Cancer. Canada.

Giovannucci, E. L (1998) Dietary influences of 1,25(OH)2 vitamin D in relation to prostate cancer: a hypothesis. Cancer Causes Control 9: 567–582.

10. Harman D (1983) Free radical theory of aging: consequences of mitochondrial aging. AGE. 6:86–94.
11. Idris S, Yisa J, Itodo A (2009) Proximate and mineral composition of the leaves of Abelmoschusesculentus. International Journal of Tropical Agriculture and Food Systems. 3(2).
12. Jain N, Jain R, Jain V, Jain S A (2012) review on: Abelmoschusesculentus. Pharmacia 1 (3):84-89.
13. Johnson, C. S., Hershberger, P. A., and Trump, D. L (2002) Vitamin D-relate therapies in prostate cancer. Cancer Metastasis Rev 21: 147–158.
14. Khomsug P, Thongjaroenbuangam W, Pakdeenarong N, Suttajit M, Chantiratikul P (2010) Antioxidative Activities and Phenolic Content of Extracts from Okra (Abelmoschusesculentus L.) Research Journal of Biological Science 5(4), 310-313.
15. Khatun H, Rahman A, Biswas M, Islam AU (2011) Water-soluble Fraction of Abelmoschusesculentus L Interacts with Glucose and Metformin Hydrochloride and Alters Their Absorption Kinetics after Coadministration in Rats. ISRN Pharmaceutical 260537.
16. Lengsfeld C, Titgemeyer F, Faller G, Hensel A (2004) Glycosylated compounds from okra inhibits adhesion of Helicobacter pylori to human gastric mucosa. Journal of Agricultural Food Chemistry 52(6), 1495-503.
17. Messing J, Thole C, Niehues M, Shevtsova A, Glocker E, Hensel A (2014) Antiadhesive properties of Abelmoschusesculentus (Okra) immature fruit extract against Helicobacter pylori adhesion. PLoS One. 9(1), e84836.
18. LG. Monte, T Santi-Gadelha, LB. Reis, E Braganhol, *et al*. (2014) Lectin of Abelmoschusesculentus (okra) promotes selective antitumor effects in human breast cancer cells. Biotechnol. Lett. 36;461-469.
19. Miller, G. J (1999) Vitamin D and prostate cancer: biologic interactions and clinical potentials. Cancer Metastasis Rev 17: 353–360.
20. Nangia-Makker P, Conklin J, Hogan V, Raz A (2002) Carbohydrate-binding proteins in cancer, and their ligands as therapeutic agents. Trends Mol Med. 8: 187–192.
21. Nangia-Makker P, Nakahara S, Hogan V, Raz A (2007) Galectin-3 in apoptosis, a novel therapeutic target. J BioenergBiomembr 39: 79–84.
22. Ni Y, Tizard I (1996) Lectin-carbohydrate interaction in the immune system. Vet Immunol Immunopathol. 55(1-3):205-23.

23. Olano-Martin E, Rimbach GH, Gibson GR, Rastall RA (2003) Pectin and pectic-oligosaccharides induce apoptosis in in vitro human colonic adenocarcinoma cells. Anticancer Res 23: 341–346.
24. Pinto LS, Nagano CS, Oliveira TM, Moura TR, Sampaio AH, Debray H, Pinto VP, Dellagostin OA, Cavada BS (2008) Purification and molecular cloning of a new galactose-specific lectin from Bauhinia variegata seeds. J Biosci 33:355–363
25. Pienta KJ, Naik H, Akhtar A, Yamazaki K, *et al.* (1995) Inhibition of spon- taneous metastasis in a rat prostate cancer model by oral administration of modified citrus pectin. J Natl Cancer Inst 87: 348–353.
26. Roy Anupam, SL Shrivastava, Mandal SM (2014) Functional properties of Okra Abelmoschusesculentus L.(Moench): traditional claims and scientific evidences. Plant Science Today 1 3: 121-130.
27. Rao, PU (1985) Chemical composition and biological evaluation of okra (Hibiscus esculentus) seeds and their kernels. Plant Foods for Human Nutrition. 35, 389–396.
28. Steyn N.P, McHiza Z, Hill J, DavidsY D, *et al.* (2014)Nutritional contribution of street foods to the diet of people in developing countries: a systematic review. Public Health Nutrition. 17(6):1363-1367.
29. Soares GSF, Assreuy AMS, Gadelha CAA, Gomes VM, *et al.* (2012) Purification and biological activities of *Abelmoschusesculentus* seed lectin. Protein J. 31:674–680.
30. Subrahmanyam GV, Sushma M, Alekya A, Neeraja CH, Harsha HS, Ravindra J (2011) Antidiabetic activity of Abelmoschusesculentus fruit extract. International Journal of Research in Pharmacy and Chemistry 1: 17–20.
31. S Solomon, N Muruganantham, M MSenthamilselvi (2016) Anticancer activity of Abelmoschusesculentus (flower) against human liver cancer 6: 154-157.
32. Sengkhamparn N, Bakx EJ, Verhoef R, Schols HA, Sajjaanantakul T, Voragen AG (2009a). Okra pectin contains an unusual substitution of its rhamnosyl residues with acetyl and alpha-linked galactosyl groups. Carbohydr Res334:1842–1851.
33. Shui G, Peng LL (2004) An improved method for the analysis of major antioxidants of Hibiscus esculentus Linn. Journal of Chromatography A, 1048;17–24.
34. Schumacher U, Feldhaus S, Mengs U (2000) Recombinant mistletoe lectin (rML) is successful in treating human ovarian cancer cells transplanted into severe combined immunodeficient (SCID) mice. Cancer Lett 150:171-5.
35. Tomoda M, Shimizu N, Gonda R (1985) Isolation and characterisation of a mucilage 'Okra Mucilage R' from the roots of Abelmoschusesculentus. Chemical & Pharmaceutical Bulletin. 33(8):3330–3335.
36. Tseng MT, Breslow RA, deVellis RF, Ziegler RG (2004) Dietary patterns and prostate cancer risk in the NHEFS cohort. Cancer Epidemiol Biomarkers Prev13:71–7
37. Thöle C, Brandt S, Ahmed N, Hensel A (2015) Acetylated rhamnogalacturonans from immature fruits of Abelmoschusesculentus inhibit the adhesion of Helicobacter pylori to human gastric cells by interaction with outer membrane proteins. Molecules 20;16770–16787.
38. Vayssade M, Sengkhamparn N, Verhoef R, Delaigue C, *et al.* (2010) Antiproliferative and proapoptotic actions of okra pectin on B16F10 melanoma cells. Phytother. Res 24, 982–989.