



## **Antifertility Effect of Okra (*Abelmoschus esculentus*) in Men**

**Haris Ja'afar Bello<sup>1,2\*</sup>, Abdulkadir Yusif Maigoro<sup>2</sup>, Mahmood Hassan Dalhat<sup>3</sup>,  
Sadeeq Muhammad Sheshe<sup>2</sup>, Abdullahi Muhammad Labbo<sup>2,4</sup>,  
Jameela Abdulrahman<sup>5</sup> and Anas Muazu<sup>1,2</sup>**

<sup>1</sup>*Department of Biomathematics, National Mathematical Centre, Abuja, Nigeria.*

<sup>2</sup>*Department of Biosciences, COMSATS Institute of Information Technology, Islamabad, Pakistan.*

<sup>3</sup>*Department of Biochemistry, Usmanu Danfodiyo University, Sokoto, Nigeria.*

<sup>4</sup>*Department of Biochemistry, Sokoto State University, Nigeria.*

<sup>5</sup>*Department of Crop Production Technology, Federal College of Forestry, Jos, Nigeria.*

### **Authors' contributions**

*This work was carried out in collaboration between all authors. Author HJB designed the study. Authors HJB, AYM and MHD wrote the drafts of the manuscript. Authors SMS, AML, JA and AM reviewed the drafts. All authors read and approved the final manuscript.*

### **Article Information**

DOI: 10.9734/AJRIMPS/2017/38671

#### Editor(s):

(1) Imran Aslan, Bingol University, Bingol, Turkey.

#### Reviewers:

(1) Franco Cervellati, University of Ferrara, Italy.

(2) S. Sainudeen Sahib, University of Kerala, India.

Complete Peer review History: <http://www.sciencedomain.org/review-history/22691>

**Mini-review Article**

**Received 3<sup>rd</sup> November 2017**

**Accepted 4<sup>th</sup> January 2018**

**Published 11<sup>th</sup> January 2018**

### **ABSTRACT**

Okra is a nutritious and medicinal vegetable used by many families especially in Asia and Africa. Despite its nutritional and medicinal values, okra is associated with sterility in humans especially men due to the presence of gossypol in the seed. Recently, some studies claimed that excess consumption of okra may have injurious effects on sperm parameters, testes weight, and testicular tissues. These detrimental effects may subsequently reduce male fertility or cause male infertility. Authors used available published data to explain the role of okra in male infertility. In conclusion, this review highlighted the effect of okra in male fertility.

\*Corresponding author: E-mail: [harisbilkis@yahoo.com](mailto:harisbilkis@yahoo.com);

**Keywords:** Okra; sperm; male infertility; vegetable; gossypol.

## 1. INTRODUCTION

Okra (*Abelmoschus esculentus*) is a vegetable crop that belongs to Malvaceae family and is the only essential member (vegetable crop) in the family. The crop is widely distributed globally but grown in some countries especially in Africa, Asian and southern Europe [1]. Okra is also known as okro, ochro, lady's finger, bamyah, gumbo, and bhindi. It is a greenish capsule of about 7-18 cm long, slightly curved and contains many seeds (Fig. 1) [2]. For about three centuries, okra has been used for many reasons. Nutritionally, it is an important plant (vegetable) containing carbohydrates, proteins, vitamins, oils, and biologically essential elements [3]. Medicinally, it is used for remedy of many diseases such as diabetes [4,5], hyperlipidemia [4], asthma [6], ulcer [7], depression, cancer [8] and renal function improvement [3]. Furthermore, it is used as antioxidant, antimicrobial, anti-inflammatory [9,10], antiviral [8], reduces the risk of Alzheimer's disease and other neurodegenerative diseases due to oxidative stress [11].



**Fig. 1. Typical okra (*Abelmoschus esculentus*) with its seeds**

The seeds of okra were reported to contain a toxic compound called gossypol or a gossypol-like compound which stimulates infertility [12]. Daily consumption of gossypol can stimulate infertility in many animals including men by irreversibly blocking spermatogenesis [13]. Although several studies reported that the compound has no other side effect, as such it is used as a contraceptive for men [14]. Zaharuddin et al. [15] recommended high consumption of okra (by women) during pregnancy because it promotes healthy pregnancy as well as reduces the rate of birth defects. In addition, okra was reported to be essential for the fetus' brain

growth and development as well as neural tube formation [15]. However, Coutinho [13] highlighted two undesirable side effects; hypokalemia and irreversibly arrest of spermatogenesis.

Many studies focus on the medicinal values of okra, neglecting its (okra) adverse effects to human health. Although, few studies highlighted its effect in fertility. Thus, the current review will provide information on the antifertility effects of okra in men.

## 2. COMPOSITION OF OKRA

Okra has significant amount of fibres, vitamin C, folate, antioxidants, potassium, and calcium. Other components of okra include protein, carbohydrate, fat, vitamins (A, B, and K), water, sugar, and essential biological minerals (eg zinc, iron, and magnesium) [1]. dos Santos et al. [16] reported a significant difference ( $P = .05$ ) in mineral contents of raw okra compared to cooked okra. Phytochemical analysis of okra indicates the presence of gossypol [12]. Gossypol is a phenolic compound present in various parts of cotton plants (*Gossypium species*). It is known to stimulate infertility in many species including humans. Although, its (gossypol) effect depend on dose and time of administration, in men gossypol irreversibly blocks spermatogenesis in over 20% of test subjects [13].

## 3. MALE INFERTILITY

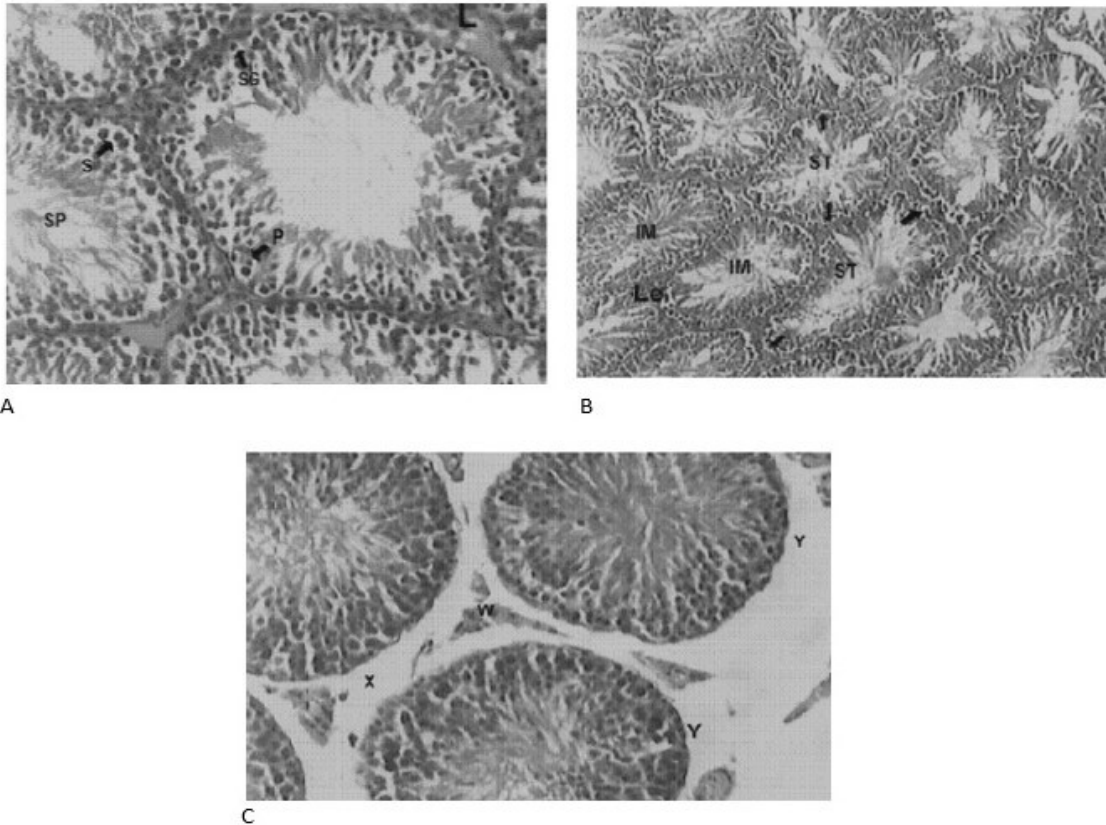
Male infertility is the inability of the male to cause pregnancy after regular unprotected sex of about a year or more [17]. Many factors such as defective sperm production and function [18], obstruction of the reproductive tract, sexually related disorders (for instance, failure/premature ejaculation, erectile dysfunction) [19] and chromosomal anomalies [20] are associated with male infertility. Furthermore, numerous diseases such as diabetes [21], obesity [18], and cancer [22] reduce male fertility. Despite the rapid population growth around the globe (especially in Asia and Africa) and lack of reliable data for infertility prevalence, the incident of male infertility is rising [23]. Interestingly, many studies pinpointed the significance of dietary factors as well as nutraceutical food in fertility, and fertility-related problems [24]. Even though, some nutraceutical food such as okra, *Carica papaya*

(papaya), *Gossypium herbaceum* (cotton) and *Azadirachta indica* (neem) are presently considered as important factors associated with male sub-fertility [25].

#### 4. OKRA IN MALE INFERTILITY

Male infertility can be due to many factors such as congenital, acquired and idiopathic [22]. Healthy diets are essential in human fecundity, diets rich in vitamins (such as E and C), antioxidant (such as selenium,  $\beta$ -carotene, lycopene and cryptoxanthin), omega 3 fatty acid, and zinc are positively correlated with increased fertility. On the other hand, diets rich in gossypol [26] such as okra, caffeine, saturated fatty acid and trans fatty acids negatively correlated with increased fertility [27]. Despite the inadequate studies on the effect of okra on male infertility,

few studies confirmed its effect on male infertility (Table 1). Oral administration of  $70 \text{ mgkg}^{-1}$  body weight per day of the methanolic extract of okra fruit for 28 days causes significant loss of testes weight and significant ( $P = .05$ ) increase in body weight of the experimental mice (treated groups) compared to control group [28]. Similarly, same results were obtained in addition to testicular tissues deterioration (Fig. 2) in a study conducted for 42 days using different doses ( $250, 500, 750$  and  $1000 \text{ mgkg}^{-1}$ ) of the methanolic extract of the fruit of okra [29]. Furthermore, Kyrian Uchenna et al. [29] reported significant ( $P = .05$ ) reduction in sperm cell count and motility as well as an increased in abnormal sperm cells. Surprisingly, another study reported significant ( $P = .05$ ) increase in serum levels of reproductive hormones (testosterone, luteinizing hormone and follicle stimulating hormone) [30].



**Fig. 2.** Light micrographs (hematoxylin and eosin stain, mag. X400) showing an effect of methanolic extract of okra fruit on spermatogenic cells in mice. (A) Control group ( $0 \text{ mgkg}^{-1}$ ) with normal spermatogenic cells L = Leydig cells, P = Primary spermatocyte, S = Sertoli cells, SG = Spermatogonia, SP = spermatids and spermatozoa. (B) The experimental group ( $750 \text{ mgkg}^{-1}$ ) with aberrant seminiferous tubules (ST), immature spermatozoa (IM) and reduced Leydig cells (Le). (C) Experimental group ( $1000 \text{ mgkg}^{-1}$ ) deterioration of interstitial cells (X), loss of Leydig cells (W) and seminiferous appears apart (Y). Source; Image adopted from Kyrian Uchenna et al. [29] with permission

**Table 1. Effect of methanolic extract of okra fruit in sperm physiology and male reproductive organs**

Effects	References
Block spermatogenesis	[28]
Decreases sperm count	[29]
Decreases sperm motility	[29]
Increases abnormal sperm morphology	[29]
Decreases testosterone level and testicular weight	[28,29]
Impairment of testicular tissues	[29]

## 5. CONCLUSION

This review highlighted the effect of okra in male infertility. The presence of gossypol in okra seed played a significant role in the pathogenesis of the diseases. The antifertility effect of okra was ascertained in mice and it was confirmed that methanolic extract of okra fruit affects testes, testicular tissues and semen parameters (motility, count, and morphology). These detrimental effects alter the semen integrity and may subsequently halt fertilization. Despite the increase in world population, the rapid increase in the rate of infertility is disturbing. Therefore, there is need to identify the factors in our day to day life that are associated with infertility. According to our knowledge, this review is the first to highlight the role of okra in male infertility.

## 6. RECOMMENDATION

Several studies have confirmed the antifertility effect of okra in mice, since most humans do not consume raw okra, similar studies should be conducted on primates using cooked okra. Also, the mechanism of its action should be elucidated. Furthermore, the consumption of okra as food (vegetable) and medicinal plant by healthy fertile humans should be properly assessed. Likewise, infertile men under medication should stop the consumption of okra especially raw.

## CONSENT

It is not applicable.

## ETHICAL APPROVAL

It is not applicable.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

## REFERENCES

- Kumar DS, Tony DE, Praveen Kumar A, Kumar KA, Srinivasa Rao DB, Nadendla R, Author C. A Review on: *Abelmoschus esculentus* (Okra). International Research Journal of Pharmaceutical and Applied Sciences (IRJPAS) 2013;3(34). Available:[www.irjpas.com](http://www.irjpas.com)
- Lengsfeld C, Titgemeyer F, Faller G, Hensel A. Glycosylated compounds from okra inhibit adhesion of *Helicobacter pylori* to human gastric mucosa. Journal of Agricultural and Food Chemistry. 2014; 52(6):1495-1503.
- Gemedede HF, Ratta N, Haki GD, Woldegiorgis Ashagrie ZBF. Nutritional Quality and Health Benefits of Okra (*Abelmoschus esculentus*): A review. International Journal of Nutrition and Food Science. 2014;4(2):208-215.
- Sabitha V, Ramachandran S, Naveen KR, Panneerselvam K. Antidiabetic and antihyperlipidemic potential of *Abelmoschus esculentus* (L.) Moench. in streptozotocin-induced diabetic rats. Journal of Pharmacy & Bioallied Sciences. 2011;3(3):397-402.
- Khosrozadeh M, Heydari N, Abootalebi M. The effect of *Abelmoschus esculentus* on blood levels of glucose in diabetes mellitus. Iranian Journal of Medical Sciences. 2016;41(3):S63.
- Sabitha V, Panneerselvam K, Ramachandran S. *In vitro*  $\alpha$ -glucosidase and  $\alpha$ -amylase enzyme inhibitory effects in aqueous extracts of *Abelmoschus esculentus* (L.) Moench. Asian Pacific Journal of Tropical Biomedicine. 2012;2(1): S162-S164.
- Gürbüz İ, Üstün O, Yesilada E, Sezik E, Kutsal O. Anti-ulcerogenic activity of some plants used as folk remedy in Turkey. Journal of Ethnopharmacology. 2003; 88(1):93-97.
- Olaru O, Nițulescu G, Orțan A, Dinu-Pîrvu C. Ethnomedicinal, phytochemical and pharmacological profile of *anthriscus sylvestris* as an alternative source for anticancer lignans. Molecules. 2015;20(8): 15003-15022.

9. Mairuae N, Cheepsunthorn P, Cheepsunthorn CL, Tongjaroenbuangam W. Okra (*Abelmoschus esculentus* Linn) inhibits lipopolysaccharide-induced inflammatory mediators in BV2 microglial cells. Trop J Pharm Res Tropical Journal of Pharmaceutical Research Journal Citation Reports Science Edition. 2017; 16(166):1285–1285.
10. Aberoumand A, Deokule SS. Comparison of phenolic compounds of some edible plants of Iran and India. Pakistan Journal of Nutrition. 2008;7(4):582–585.
11. Mairuae N, Connor JR, Lee SY, Cheepsunthorn P, Tongjaroenbuangam W. The effects of okra (*Abelmoschus esculentus* Linn.) on the cellular events associated with Alzheimer's disease in a stably expressed HFE neuroblastoma SH-SY5Y cell line. Neuroscience Letters. 2015;603:6–11.
12. Martin FW, Telek L, Ruberte R, Santiago AG. Protein, oil and gossypol contents of a vegetable curd made from okra seeds. Journal of Food Science. 1979;44(5): 1517–1519.
13. Coutinho EM. Gossypol: A contraceptive for men. Contraception. 2012;65(4):259–263.
14. Qian S, Wang Z (1984). Gossypol: A potential antifertility agent for males. Annual Review of Pharmacology and Toxicology. 1984;24(1):329–360.
15. Zaharuddin ND, Noordin MI, Kadivar A. The Use of *Hibiscus esculentus* (Okra) gum in sustaining the release of propranolol hydrochloride in a solid oral dosage form. BioMed Research International. 2014;1–8.
16. dos Santos IF, dos Santos AMP, Barbosa UA, Lima JS, dos Santos DC, Matos GD. Multivariate analysis of the mineral content of raw and cooked okra (*Abelmoschus esculentus* L.). Microchemical Journal. 2013;110:439–443.
17. Alkhedaide A, Alshehri ZS, Sabry A, Abdel-Ghaffar T, Soliman MM, Attia H. Protective effect of grape seed extract against cadmium-induced testicular dysfunction. Molecular Medicine Reports. 2016;13(4):3101–3109.
18. Adewoyin M, Ibrahim M, Roszaman R, Isa M, Alewi N, Rafa A, Anuar M. Male infertility: The effect of natural antioxidants and phytochemicals on seminal oxidative stress. Diseases. 2017;5(1):9.
19. de Kretser DM, Baker HWG. Infertility in men: Recent advances and continuing controversies 1. The Journal of Clinical Endocrinology & Metabolism. 1999;84(10): 3443–3450.
20. O'Flynn O'Brien KL, Varghese AC, Agarwal A. The genetic causes of male factor infertility: A review. Fertility and Sterility. 2010;93(1):1–12.
21. La Vignera S, Condorelli RA, Di Mauro M, Lo Presti D, Mongioi LM, Russo G, Calogero AE. Reproductive function in male patients with type 1 diabetes mellitus. Andrology. 2015;3(6):1082–1087.
22. Jungwirth A, Diemer T, Dohle G, Giwercman A. Guild Lines on Male Infertility; 2015.
23. Mascarenhas MN, Cheung H, Mathers CD, Stevens GA. Measuring infertility in populations: Constructing a standard definition for use with demographic and reproductive health surveys. Population Health Metrics. 2012;10(1):17.
24. Polito M, Conti A, Tiroli M, Capece M, Muzzonigro G, Polito M. Diet and male infertility. Journal of Andrological Sciences. 2011;18:60–63.
25. Devi P, Kumar P, Dhamija I. Antifertility activity of medicinal plants on male and female reproduction. International Journal of Pharmaceutical Sciences and Research. 2015;6(3):988.
26. Gadelha ICN, Fonseca NBS, Oloris SCS, Melo MM, Soto-Blanco B, Soto-Blanco B. Gossypol toxicity from cottonseed products. The Scientific World Journal. 2014;2014:231635.
27. Salas-Huetos A, Bulló M, Salas-Salvadó J. Dietary patterns, foods and nutrients in male fertility parameters and fecundability: a systematic review of observational studies. Human Reproduction Update. 2017;23(4):1–19.
28. Olatunji-Bello II, Ijiwole T, Awobajo FO. Evaluation of the deleterious effects of aqueous fruit extract of *Abelmoschus esculentus* (Okro Fruit) on some male reproductive parameters in sprague dawley rats. Journal of Phytology. 2009; 1(6):461–468.
29. Kyrian Uchenna N, Godswill Nweze K, Izuchukwu Charles I. Effects of the methanolic extract of *Abelmoschus esculentus* (L) Moench (Okro) fruit on the testes and sperm characteristics of male albino wistar rats. CASRP Publishing Company. 2014;2(10):2686–2690.

30. Kyrian U, Amah-Tariah F, Datonye V, Charles I. Methanolic extracts of the fruit of *Abelmoschus esculentus* (Okro) causes increase in the serum concentration of some reproductive hormones and decreases total sperm count in male albino wistar rats. *European Journal of Pharmaceutical and Medical Research*. 2015;2(5):57-66.

---

© 2017 Bello et al.; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

*Peer-review history:*  
The peer review history for this paper can be accessed here:  
<http://www.sciencedomain.org/review-history/22691>