



Medicinal Properties of Herbal Plant *Averrhoa carambola* L Against Burden of Cancer

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Received: January 20, 2021

Published: January 30, 2021

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Abstract

Globally, Approximately 70% of deaths from cancer occur in low- and middle-income countries due to the five leading behavior and dietary risks such as high body mass index, intakes of low fruit and vegetables lack of physical activities, tobacco and alcoholism. In low and middle income countries, about 25% of infectious diseases are hepatitis and human papilloma virus caused by cancer. Currently available chemo and radio therapies are have not only been able to cure this devastating disease but also cause many undesirable side effects. Medicinal plants has an important position in the drug discovery and many modern drugs have either origin in traditional medicine of different cultures, by accumulating information on the popular medicinal use of plants. There are well developed traditional medical systems with various herbal preparations which use to treat cancer through eliminating the carcinogen from the systems, blocking one or more steps in cancer development, retarding the further growth of cancer cells while minimizing side effects of chemotherapy. Therefore, there is an increasing demand for alternative plants based medicine for the treatment of various types of cancer due to low cost, lesser side effects, and long term effectiveness in chronic conditions. *A. carambola* plant has various pharmacological actions such as antioxidant, anti-inflammatory, hypotensive, hepatoprotective, anti-ulcer, antimicrobial and anthelmintic etc. Due to the presence of constituents such as alkyl phenols, benzoquinones, carotenoids, β - sitosterol, lupeol, anthraquinone glucoside and p-Anisaldehyde. Therefore this herbal could be developed valuable therapeutic agent for the cancer.

Keywords: Cancer; *A carambola*; Herbal; β -sitosterol; Sagadam; Star Fruit

Introduction

Cancer is a main reason of demise global amongst female in each high-income international locations and middle-income international locations due to the boom and getting old of the population. This growing burden is anticipated to be mainly stated in low and middle-income international locations (LMICs), the place the common lifestyles expectancy is turning into longer due to public fitness advances such as the manipulate of infectious disorder and discounts in maternal, infant, and childhood mortality [1]. The most cancers burden is additionally developing in LIMCs due to the occurrence of most cancers danger elements as nations journey monetary transition [1].

Among females, most cancers is the 2d main motive of demise worldwide, accounting for 14% of all deaths (Table 1), and in the Americas, Europe, and the Western Pacific regions. It is the 1/3 main purpose of loss of life in the Eastern Mediterranean, fourth in

South-East Asia, and sixth in Africa (Table 2).

Rank	Top ten causes of death	Deaths	%
1	Cardiovascular diseases	8,820	34
2	Malignant neoplasms	3,544	14
3	Infectious and parasitic diseases	3,016	12
4	Respiratory diseases	1,756	7
5	Respiratory infections	1,461	6
6	Unintentional injuries	1,328	5
7	Neonatal conditions	1,097	4
8	Digestive diseases	929	4
9	Neurological conditions	821	3
10	Diabetes mellitus	813	3
	All causes	26,023	

Table 1: Leading causes of death among females worldwide ($\times 1000$), 2012.

Based on World Health Organization (WHO) and International Agency for Research on Cancer (IARC), there have been 6.7 million new most cancers instances and 3.5 million deaths amongst girls global in 2012 (Table 3) [2,3], Of these, 56% of instances and 64%

of deaths had been in much less developed countries. These numbers are predicted to extend to 9.9 million instances and 5.5 million deaths amongst women yearly by using 2030 as a end result of the increase and getting old of the populace [3].

Rank	Top ten causes of death	Deaths	%	Top ten causes of death	Deaths	%
	Africa			Americas		
1	Infectious and parasitic diseases	1,568	35	Cardiovascular diseases	934	31
2	Cardiovascular diseases	513	12	Malignant neoplasms	615	20
3	Respiratory infections	479	11	Neurological conditions	259	9
4	Neonatal conditions	393	9	Respiratory diseases	200	7
5	Unintentional injuries	253	6	Diabetes mellitus	161	5
6	Malignant neoplasms	232	5	Digestive diseases	137	5
7	Nutritional deficiencies	174	4	Respiratory infections	132	4
8	Maternal conditions	171	4	Unintentional injuries	110	4
9	Digestive diseases	134	3	Infectious and parasitic diseases	110	4
10	Diabetes mellitus	99	2	Genitourinary diseases	91	3
	All causes	4,446		All causes	3,011	
	South-East Asia			Europe		
1	Cardiovascular diseases	1,685	27	Cardiovascular diseases	2,406	53
2	Infectious and parasitic diseases	889	14	Malignant neoplasms	886	20
3	Respiratory diseases	661	11	Neurological conditions	215	5
4	Malignant neoplasms	554	9	Digestive diseases	190	4
5	Unintentional injuries	436	7	Respiratory diseases	161	4
6	Neonatal conditions	402	6	Unintentional injuries	123	3
7	Respiratory infections	376	6	Respiratory infections	102	2
8	Digestive diseases	243	4	Diabetes mellitus	87	2
9	Diabetes mellitus	208	3	Infectious and parasitic diseases	86	2
10	Genitourinary diseases	181	3	Genitourinary diseases	75	2
	All causes	6,216		All causes	4,527	
	Eastern Mediterranean			Western Pacific		
1	Cardiovascular diseases	523	29	Cardiovascular diseases	2,730	71
2	Infectious and parasitic diseases	220	12	Malignant neoplasms	1,064	28
3	Malignant neoplasms	174	10	Respiratory diseases	602	16
4	Neonatal conditions	162	9	Unintentional injuries	299	8
5	Respiratory infections	139	8	Respiratory infections	228	6
6	Unintentional injuries	103	6	Diabetes mellitus	187	5
7	Digestive diseases	76	4	Digestive diseases	144	4
8	Diabetes mellitus	63	4	Infectious and parasitic diseases	142	4
9	Respiratory diseases	56	3	Neurological conditions	106	3
10	Genitourinary diseases	50	3	Genitourinary diseases	103	3
	All causes	1,792		All causes	3,870	

Table 2: Leading causes of death among females by world region (×1000), 2012.

Cases Deaths			
Worldwide			
Breast	1,671,100	Breast	521,900
Colorectum	614,300	Lung, bronchus, and trachea	491,200
Lung, bronchus, and trachea	583,100	Colorectum	320,300
Cervix uteri	527,600	Cervix uteri	265,700
Stomach	320,300	Stomach	254,100
Corpus uteri	319,600	Liver	224,500
Ovary	238,700	Pancreas	156,600
Thyroid	229,900	Ovary	151,900
Liver	228,100	Esophagus	119,000
Non-Hodgkin lymphoma	168,100	Leukemia	114,200
All sites*	6,657,500	All sites*	3,548,200
More developed			
Breast	788,200	Lung, bronchus, and trachea	209,900
Colorectum	338,000	Breast	197,600
Lung, bronchus, and trachea	267,900	Colorectum	157,800
Corpus uteri	167,900	Pancreas	91,300
Ovary	99,800	Stomach	68,000
Stomach	99,400	Ovary	65,900
Thyroid	93,100	Liver	42,700
Pancreas	92,800	Leukemia	40,300
Melanoma of skin	91,700	Cervix uteri	35,500
Non-Hodgkin lymphoma	88,500	Corpus uteri	34,700
All sites*	2,826,900	All sites*	1,287,000
Less developed			
Breast	882,900	Breast	324,300
Cervix uteri	444,500	Lung, bronchus, and trachea	281,400
Lung, bronchus, and trachea	315,200	Cervix uteri	230,200
Colorectum	276,300	Stomach	186,100
Stomach	220,900	Liver	181,800
Liver	185,800	Colorectum	162,500
Corpus uteri	151,700	Esophagus	103,700
Ovary	139,000	Ovary	86,000
Thyroid	136,800	Leukemia	73,800
Esophagus	114,400	Pancreas	65,300
All sites*	3,830,600	All sites*	2,261,200

Table 3: Estimated new cancer cases and deaths worldwide for leading cancer sites among females, by level of development, 2012.

* Excluding non-melanoma skin cancers: Source: GLOBOCAN 2012.

Herbal plant: *Averrhoa carambola* L. (*Oxalidaceae*)

Averrhoa carambola L. (*Oxalidaceae*) is many times recognised as 'Star fruit English: Carambola apple, Tamil: Sagadam [4]. Carambola had received the repute of a modern-day business crop in India and Sri Lanka. It is fit for human consumption and has quite a number uses. The ripe fruit may also be processed into fermented or unfermented drinks, jam or jelly can be eaten clean or as dessert. The unripe fruit ate up as a vegetable. The candy kind is processed into wine in Surinam [5,6].

Kingdom [7]

Division: Spermatophyta

Sub-division: Angiospermae

Class: Dicotyledonae

Sub-class: Polypetalae

Order: Geraniales

Family: Oxalidaceae

Genus: *Averrhoa*

Species: *carambola*

Morphology of *A. carambola* (habitat and distribution)

The *A. carambola* was once originated from Ceylon and the Moluccas [8], however it has been cultivated in Southeast Asia and Malaysia for many centuries. The plant is determined at some point of India, [9] in particular in Gujarat and Maharashtra states. It is additionally cultivated during the tropics and possibly a native of Malaysia [10]. The carambola tree is a much-branched, slow-growing, bushy, broad, and short-trunked with, rounded crown and reaches 20 to 30 toes in top [7].

Carambola tree is regarded the extra necessary between two species- Bilimbi (*Averrhoa bilimbi* L.) and carambola (*Averrhoa carambola* L.) The fruit is in general cultivated in Sri Lanka, India, and China. The plant is a good-looking evergreen tree about 9.0m in height, leaves are compound, alternate, leaflets 5-11, glabrous surface, base oblique, the apex is acute. The leaflets are touchy to mild and greater or much less inclined to fold collectively at night time or when the tree is shaken or shocked. Small clusters of crimson stalked, purple-streaked flowers, about 6mm wide, are borne on the twigs in the axils of the leaves. The colour of the flora is white and purple, the fruit is ovoid and indehiscent [5,7].



Figure 1: *Averrhoa carambola* – a. Tree; b. Leaves; c. Flower; d. Fruit.

Bioactive compounds in *Averrhoa carambola*

p-Anisaldehyde [11] and β -sitosterol [12] had been remoted from carbon tetrachloride and chloroform soluble component of the methanol extract of stem bark of *Averrhoa carambola* L [13,14]. Nordby and Hall said that the essential sterols which are observed in the fruits of carambola are β - sitosterol, campesterol, and isofucosterol [15]. It additionally contained the 4 principal plant fatty acids – palmitic, oleic, linoleic, and linolenic acid. Fruits of *Averrhoa carambola* L. are an magnificent supply of herbal antioxidants [16]. Two alkyl phenols, namely, 2, 5-dimethoxy-3-undecylphenol, and 5-methoxy-3-undecylphenol, had been remoted collectively with two recognized benzoquinones, 5-O-methylembelin and 2-dehydroxy-5-O-methylembelin from the timber of *Averrhoa carambola* [17]. ζ -carotene, β -cryptoflavin, mutatoxanthin, β -carotene, β -apo-8'-carotenal, cryptoxanthin, cryptochrome, and lutein have been current in fruit of carambola [18]. Also, recognized compounds are lupeol and anthraquinone glucoside [19].

Traditional uses

In Ayurveda, the ripe fruit is used as a digestive, tonic, and strengthening. The dried fruit is additionally used in a fever; it has cooling and antiscorbutic properties. Fruits and fruit juice are oftentimes used as antioxidant and astringent. The ripe fruit is regarded for curing bleeding piles, specifically for inner piles. Fruits

are beneficial in diarrhea, vomiting, hyperdipsea, haemorrhoids, intermittent fever, scabies, and common debility. Also, the fruit is sour, astringent to the bowels, allays thirst, and is very a good deal beneficial in the removal of intestinal worms. The leaves are antipruritic, antipyretic, anthelmintic and are additionally beneficial in scabies, fractured bones and a variety of kinds of poisoning, intermittent fevers, and removal of intestinal worms [4,5].

Medicinal properties of *A. carambola*

Anti-inflammatory activity

Cabrini, *et al.* said that ethanolic extracts from *A. carambola* L. leaf and its ethyl acetate, butanol, and hexane fractions are beneficial in decreasing croton oil-induced ear edema and mobile migration in mice. These consequences justify the normal use of this plant for pores and skin inflammatory disorders. Analysis of the Potential Topical Anti-inflammatory Activity of *Averrhoa carambola* L. in mice used to be suggested [20,21].

Hypotensive effect

Hypotensive results of aqueous extract of *Averrhoa carambola* L. (Oxalidaceae) in rats have been said by using in vivo and in vitro strategy [22].

Hepatoprotective effect

Hepatoprotective impact of *Averrhoa carambola* fruit extract used to be mentioned on carbon tetrachloride-induced hepatotoxicity in mice [23].

Antioxidant activity

A team of researchers mentioned that residue from megastar fruit is a true supply for meals components and antioxidant nutraceuticals [24]. This learn about additionally confirmed that big name fruit (*Averrhoa carambola* L.) is an super supply of herbal antioxidants and that polyphenolics are its predominant antioxidants. Analysis of polyphenolic antioxidants in megastar fruit used to be additionally accomplished the usage of liquid chromatography and mass spectrometry [25].

Hypoglycemic activity

Study it has been stated that insoluble fiber-rich fractions which have been remoted from the pomace of carambola, includes attainable hypoglycemic results as tested by means of a learn about on numerous in vitro methods. The fiber additionally efficaciously absorbs glucose, retard glucose diffusion, delay the launch of glucose from starch, and inhibit amylase recreation to a positive extent [26].

Anti-ulcerogenic effects

It has been pronounced that the anti-ulcerogenic achievable of an extract of leaves of *Averrhoa carambola* administered by way of oral gavage in the following ulcer fashions in rats: lesions precipitated via acidified ethanol, indomethacin, and acute stress. ACE, at doses of 800 and 1200 mg/Kg, p.o., solely confirmed giant anti-ulcer undertaking in the acidified-ethanol-induced ulcer mannequin in rats [27].

Anthelmintic activity

Shah N.A., *et al.* (2011), stated the anthelmintic assay with the aqueous extract of *Averrhoa carambola* leaves at a range of concentrations (10, 50 and 100mg/ml) the usage of albendazole as reference preferred at the equal attention as that of the extract. It was once located that the leaves of the *Averrhoa carambola* displayed a massive anthelmintic pastime in a dose-dependent manner [28].

Hypocholesterolaemic and hypolipidemic activity

Chau CF, *et al.* (2004) suggested that the remoted water-insoluble fiber-rich fraction (WIFF) from the pomace of famous person fruit, confirmed hypo-cholesterolaemic and hypo-lipidemic activity. Investigation in hamsters confirmed said ldl cholesterol and lipid-lowering consequences of WIFF [29].

Antimicrobial activity

It was once suggested that *Averrhoa carambola* stem extracts exhibited antibacterial exercise with the aid of inhibiting *Staphylococcus aureus* and *Klebsiella* sp. As indicated through a minimal bactericidal attention (MBC) of 15.62 mg/ml and a hundred twenty five mg/ml respectively. Again, Mia Masum Md., *et al.* (2007) investigated the anti-microbial exercise of *Averrhoa carambola* through disc diffusion approach and mentioned that the methanolic extract and its petroleum ether, carbon tetrachloride, chloroform, and aqueous soluble fractions of *Averrhoa carambola* bark inhibited the increase of a number Gram +ve microorganism and Gram -ve microorganism [30,31].

Chemical composition report

The phytochemical find out about confirmed that two alkylphenols, namely, 2, 5- dimethoxy-3-undecylphenol and 5-methoxy-3-undecylphenol, had been remoted collectively from the timber of *Averrhoa carambola* with two recognized benzoquinones, 5-O-methylembelin and 2-dehydroxy-5-O- methylembelin [17]. Another phytochemical learn about stated that the carotenoids of the

tropical fruit *Averrhoa carambola* had been investigated and most of the mass spectra had been taken. The foremost pigments have been phytofluene, ζ -carotene, β -cryptoflavin, and mutatoxanthin. Additionally, β -carotene, β -apo-8'-carotenal, cryptoxanthin, cryptochrome, and lutein had been existing in small quantities [18].

The installed danger elements for breast most cancers encompass a household records of breast cancer, BRCA1 or two mutations, some reproductive elements (nulliparity, early age at menarche, late menopause, and later age at first full-term pregnancy), alcohol drinking, bodily inactivity, extra physique weight (postmenopausal breast cancer), the use of exogenous hormones (oral contraceptives and blended postmenopausal hormone substitute therapy), and radiation publicity [32,33].

Also, latest potential research have proven an affiliation between smoking and breast most cancers [34,35]. On the different hand, breastfeeding has been mentioned to decrease breast most cancers danger [36], in specific the hazard of estrogen and progesterone receptor-negative subtypes [37]. Medicinal plant life world-famous as they locate various purposes throughout the world due to the excessive degree of potential to deal with more than a few ailments with lesser aspect consequences and decrease fee additionally can be handled to autoimmune and immune-mediated illnesses [38,39].

Conclusion

There are ranges of advantageous most cancers manipulate measures on hand to nations of all aid levels. Many of these measures are extraordinarily reasonably-priced given the lives saved for the fee of the intervention, specifically in the case of vaccination. To stop most cancers in the future, international locations need to prioritize insurance policies to decrease recognized most cancers danger elements and make prevention handy to all. For these who have most cancers today, tremendous remedies and palliative care are additionally needed. In addition to these needs, most cancers surveillance and lookup for prevention and therapy are crucial for the placing of cancer manage priorities and for finding out the most advantageous interventions and redress in a given context. For LMICs, all of these things to do might also require help and dedication from the world community.

Traditional medication has a profile to the extent in drug improvement from a herbal supply is concerned. *A. Carambola* consists of severa pharmacological movements that have been scientifically proved by using in-vitro. Furthermore, *A. carambola* natural

plant advised to acts as a lead compound for the improvement of economical, effective, and nontoxic immunomodulatory marketers for the remedy of breast most cancers and different Non-communicable illnesses too.

Consent for Publication

We certify this manuscript has not published elsewhere and not submitted to another Journal.

Competing Interests

Nil.

Acknowledgment

The authors want to thank the technical officer in the Department of Farm Animal Production and Health, Faculty of Veterinary Medicine and Animal Science, University of Peradeniya, Sri Lanka for providing necessary facilities and good guidance to write this review article.

Funding Source

No.

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